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# Eye Injuries in Club and School Sports – Current National Figures

*Augenverletzungen im Vereins- und Schulsport – aktuelle nationale Zahlen*

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## Summary

- › **Problem:** Visual deficits/ametropia are particularly significant obstacles in sports because the visual system controls/corrects all of an athlete's movements. However, athletes are at increased risk for eye injuries caused by high-velocity objects e.g. balls or physical contact with opponents. This study presents the current (German) figures on eye injuries in club and school sports and evaluates the risk of eye injuries in various sports.
- › **Methods:** We evaluated 2,392 eye injuries, selected from the 221,273 club sports injuries recorded in the Ruhr University Bochum and ARAG Sports Insurance database for the period 1987-2017. The school sports eye injuries recorded by the German Social Accident Insurance for 2019 were also analyzed.
- › **Results:** Of all the club sports injuries recorded, 1.08% were eye injuries; of these, 19.7% had to be treated in hospital, 13.9% required surgery, and 56.9% prevented the injured athletes from working. Blunt trauma was the most common cause of injury, comprising more than 50% of cases. Eye injuries were strongly overrepresented in club sports injuries sustained during water polo, squash, badminton, and tennis (injury proportion ratio (IPR)=5.1-8.8). In school sports, eye injuries comprised 1.83% of the reported cases.
- › **Discussion:** Eye injuries in sports are relatively rare, but often serious. Based on the increased IPR found for some sports, further studies must analyze the risk of eye injury in more detail. Eye protection in the form of sport-appropriate glasses should be used.

## Zusammenfassung

- › **Problemstellung:** Visuelle Defizite im Sport fallen besonders ins Gewicht, weil das visuelle System alle Aktivitäten beim Sport kontrolliert und korrigiert. Im Sport besteht aber auch das Risiko, eine Augenverletzung zu erleiden, z.B. durch Balltreffer oder in Zweikampfsituationen. Ziel ist es, aktuelle (nationale) Zahlen zu Augenverletzungen im Vereins- und Schulsport zu präsentieren sowie das Risiko von Augenverletzungen in verschiedenen Sportarten aufzuzeigen.
- › **Methoden:** Ausgewertet wurden 2.392 Augenverletzungen auf der Basis von 221.273 im Zeitraum von 1987-2017 erfassten Sportverletzungen (Vereinssport) aus der Sportunfalldatenbank der Ruhr-Universität Bochum und der ARAG Allgemeine Versicherungs-AG (Düsseldorf). Zusätzlich wurden Augenverletzungen im Schulsport auf Basis der Daten der Deutschen Gesetzlichen Unfallversicherung (Berichtsjahr 2019) analysiert.
- › **Ergebnisse:** 1,08% aller Sportverletzungen im Vereinssport sind Augenverletzungen. 19,7% dieser Verletzungen mussten im Krankenhaus behandelt werden, 13,9% mussten operiert werden, 56,9% der Verletzten waren arbeitsunfähig. Mit über 50% dominieren die stumpfen Traumata, z.B. Prellungen. Augenverletzungen sind in den Sportarten Wasserball, Squash, Badminton und Tennis im Kollektiv der Vereinssportunfälle stark überrepräsentiert (Injury Proportion Ratio (IPR)=5,1-8,8). Im Schulsport liegt der Anteil an Augenverletzungen bei 1,83%.
- › **Diskussion:** Augenverletzungen im Vereins- und Schulsport sind zwar relativ selten, häufig aber schwerwiegend. Basierend auf den Hinweisen, die sich aus der erhöhten IPR bei einigen Sportarten ergeben, sollten weitere Studien das Verletzungsrisiko für Augenverletzungen in verschiedenen Sportarten genauer analysieren. Bei Sportarten mit erhöhtem Augenverletzungsrisiko sollten (schul-)sporttaugliche Brillen (plus Augenschutz) verwendet werden.

## KEY WORDS:

Sport Injury, Injury Proportion Ratio, Eye Protection, Sport Safety

## SCHLÜSSELWÖRTER:

Sportverletzungen, Verletzungsquote, Sporttaugliche Brillen/Augenschutz, Sicherheit im Sport

## Introduction

Visual deficits/ametropia are particularly important difficulties/obstacles in sports because vision is necessary to assess other players' positions and actions and to plan one's own movements (7, 8). In many sports, visual perception/information is essential for reactive and anticipatory actions. Optimal eyesight/vision is invaluable in competitive, leisure/amateur, and school sports (7, 8, 9).

However, athletes are at increased risk for eye injuries: they can be struck by a ball, another player, or other object in a duel – such as someone else's head, elbow, or finger(s) during tackles in games such as handball or water polo (9, 12, 16, 17). Although eye injuries are relatively rare in sports, they can cause serious difficulties for those who sustain them, far beyond the loss of the ability to play a preferred sport.



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## Objective

To better understand the risk of eye injuries in club and school sports, the current (German) figures on such injuries will be presented, and the risk of eye injuries in different sports will be discussed.

## Materials and Methods

## Club Sports

To assess the incidence of eye injuries in club sports, we evaluated 2,392 eye injuries included in the 221,273 club sport injury reports recorded from 1987 to 2017 in the sports injury database maintained by the Ruhr University Bochum and ARAG Sports Insurance (Düsseldorf). This database included only pure injury reports, so exposure data were not collected. To verify that eye injuries were overrepresented in some sports, the injury proportion ratio (IPR) – defined as a  $\chi^2$  ratio to compare the relative proportions of categorical variables – was used (11). In this case, the frequency of eye injuries that took place in a specific sport compared to the frequency of all injuries recorded for that sport was determined for club sport.

## School Sports

With regard to school sports, previously unpublished data from the German Social Accident Insurance (DGUV) relating to the topic “eye injuries in school sports” reported during 2019 were analyzed. The data can be retrieved/requested from the DGUV (statistik@dguv.de). This collection also consisted entirely of pure injury reports, so exposure times were not available. The absolute numbers stated in the results were based on an extrapolation of a 3% sample of the accidents reported to insurers.

## Results

## Club Sports

Of the club sports data, the average age of the 2,392 athletes who sustained eye injuries (which represented 1.08% of all sports injuries) was  $31.9 \pm 16.9$  years (range: 1-95 years). Seventy-eight percent of the injured athletes were male and 22% were female. The mean age of the male athletes was  $32.1 \pm 16.7$  years (range: 3-95 years), while that of the female athletes was  $30.6 \pm 17.7$  years (range: 1-82 years). Following their injuries, 19.7% of the athletes had to be treated in hospital, 13.9% required surgery, and 56.9% were unable to attend work (or school). Of those who were unable to work, 60.6% required fewer than 7 days off, 22.1% required 8-14 days off, 6.8% required 15-21 days off, 2.7% required 22-28 days off, 4% required 29-35 days off, and 3.9% required 36 days or more off. On average, the injured athletes had to refrain from sports activities for 24.8 days. Among the types of eye injuries in sports, blunt trauma is the most common, accounting for more than 50% of incidents. These injuries include trauma in general (67.4%; i.e. multiple injuries within the eye and head region), contusion (23.3%; e.g. blow or contusion caused by a blunt object), injuries to the skin around the eye (9.4%; e.g.

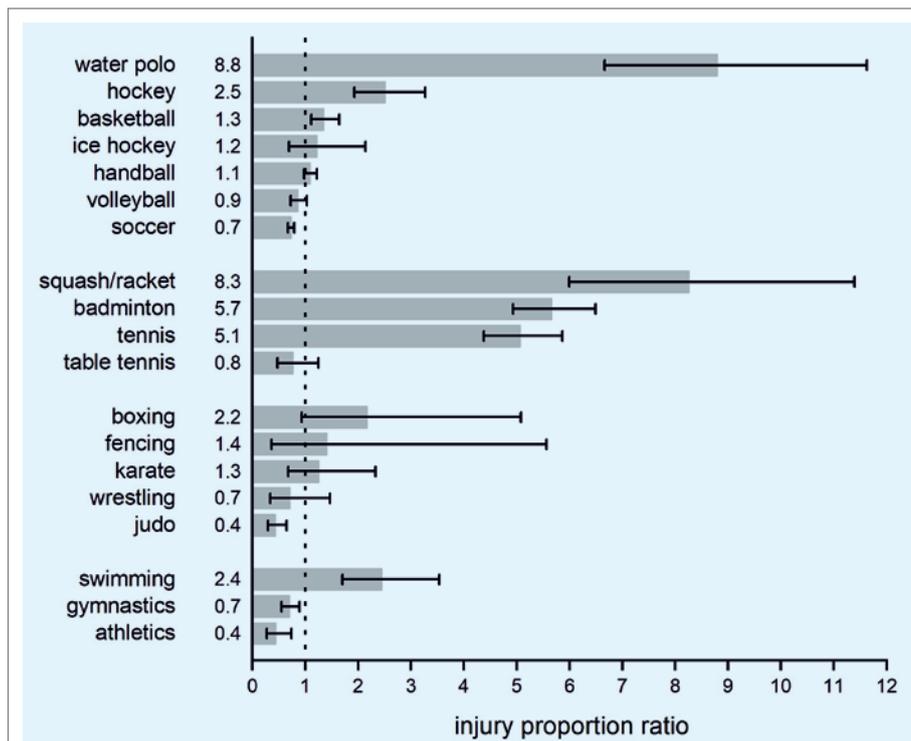


Figure 1

Injury proportion ratio (IPR) for eye injuries in different sports. IPR  $\pm$  95% CI (Confidence Interval) are shown. IPR differs significantly from the mean ( $\neq 1$ ) unless the CI contains 1. We evaluated 2,392 eye injuries out of 221,273 club sports injuries recorded from 1987 to 2017 from the sports injury database of the Ruhr University Bochum and ARAG Sports Insurance (Düsseldorf, Germany).

abrasion, cut, laceration), internal/nervous lesions (4.6%), and orbital fractures (2%). These injuries are frequently caused by athletes being struck by the following objects: balls (e.g., in tennis, squash, or soccer/football); sticks, bats, or rackets (e.g., in squash, tennis, and field, ice, and roller hockey); or other body parts, such as hands or elbows, in hand-to-hand fights or tackles (e.g., in handball, soccer/football, or water polo). Accordingly, racket sports, such as tennis (IPR=5.1), badminton (IPR=5.7), and especially squash (IPR=8.3), as well as water polo (IPR=8.8), which is characterized by grappling and other forms of physical contact, are significantly overrepresented among the reported injuries. This was found to be true for all cases where the 95% confidence interval did not contain the value 1 (see figure 1).

## School Sports

Of the 408,871 school sports injuries reported for 2019, 15.3% of these were head injuries and 7,469 (1.83%) were eye injuries. 13.9% of all pupil accidents with eye injuries were sports accidents (boys=14.3%; girls=13.3%). When these data were broken down by gender, 5,081 boys (68%) sustained eye injuries in school sports events, compared to 2,388 girls (32%). Most of these eye injuries (36.1%) occurred during elementary school physical education classes, followed by comprehensive/integrated schools (18.8%), grammar/high schools (18%), secondary schools (11.1%), vocational schools (6.5%), secondary schools with lower secondary education (level 2; 6.2%), and specialist schools and schools for mentally handicapped children (3.3%).

The total number of student accidents involving eye injuries decreased between 2012 and 2019, and the percentage of such injuries occurring during physical education classes has been decreasing since 2015 (see figure 2).



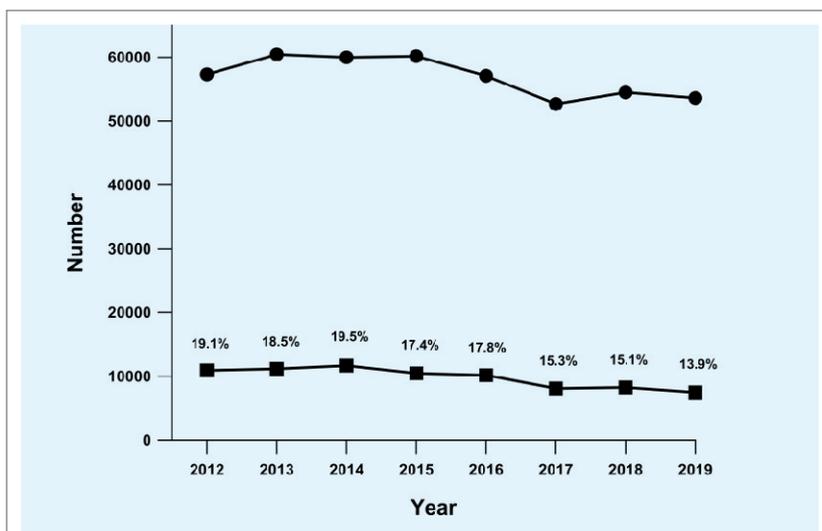


Figure 2

School sports accidents resulting in eye injuries. Upper curve: number of all school accidents with eye injuries per year; lower curve: relative proportion of these in sports (school sports accidents).

## Discussion

The percentage of sports accidents involving eye injuries occurring during school sports events (1.83%) was significantly higher than that occurring in club sports (1.08%). This cannot be explained by the different age ranges of the sample populations for club and school sports. The percentage of eye injuries involving club athletes up to 21 years of age was lower than that of club sports as a whole, at 0.85%. In contrast, the percentage of eye injuries affecting athletes over 50 years of age was 2.2%, which is significantly higher than that for the overall population of this cohort.

The reasons for the difference in the incidence of eye injuries in children and adolescents can only be speculated about here. It is possible that school sports instructors devote more time to activities/sports that entail a presumably higher risk of eye injuries, such as basketball (see Patel et al. (15; cf. also 2, 5)) and badminton, than clubs do. Another reason may be the different methodologies used to record the injuries that occur in these two settings. While it is generally assumed that approximately 10% of sports injuries require inpatient treatment (6), the available data indicate that this percentage is, in fact, approximately 33% for club sports and approximately 3.5% for school sports. Similarly, the injuries recorded in the club sports data tended to be more serious, while those recorded in the school data tended to be more minor – which was certainly due to the fact that teachers are more “careful” in reporting injuries to the accident insurers (and also report minor injuries).

In club sports, eye injuries are overrepresented in the incidents reported involving men; the IPR for men was 1.31, while that for women was 0.76. This trend was the same for school sports, which was corroborated in the US data (15). In school sports, eye injuries occurred significantly more often in male athletes than in female athletes (boys with eye injuries represent 0.6 out of every 1,000 insured patients, while girls with eye injuries represent 0.4 out of every 1,000 insured patients). This was also corroborated in American studies for 5-11-year-old (elementary school) and 12-18-year-old (middle and high-school aged) students (15). According to Leivo et al. the largest number of all eye traumas was observed in the 10- to 19-year-old age group (13). However, Boden et al. reported similar rates of injuries for male and female students who played basketball

and soccer (football) in high school (1). Erickson documented that over 80% of sports participants with eye injuries treated in US hospitals were male, and over half were under 18 years of age (4).

According to MacEwen and McLatchie, sports activities are responsible for approximately 25%-40% of all eye injuries that require Hospital treatment (14; see also 18). They found that most eye injuries involved the external eye (14), which is consistent with the results of this study.

According to Patel et al., who analyzed school-related eye injuries in the United States treated in emergency departments between 2000 and 2019, 36% of all eye injuries sustained by school-aged children happened during school sports events, most often basketball games (15). Due to the particular risk of injury in sports such as tennis, badminton, and especially squash (see also Patel et al. (15)) and water polo, in which (crawl) swimming and lunging, throwing, and catching movements are performed above the water surface – in other words, at head and eye

level (12) – ophthalmologists have long recommended the use of sports goggles (2, 4, 10, 12, 16, 17). However, other sports that are played at school, even those not named above as “high-risk sports”, especially games that involve one-on-one contact, entail hazards for the eye/face area. Many involve actions that may easily result in injury, such as “elbow checks”, finger gouges, and balls and other missiles being thrown or propelled at high velocities.

Consequently, corrective glasses or protective eyewear must meet the requirements for use in school sports – i.e., they must not pose any additional risk of injury to the eyes and face (cf. DIN 58184; 3, 9) – and should also be suitable for everyday use outside of sports activities, if possible (9). For sports that entail an increased risk of eye injury, glasses suitable for (school) sports that also offer eye protection should be used. Even (functionally) one-eyed children should look for the seal “plus eye protection” when selecting glasses suitable for (school) sports, especially to protect their remaining/healthy eye (2, 3, 4, 8, 9).

## Conclusion

Eye injuries in sports are relatively rare (1.08% of all recorded injuries in club sports and 1.83% in school sports), but can often also be severe. Similar to the literature the results of this study confirm that, most of the eye-injured were young males (1, 4, 5, 13, 18, etc.). The majority of eye injuries were mild (13, 18) including eyelid swelling, hematoma or lacerations, corneal abrasion/erosions, conjunctiva lacerations and hyphema.

Approximately 20% of all patients with sport-related eye injury were hospitalized (14, 18) which is consistent with the results of this study (club sports=19.7%).

A large part of sports-related eye injuries can be prevented with adequate eye protection (1, 2, 4, 9, 10, 12, 13, 14, 18).

It is imperative that injuries to the eyes in club and school sports caused by unsuitable glasses be avoided. ■

## Conflict of Interest

*The authors have no conflict of interest.*

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