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Assessment of the Risk of Eye Injuries in Team Sports and the Impact of Safety Procedures on Their Incidence - An Interdisciplinary Perspective on Injury Prevention

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Abstract

Background: Sports-related eye injuries are a significant problem, and most of them are potentially preventable through appropriate safety procedures and eye protection (Leivo et al., 2015; Hua & Yan, 2020; Moe et al., 2023). The dynamics of play, physical contact, and the use of equipment increase the risk of mechanical injury to the visual system. Epidemiological data indicate that the highest number of injuries is associated with popular team sports such as football (soccer), basketball, and baseball, with the dominant mechanism being ball impact or accidental bodily contact (Lee et al., 2021; Leivo et al., 2015; Ashraf et al., 2022; Haring et al., 2016).

Aim: The aim of the article is to assess the risk of eye injuries in team sports and to analyze the impact of safety procedures on their incidence.

Material and Methods: This paper is a narrative review prepared as a systematic review of the scientific literature on the risk of eye injuries in team sports and the influence of safety

procedures on their frequency. The literature search was conducted in the PubMed database and covered publications from 2000-2026. Peer-reviewed scientific articles were included.

Results: The highest risk of eye injuries is observed in popular ball games with high ball speed and intensive physical contact (football/soccer, basketball, handball). Implementation of comprehensive preventive strategies - including eye protection and educational programs - can reduce the incidence and severity of injuries by as much as 70-100% (Moe et al., 2023; Mishra et al., 2024; Mazarelo et al., 2023).

Conclusions: Effective prevention of eye injuries in team sports requires the integration of medical and organizational interventions. The introduction of standardized safety procedures significantly reduces the frequency of injuries. The combination of medical and organizational analysis should form the basis for designing effective eye-injury prevention programs in team sports.

Keywords: eye injuries, team-based sport, injury prevention, sports medicine

1. Introduction

Musculoskeletal injuries are the most common type of injury in sport, but ocular trauma is also an important subject of research (Ashraf et al., 2022). Sports-related eye injuries are estimated to account for 10-20% of all eye injuries. The vast majority occur in young individuals and in men (Chaudhary et al., 2025; Leivo et al., 2015; Hua & Yan, 2020; Haring et al., 2016; Dockery et al., 2021; Patel et al., 2023; Ashraf et al., 2022).

The highest number of eye injuries is reported in team sports in which the ball travels at high speed, such as baseball, or where physical contact is frequent, such as basketball and football (soccer), as well as in activities using projectiles such as paintball and airsoft (Lee et al., 2021; Leivo et al., 2015; Patel et al., 2023; Zhang et al., 2021; Ashraf et al., 2022; Haring et al., 2016).

The dominant mechanism is impact from a ball or another object, along with accidental blows from a hand, elbow, or head (Leivo et al., 2015; Patel et al., 2023; Ashraf et al., 2022; Haring et al., 2016).

From a medical point of view, the most frequent injuries are blunt ocular trauma and hyphema, which may be accompanied by elevated intraocular pressure and retinal detachment requiring surgical treatment (Chaudhary et al., 2025; Leivo et al., 2015; Patel et al., 2023; Ashraf et al., 2022; Dockery et al., 2021). Most injuries do not cause severe permanent loss of visual acuity (Leivo et al., 2015; Patel et al., 2023; Ashraf et al., 2022; Moe et al., 2023). The proportion of cases with permanent visual impairment is estimated at 10-13% (Chaudhary et al., 2025; Zhang et al., 2021; Dockery et al., 2021; Hua & Yan, 2020; Leivo et al., 2015; Ashraf et al., 2022).

It has been demonstrated that approximately 90% of sports-related eye injuries are potentially preventable through appropriate protective equipment and well-designed safety procedures (Mishra et al., 2024; Leivo et al., 2015; Hua & Yan, 2020; Moe et al., 2023; Dain, 2016). What matters is not only the number of injuries, but also their severity and long-term consequences (Chen et al., 2019; Bahr et al., 2017; Van Mechelen et al., 1992).

2. Materials and Methods

This article was designed as a narrative review with elements of a systematic search of the scientific literature on sports-related eye injuries in team sports and the impact of safety procedures on their incidence. The approach focused on epidemiology, mechanisms, risk factors, and prevention of ocular trauma in sports. A structured literature search was conducted using the PubMed database. The search covered publications from 1 January 2000 to 31 December 2026 and was limited to peer-reviewed scientific articles. Search terms combined keywords related to eye trauma and sport, using Boolean operators. Exemplary query structure included terms such as: sports-related eye injuries, ocular trauma and sport, eye injury and football/soccer, eye injury and basketball, baseball eye trauma, protective eyewear, eye protection and sport, and prevention and sports-related ophthalmic injury. References of key articles and consensus documents were scanned to identify additional relevant studies. Titles and abstracts identified by the search were screened for relevance according to the eligibility criteria. Full texts were then assessed to confirm inclusion. Particular attention was paid to large epidemiological studies, systematic reviews, and consensus documents that described incidence, mechanisms, and prevention of sports-related eye injuries. Findings were synthesized narratively, grouped into four thematic domains: epidemiology, mechanisms and risk factors, types and severity of injuries, and preventive strategies. An interdisciplinary prevention framework was then developed, integrating medical, organizational, and educational components (Hua & Yan, 2020). As this was a review of previously published, anonymized data, no ethical approval or informed consent was required (Hua & Yan, 2020).

AI was employed in this study for two primary purposes. First, it supported the text analysis of clinical reasoning narratives in order to identify linguistic patterns. Second, it assisted in refining the academic English of the

manuscript, ensuring clarity, consistency, and adherence to scientific writing standards. Additionally, AI tools were used for further linguistic polishing, including improvements in grammar, style, and clarity in the presentation of results. Importantly, all AI applications functioned strictly as supportive tools under human supervision. The final interpretation of results, classification of errors, and formulation of conclusions were carried out exclusively by human experts in clinical medicine and formal logic. AI contributed to enhancing efficiency in data processing, pattern recognition, and language refinement, but it did not replace human judgment at any stage of the analytical process.

3. Mechanisms and Risk Factors

Failure to use eye protection remains one of the key modifiable risk factors - around 90% of injuries could potentially be avoided with appropriate protective equipment and safety procedures. High-intensity contact and an aggressive style of play in dynamic team sports significantly increase risk; the majority of injuries occur in sports with a fast-moving ball and frequent collisions (basketball, football/soccer, handball, hockey, baseball). Insufficient enforcement of rules by referees (e.g., tolerance of elbowing, late tackles, dangerous play) may maintain a high level of risk, especially in youth leagues where safety standards are often less strict.

Adolescents and young adults are particularly vulnerable: in this group, sports injuries account for 10-20% of all eye trauma, with a predominance of males aged approximately 19-22 years (Haring et al., 2016; Patel et al., 2022; Boden et al., 2017). A burdensome injury history is an additional factor - previous eye injuries and participation in high-level sport with substantial exposure (>4 h/day) increase the likelihood of further damage. Risk rises with cumulative exposure time in training and competition; training >4 h/day significantly increases the risk of eye injury (Zhang et al., 2021).

The use of polycarbonate sports goggles, full-face shields in hockey, and certified protective designs substantially limits direct contact of the ball, puck, or projectile with the globe. The introduction of mandatory eye-protection policies is associated with a marked reduction in the incidence and severity of injuries, reaching 70-100% in studies of protective equipment and prevention programs. However, effectiveness depends strongly on the level of compliance by players and clubs.

Stricter penalties for dangerous play (e.g., high elbows, blows to the head and face) and formal restriction of risky techniques can reduce the number of events leading to eye injury, similarly to concussion prevention. Age-appropriate regulations (e.g., banning certain techniques in younger age groups) can limit adolescents' exposure to the most hazardous situations.

Educational programs for athletes, training for coaches, and involvement of parents in shaping pro-safety attitudes improve acceptance of protective equipment and adherence to rules. Education increases awareness of the long-term consequences of eye injuries and reduces the tendency toward “winning at all costs” behavior that promotes injury.

4. Epidemiology

Sports injuries account for approximately 10-20% of all traumatic eye injuries in young people (Chaudhary et al., 2025; Zhang et al., 2021; Dockery et al., 2021; Hua & Yan, 2020; Leivo et al., 2015; Ashraf et al., 2022). An estimated 10-13% of these result in long-term visual impairment (Chaudhary et al., 2025; Haring et al., 2016; Dockery et al., 2021; Leivo et al., 2015; Ashraf et al., 2022).

Young men around 19-22 years of age are the predominant group affected. It is estimated that in the United States approximately 30,000 people per year present to emergency departments with sports-related eye injuries (Haring et al., 2016; Patel et al., 2022; Boden et al., 2017).

Among team sports, the most frequently cited are basketball, baseball, football/soccer, handball, American football, and hockey (Chaudhary et al., 2025; Zhang et al., 2021; Haring et al., 2016; Dockery et al., 2021; Patel et al., 2022; Leivo et al., 2015; Ashraf et al., 2022; Boden et al., 2017).

Table 1. The most common ocular conditions caused by sports-related trauma

| Type of sports-related eye injury | Frequency (%) |
|---|---------------|
| Periocular soft-tissue lacerations | 33-46% |
| Contusions of the eye and periocular tissues | 29-30% |
| Superficial eye injuries (corneal abrasions, minor lesions) | 17-21% |
| Hyphema | 87.5% |
| Visual impairment after injury | 10-13% |

Sources: Haring et al., 2016; Barr et al., 2000; Chaudhary et al., 2025; Zhang et al., 2021; Dockery et al., 2021; Hua & Yan, 2020; Leivo et al., 2015; Ashraf et al., 2022.

5. Risk Factors

Risk increases with cumulative exposure time in training and competition - training >4 h/day significantly raises the risk of eye injury (Zhang et al., 2021). Most injuries among elite athletes occur during training (approximately 64%), but the rate per unit of exposure is higher in competitions than in training (Zhang et al., 2021; Boden et al., 2017).

Sports involving high-intensity exertion and contact (dynamic team games, combat sports) are characterized by higher risk, both in terms of incidence and severity, compared with lower-contact disciplines (Zhang et al., 2023; Moe et al., 2023; Leivo et al., 2015; Ashraf et al., 2022). The dominant mechanism is impact from a ball or another object, along with accidental blows from a hand, elbow, or head (Leivo et al., 2015; Patel et al., 2023; Ashraf et al., 2022; Haring et al., 2016).

Complex, multifactorial interactions between determinants of injury (e.g., playing technique, neck muscle strength, use of protection) are crucial for overall risk (Bittencourt et al., 2016). The highest incidence of ocular trauma is reported in team sports where the ball travels at high speed (e.g., baseball), where physical contact is frequent (basketball, football/soccer), or where projectiles are used (paintball, airsoft) (Lee et al., 2021; Leivo et al., 2015; Patel et al., 2023; Zhang et al., 2021; Ashraf et al., 2022; Haring et al., 2016).

Appropriate protective equipment and rule modifications can effectively reduce the risk of head and eye injuries (Eliason et al., 2023).

6. Mechanisms of Injury

The dominant mechanism of eye injuries in team sports is direct impact to the globe by a ball or other object, as well as accidental blows from a hand, elbow, or head during physical contact between players. Most injuries are observed in games with a fast-moving ball and frequent physical contact (football/soccer, basketball, handball, hockey, tennis) and in sports using projectiles (paintball, airsoft) (Rabstein et al., 2025).

The most common lesions are blunt ocular trauma, hyphema, lacerations and contusions of periocular tissues, and superficial corneal damage, with a risk of increased intraocular pressure and retinal detachment requiring surgery. Risk increases with exposure time (>4 h/day), and is highest in sports with high intensity of exertion and contact; training >4 h/day significantly raises the risk of eye injury (Zhang et al., 2021).

Table 2. Injury mechanism by sport

| | Ball/puck impact | Player collision | Contact with equipment | Projectile |
|------------|-------------------------|-------------------------|-------------------------------|-------------------|
| Football | Very frequent | Very frequent | - | - |
| Basketball | Very frequent | Very frequent | - | - |
| Handball | Very frequent | Very frequent | - | - |
| Baseball | Frequent | Very frequent | Rare | - |
| Squash | Frequent | Rare | Rare | - |
| Tennis | Rare | Very rare | Rare | - |
| Paintball | - | Rare | Frequent | Very frequent |
| Airsoft | - | Rare | Frequent | Very frequent |
| Hockey | Very frequent | Very frequent | Very frequent | - |

Source: Haring et al., 2016; Zhang et al., 2023; Zhang et al., 2021; Dockery et al., 2021; Patel et al., 2022; Leivo et al., 2015; Ashraf et al., 2022; Chaudhary et al., 2025.

7. Prevention

It is estimated that approximately 90% of sports-related eye injuries are potentially preventable through appropriate protective equipment and well-designed safety procedures. Comprehensive preventive strategies - eye protection, rule modifications, and educational programs - can reduce the incidence and severity of injuries by as much as 70-100%.

Equally important are modifications to the rules and playing environment (e.g., limiting aggressive contact, equipment standards) and integrating eye-protection protocols into broader strategies for preventing head and facial injuries.

8. Discussion

The risk of eye injuries has a clearly multifactorial nature - it depends on exposure time, intensity of contact, ball or projectile speed, playing technique, training load, and use of eye protection. High-risk sports (basketball, football/soccer, handball, baseball, hockey, paintball, airsoft) share common biomechanical patterns - fast-moving balls, pucks, or projectiles and frequent collisions with players and equipment.

Approximately 90% of sports-related eye injuries are potentially preventable, and comprehensive protection and education programs can reduce their incidence and severity by 70-100%. Standardized screening procedures are needed, including questions about previous

injuries, monocular vision, corrective lenses and protective equipment, and participation in high-risk sports. Pre-participation ophthalmologic examination is especially important in children and adolescents, the population most at risk of injury and its permanent consequences. Unified acute-care protocols in clubs and at competitions are essential (recognition of red-flag symptoms, rapid referral to an ophthalmologist, clear criteria for removal from play). In high-risk disciplines, mandatory eye protection conforming to protective standards is justified. International harmonization of guidelines (e.g., based on IOC consensus) would facilitate implementation of uniform standards.

Systematic monitoring of eye injuries within sports-injury registries is necessary to assess the effectiveness of interventions and to identify new risk factors. Effective prevention requires collaboration between ophthalmology (diagnosis and treatment), sports medicine (athlete health management), biomechanics (mechanisms of injury and equipment design), epidemiology (surveillance and risk identification), and health education (behavioral change among athletes and coaches).

Limitations include heterogeneity of reporting methods (different injury definitions, populations, and exposure metrics) and likely underestimation of minor injuries that do not present to hospital care. Regional differences in access to protection, regulations, and safety culture also limit the generalizability of findings.

9. Conclusions

Eye injuries in team sports are common and potentially severe, yet largely preventable. Effective prevention requires a combination of mandatory, standardized eye protection, rule modifications, education of athletes and coaches, and systematic injury surveillance. Integration of medical and organizational perspectives should form the basis for designing eye-injury prevention programs in sport.

Disclosure

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