

# An Analysis of Ocular Trauma Resulting From Pediatric Sports Injuries

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**Purpose:** Although sports participation among pediatric patients benefits overall development, the risks of ocular trauma are often overlooked. This retrospective cohort study investigated sports groups to determine which caused the greatest ocular trauma and initial presenting visual acuity (VA) impairment.

**Patients and Methods:** 1,290 pediatric ocular traumas in two Indianapolis tertiary care centers over a 10-year period were collected and stratified based on sport category, injury type, age, and need for surgical intervention. Chi-square analysis and Fisher exact testing were used to determine each variable's significance.

**Results:** Ocular injuries were most commonly attributed to baseball (38.5%), basketball (16.9%), and soccer (14.9%). The most common ocular diagnoses were contusions (82.4%) and hyphemia (8.1%). Orbital fractures were the most common diagnosis requiring surgery (54.5%) with baseball as the most common cause (67.0%) of these fractures. Analysis of significant visually impairing traumas indicated that golf and archery were the most detrimental in initial presenting VA followed by football and baseball. Lastly, children aged 0–11 years old ( $p = <0.01$ ) most commonly had injuries attributable to baseball ( $p = <0.01$ ) whereas older children aged 12–18 more commonly had injuries attributable to soccer ( $p = 0.04$ ) and football ( $p = 0.04$ ).

**Conclusion:** With our study illustrating that archery and golf were the most detrimental on initial presenting VA while baseball was the most common cause of impactful injuries, particularly among children aged 3–11 years, safety guidelines should include mandatory eye protection to decrease the risk of sport-related ocular injury.

**Keywords:** visual acuity, eye protection, orbital fracture, baseball, contusion, football

## Introduction

Ocular injuries commonly occur during sports and can pose a significant threat not only to the orbit and surrounding adnexa but also to vision itself.<sup>1</sup> The risk of ocular injury varies among different sports and many studies attempted to elucidate the contributing factors. Certain factors such as the level of contact involved and the type of equipment utilized have been demonstrated to significantly impact the likelihood of sustaining a sport-related ocular injury.<sup>2,3</sup> Sports with the highest incidence of ocular injury in the United States are basketball, baseball, softball, football, racquetball, and soccer.<sup>4,5</sup> These injuries disproportionately affect individuals under the age of 15, with reports indicating that over 20,000 sport-related eye injuries occur in the pediatric population annually and 14% of all injuries that present to the emergency department in patients under the age of 18 have ocular involvement.<sup>6–8</sup> Current sport participation levels for youth aged 6–12 in the United States are available as of 2021, with the top 5 sports being bicycling (18%), basketball (14.5%), baseball (12.6%), soccer (7.4%), and tennis (5.8%). The top 5 sport participation levels for ages 13–17 are bicycling (21%), basketball (17.5%), baseball (9.5%), tennis (8%), and tackle football (6.9%).<sup>9</sup>

Despite the significant morbidity associated with sport-related ocular injury and attempts made by the American Academy of Ophthalmology and the American Academy of Pediatrics to encourage the use of eye protection, it is still estimated that approximately 90% of injuries are preventable.<sup>4</sup>

This study aimed to analyze ocular injuries in Indiana sports with children aged 3–18 in Indiana and their impact on visual acuity (VA). Stratification of types of ocular injury by sport can provide further information to direct prevention guidelines and treatment of sport-related ocular injuries.

## Materials and Methods

### Collection

The study was approved by the Institutional Review Board and in accordance with the Declaration of Helsinki and the National Institute for Health Research guidance on ethical approval. HIPPA regulations were followed. No patient consent was obtained as the study was retrospective using de-identified data analysis and all patient confidential data was protected.

This retrospective chart review studies patients less than 18 years of age diagnosed with traumatic ocular injury at Indiana University Health University Hospital (IUH) and Eskenazi Hospital between January 1, 2011, and November 30, 2021. Both hospitals are tertiary care centers. The IUH electronic medical record (EMR) was accessed to include all pediatric patients that were recipients of traumatic ocular injury during this period. Patients were identified by the International Classification and Disease (ICD) diagnosis on the EMR to indicate injury type. A comprehensive list of the ICD-9 and ICD-10 diagnostic codes used to extract data is provided in [Supplemental Table 1](#).

Demographic information for each patient including age, sex, and race/ethnicity was recorded. Each subject's clinical history was manually assessed to determine the cause of the ocular injury. Any patient with sports-related injuries who required surgical intervention was recorded for the type of surgery, post-operative diagnosis, and VA on latest follow up.

### Analysis

Multiple t-test analyses with the Holm-Sidak method were used to compare mean values, and Chi-squared test and Fisher exact test for proportional differences were used when needed. Visual acuity was collected and categorized as category 1, category 2, or category 3. Category 1 described moderate visual impairment with a Snellen VA of 20/70 to 20/200. Category 2 described severe visual impairment with a Snellen of 20/200 to 20/400. Category 3 described blindness with a Snellen VA of 20/400 – near point. It should be noted that the WHO has developed 5 categories of visual impairment also based on Snellen VA, and that while our categories 1 and 2 match, our category 3 combines the WHO's categories 3–5, which entails the term blindness.<sup>10</sup> Recorded visual acuities were noted in Snellen VA values and converted to LogMAR for consistent data analysis.

Cross-sectional analysis was used to determine if age played a role in the prevalence of ocular injury within each type of sport group. Patients were categorized according to age into groups of 3–11 years and 12–18 years, with 3 years old being the youngest recorded ocular injury in our final cohort.

## Results

During our study timeframe, there were 2,372 documented charts consistent with our inclusion criteria as defined by ocular trauma ICD codes and patient age. Removal of duplicated visits yielded 1,290 cases. Of these, 148 cases were sport-related ocular traumas, representing approximately 11.5% of our initial cohort.

### General Demographics

The majority of patients with sports-related injuries were male (75%) and Caucasian (75%). Age groups were relatively equally distributed with 42% of our patients aged 3–11 at the time of injury and 58% aged 12–18 at the time of injury with a median age of 12.8 years ([Table 1](#)).

**Table 1** Patient Demographics

Category	# Eyes	Percentage
Sex		
Male	111	75.5
Female	37	25.2
Ethnicity		
White/Non-Hispanic or Latino	111	75.5
Hispanic or Latino	8	5.4
Black/AA	21	14.3
Asian American	1	0.6
Unknown	7	4.8
Trauma Status		
Orbital Fracture	17	11.6
Surgical Intervention	11	7.5
Open Globe	1	0.6
Age		
3–11 Years	62	42.2
12–18 Years	86	58.5
Mean		12.7
Median		12.8
Sport		
Baseball	57	38.8
Basketball	25	17.0
Soccer	22	15.0
Other*	12	7.5
Softball	9	6.1
Wrestling	9	6.1
Golf	8	5.4
Football	6	4.1

**Notes:** \*Other category includes: archery, cheerleading, tennis, volleyball, badminton, hockey, rugby, and swimming.

## Sport and Injury Demographics

Baseball was the most common cause of sport-related injury followed by basketball and soccer (Table 1). Contusion, followed by hyphema, or bleeding from the anterior chamber, were the most common injuries, compromising a total of 90.5% of the total injuries (contusion 82.5%, n=122; hyphema 8.1%, n=12). Cross-analysis of types of injury and sport shows that contusions were most prevalent in baseball (n=49; 40%) and basketball (n=25; 20%) injuries. In our cohort,

16.4% of hyphemas and contusions cases had underlying orbital fractures and 31.8% of these injuries required surgical intervention.

Football, baseball, archery, and soccer were most associated with posterior pole pathologies and vitreous hemorrhage was seen as the most common posterior pole injury. (Table 2).

## Impact on Visual Acuity

Of the 66 patients who had VA recorded on initial admission, 13.6% (n=9) required surgical intervention. Snellen VA from initial and longitudinal visits were collected and averaged to the nearest Snellen value using mean LogMAR values among patients in each sport group and among those who required surgical intervention (Table 3). Baseball and football injuries were impactful on initial presenting VA with both sports causing cases of blindness or severe VA impairment in greater proportion compared to the other sports analyzed, including archery, golf, and tennis (n=2 each) (Figure 1).

**Table 2** Descriptive Analysis Between Sport and Type of Posterior Pole Injury and Other Ocular Pathologies

Injury (Total Number)	Sport Category	Number of Eyes	Percentage of Injury
Retinal detachment and defects (4)	Football	1	25.0%
	Baseball	1	25.0%
	Archery	1	25.0%
	Golf	1	25.0%
Macular scar (2)	Archery	1	50.0%
	Baseball	1	50.0%
Vitreous Hemorrhage (6)	Soccer	4	66.7%
	Baseball	1	16.7%
	Golf	1	16.7%
Unspecified chorioretinal scar (1)	Soccer	1	100%
Macular cyst, hole, pseudohole (1)	Soccer	1	100%
Orbital fractures (18)	Baseball	12	66.7%
	Basketball	1	5.5%
	Football	1	5.5%
	Soccer	3	16.7%
	Softball	1	5.5%
Open globe (1)	Golf	1	100%

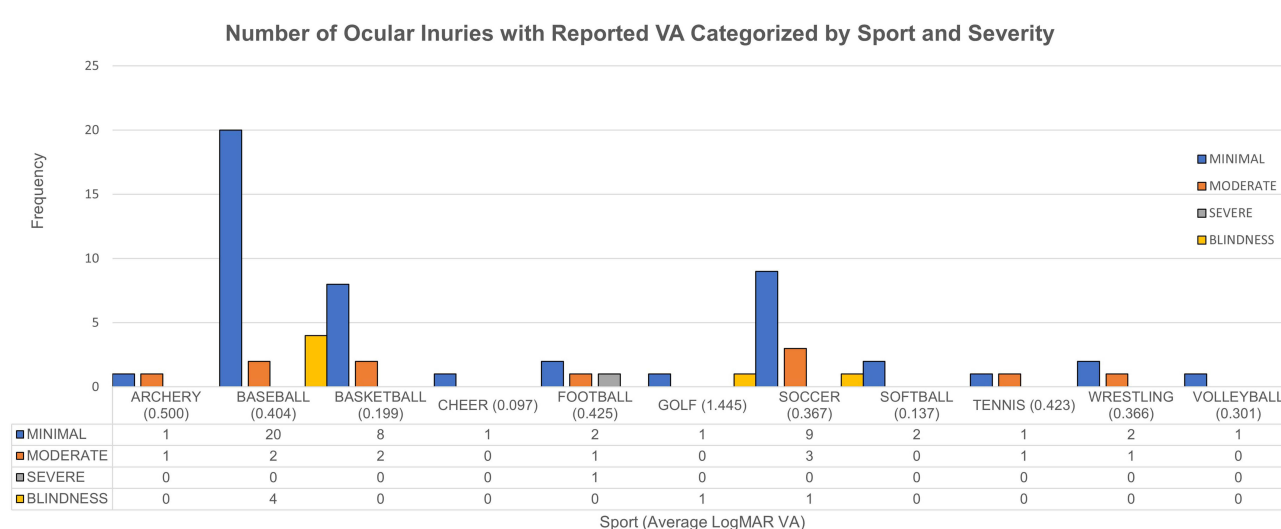
**Table 3** Average Snellen Visual Acuity of Sport Injuries on Initial Presentation and Follow-up

Sport	Average Visual Acuity (LogMAR values)			
	All Injuries	Injuries Requiring Surgery	All Injuries on Follow-Up	Injuries Requiring Surgery on Follow-Up
Archery	20/63 (0.500)	20/20 (0)*	20/15 (-0.125)*	20/15 (-0.125)*
Baseball	20/50 (0.404)	20/198 (0.996)	20/43 (0.329)	**CF @ 2' (1.8)*
Basketball	20/32 (0.199)	20/20 (0)*	20/20 (0)*	20/20 (0)*
Soccer	20/47 (0.367)	20/90 (0.651)	20/78 (0.59)	20/3170 (2.2)*
Football	20/53 (0.425)	20/200 (1.00)*	20/40 (0.301)*	20/40 (0.301)*
Cheerleading	20/25 (0.097)*	n/a	n/a	n/a
Golf	20/562 (1.4485)	n/a	***LP only (2.8)*	n/a
Softball	20/27 (0.137)	n/a	n/a	n/a
Wrestling	20/46 (0.366)	n/a	n/a	n/a
Volleyball*	20/40 (0.301)*	n/a	n/a	n/a

Note: \*n=1 \*\*CF=Counting Fingers \*\*\*LP=Light Perception.

### Injuries Requiring Surgical Intervention

Orbital contusions and retinal detachments/defects were the most common diagnoses on admission that resulted in the need for surgical intervention. Orbital fracture was the leading cause of ocular injuries requiring surgery (54.5%; n=6) followed by retinal detachments and tears (27.3%; n=3). Baseball accounted for the majority (66%; n=4) of orbital fracture injuries followed by soccer 16.7% (n=1) and basketball 16.7% (n=1). Baseball, football, and soccer equally contributed to 1 retinal detachment injury requiring surgery. Soccer caused the lone macular hole injury requiring surgical intervention while golf caused the lone ruptured globe injury requiring surgical intervention.



**Figure 1** Number of Ocular Injuries with Reported VA Categorized by Sport and Severity.

Notes: Figure 1 categorizes ocular injuries by both sport and severity of each as minimal, moderate, severe, or blindness. The frequency of injury by sport is noted as well as the average LogMAR visual acuity across each sport.

**Table 4** Distribution of Age Between Sports

Distribution of Age Between Sports				
	3–11 Years (n=62)	12–18 Years (n=86)	Total	P-value
Golf	3	5	8	0.79
Baseball/Softball	36	30	66	<0.01*
Soccer	5	17	22	0.04*
Wrestling	3	6	9	0.59
Basketball	8	17	25	0.27
Other	7	5	12	0.25
Football	0	6	6	0.04*

**Note:** \*: These values are statistically significant with P values < 0.05.

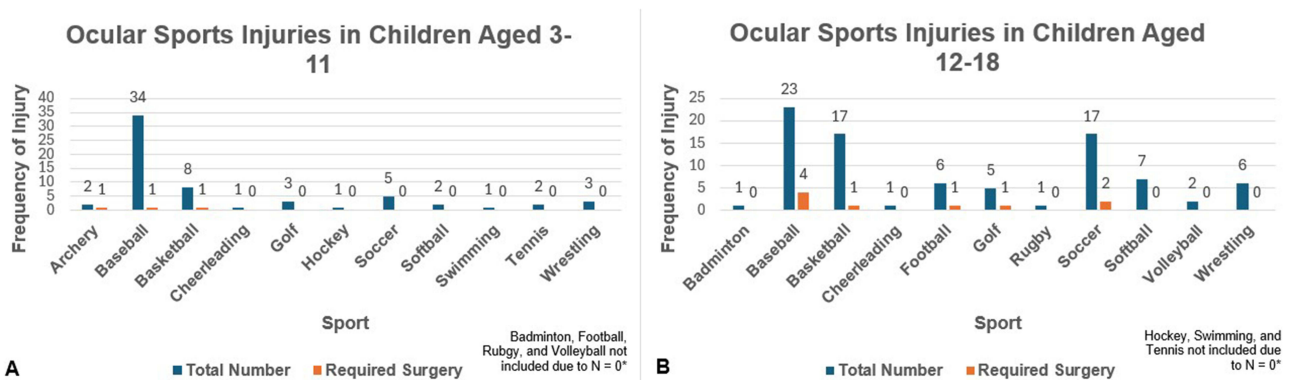
### Orbital Fractures

Sport-related pediatric injuries were the cause of 18 out of 27 total orbital fractures observed in our study. Baseball (n=12) was the most common cause of these orbital fractures, comprising 67% (p=0.0001) of all orbital fracture injuries. Interestingly, sub-analysis of baseball-related orbital fractures requiring surgery (n=4) indicated that 75% were orbital floor fractures. In total, 27.8% of all orbital fractures were due to orbital floor fractures. In our cohort, 16.4% of hyphemas and contusions cases also had underlying orbital fractures.

### Age Stratification of Sport and Injury

Certain sports, including hockey, tennis, archery, and swimming were only seen in children aged 3–11 years while sports such as rugby, badminton, football, and volleyball were only seen in children aged 12–18 years thus were categorized under “Other” in Table 4. Table 4 provides a comprehensive list of the sports examined and the statistical significance to each age group. Baseball and softball injuries comprised a majority of all ocular injuries overall, accounting for 44.5% of all injuries. Chi-square analysis found that baseball and softball injuries were statistically associated with ages 3–11. Conversely, soccer and football participation showed significant association with ocular injuries in older children aged 12–18 years.

Injuries requiring surgical intervention were noted in patients aged 3–11 years old who participated in baseball and basketball. For children aged 12–18 years old, baseball, basketball, football, golf, and soccer were the sports that required at least 1 surgical intervention. Overall, baseball was the most frequent cause for surgical intervention in both groups combined (Figure 2).



**Figure 2** Ocular Sports Injuries in Children Aged 3–11 and 12–18.

**Notes:** Graphical representation of ocular sports injuries in children categorized by sport and age of injury listed by both total number of injuries in blue and injuries requiring surgery in orange. (A). Ocular sports injuries in children aged 3–11. (B). Ocular sports injuries in children aged 12–18. \*Badminton, football, rugby, and volleyball not included due to N=0. B: \*Hockey, swimming, and tennis not included due to N=0.

## Discussion

Ocular trauma and its complications can predispose patients to long-term physical and mental comorbidities.<sup>3,11</sup> As a leading cause of ocular trauma, sports participation constitutes approximately 22% to 40% of hospitalized cases and ocular morbidity.<sup>3</sup> Despite the concern for ocular trauma, the health benefits of youth sport group participation are well known. In addition to the benefits of overall physical activity such as cardiorespiratory fitness, muscular conditioning, and favorable metabolic profiles,<sup>12</sup> sports participation is shown to have improved psychological and social health with reduced levels of anxiety and depression among participants.<sup>13</sup> In order to optimize health benefits of sport participation, it is necessary to understand the leading causes of sport-related injuries in order to provide more focused safety guidelines. Our study is one of the few to provide an in-depth analysis of sport-participation ocular injuries with emphasis on the type and severity of injury as well as analysis on different pediatric age groups to determine differences in participation and injury.

Similar to prior studies, approximately 10% of our study's pediatric population were evaluated for ocular trauma due to sport-related injuries.<sup>13</sup> Baseball (38.8%, n=57), basketball (17%; n=25), and soccer (14.9%; n=22) were the most common sports associated with ocular trauma in our cohort. Although this is similar to findings by Dockery et al who found participation in these three sports as the most common causes of pediatric ocular injuries in a Massachusetts tertiary eye clinic, these rankings differ slightly from the American Academy of Ophthalmology which states that basketball followed by both baseball and softball are the most common causes of ocular injury in pediatric sports.<sup>7,14–16</sup> Nonetheless, it should be noted that these trends are not universal as each nationality prefers different popular sports. While baseball, basketball, and soccer are popular in the United States,<sup>14</sup> countries such as Finland have a higher number of participants in floorball, soccer, and tennis and report these sports as the most common cause of ocular injury.<sup>17</sup> China shows injuries most commonly from handball, water polo, and diving.<sup>18</sup>

Contusion and hyphema were the leading diagnoses for ocular trauma on initial admission for our cohort, making up a combined 90.5% of all sport trauma cases.

Both injuries are typically due to blunt force trauma that acutely elevates intraocular pressure.<sup>19</sup> Although uncomplicated contusions usually present with mild symptoms and are managed conservatively, detailed initial examination must be performed to rule out serious comorbidities that require urgent medical management.<sup>19,20</sup> Similarly, the acute changes in intraocular pressure following blunt trauma expose the anterior chamber vasculature to shearing forces which results in the accumulation of red blood cells and subsequent hyphema.<sup>21</sup> While small-sized hyphemas typically resolve spontaneously within days to weeks, complications arising with secondary hemorrhage can occur in 6% to 38% of patients within a week of initial injury.<sup>14</sup> Moreover, both contusions and hyphemas can mask other more serious traumas.

A way to quantify the effect that ocular trauma has on VA could be with visual dysfunction. Visual dysfunction is often experienced after an acute brain injury (ABI) with trauma from sports being one of the most common causes of an ABI.<sup>22</sup> Individuals with visual dysfunction can experience a variety of symptoms, ranging from eye fatigue to diplopia and photophobia.<sup>23</sup> The impact of untreated visual dysfunction can have profound effects on a child's quality of life, stunting their academic and social trajectory.<sup>24</sup> Children with visual impairment have significantly lower quality of life measurements when compared to children without visual impairments.<sup>24</sup> Additionally, if left untreated, visual dysfunction in children can lead to impaired academic development in a school setting and can have profound influences on the child's learning potential.<sup>23</sup> The effects of visual impairment highlight the continual need to monitor eye traumas for untreated visual dysfunction and showcase the potential consequences of ocular trauma on a child's growth.

### Baseball – Most Common and Detrimental

Of the three most common sports causing ocular injury (baseball, basketball, and soccer), baseball was the only sport that demonstrated a statistically significant association with more than one injury – contusion and retinal injury. When analyzing visual impairment caused by sport trauma, baseball was the leading cause for all injuries resulting in blindness. Baseball can be categorized as a high-risk sport for injury due to its usage of a hard ball and bat.<sup>25</sup> The most common mechanism of ocular injury was found to be blunt trauma resulting from the hardness, velocity, and size of the baseball. The leading cause of ocular trauma in baseball was found to be due to contact with the baseball 24.6% of the time.<sup>7</sup> Baseball additionally constituted the primary cause of ocular injuries requiring surgical intervention, particularly orbital

fractures. Our data showed that patients aged 3–11 years were more likely to sustain an ocular injury from participation in baseball compared to older children aged 12–18 years. It is worth noting here that children ages 12 and younger play on a Little League field sized 46–60 feet between base paths while children above the age of 12 play on a field sized 60–90 feet between base paths. This could contribute to a greater number of ocular injuries in children 12 and younger due to the shorter distance the ball has to travel. Although ocular trauma from soccer and football more commonly affected older children, baseball remained the leading cause of ocular injuries requiring surgical intervention in both groups. Overall, the high prevalence of ocular trauma in younger pediatric populations remains a worrisome overall trend.

Similar to previous studies, 12% of sport-traumas resulted in orbital fractures.<sup>18</sup> Baseball was the primary cause, composing 72% of all sports-related orbital fractures. This differs slightly from the findings of Jones et al, who analyzed orbital blowout fractures in Manchester Royal Eye Hospital from 1987 to 1992 and found that soccer was more common.<sup>26</sup> The difference in these findings, however, may be explained by the variability in national preference and popularity of soccer in Manchester, UK compared to the United States.<sup>14</sup>

## Baseball Orbital Fractures

Orbital fractures with no accompanying loss of extraocular motility can be managed conservatively.<sup>26</sup> Surgical repair is indicated for injuries that illustrate entrapment, enophthalmos, and/or vertical ocular dystopia, particularly in cases with large orbital defects and loss of extraocular range of motion.<sup>27</sup>

In our study, the 27.8% of all orbital fractures due to orbital floor fractures were primarily directed to the floor of the orbit with minimal extension to other regions of the face and skull. To note, 66.7% of all cases of orbital fractures requiring surgery were orbital floor fractures independent of other facial fractures. This trend becomes more pronounced when viewing baseball-related injuries which were associated with orbital floor fractures exclusively. Only two cases of fractures extending past the orbit exist in our cohort. This differs from the findings of Ohana, who found that zygomatico-maxillary complex fractures were the most common type of orbital fracture in sport related injuries among adults.<sup>4</sup> The difference may be due to anatomical differences in pediatric skull and sinus development. In particular, immaturity of pediatric facial bones provides inherent resistance to fracturing of the bones.<sup>27</sup> Cartilaginous suture and cancellous bone allow for these bones to absorb blunt trauma energy, decreasing the risk of fracture. Several studies have found that this transition point to be around age 7.1 years with older children at increased risk of lower orbital fractures as compared to orbital roof fractures.<sup>28</sup> This coincides with our current data, as the average age for sports-related orbital fractures was found to be 13.4 years with baseball-related orbital fracture average age of 13.6 years. It should be noted that among all 148 cases of ocular injury, only 9, or 6%, required surgery.

## Limitations

There are several limitations to these results. This study was primarily a descriptive analysis of ocular injury among a pediatric sports population; therefore, caution should be taken when drawing causative conclusions from the results. The sample size was also relatively small as Table 3 has many values with an  $n=1$ , future studies could improve upon this study by increasing the number of cases analyzed. It is also worth noting that there could be a number of ocular injuries going unreported in Indiana, as this study only considers those that are treated at a given hospital. Lastly, the study could be improved with the addition of the Birmingham Eye Trauma Terminology (BETT) classification system.<sup>29</sup> The BETT attempts to standardize eye trauma terminology by providing a clear definition of injury types. Unfortunately, not all details for adequate classifications were available in our study to properly classify injuries.

## Current Safety Guidelines

Roughly 90% of ocular sports injuries are considered to be preventable with proper precautions and protective equipment.<sup>25</sup> Sports can be categorized into low risk, high risk, or very high risk according to the type of equipment utilized.<sup>25</sup> Low-risk sports use no ball, puck, bat, stick, racquet, or body contact. High-risk sports involve a ball, puck, bat, stick, racquet, and/or body contact. Very high-risk sports include no ocular protective equipment. According to published data from the American Academy of Ophthalmology (AAO) and other studies, baseball is considered a high-



**Figure 3** Batter's and Catcher's Helmets Approved for use by the National Operating Committee on Standards for Athletic Equipment (NOCSAE).<sup>31</sup>  
**Notes:** (A) An example of a batter's helmet approved by the NOCSAE. (B). An example of a catcher's helmet approved by the NOCSAE.

risk sport due to the ball and bat, as well as the high projectile velocity and hardness of the ball.<sup>3,6</sup> Although the AAO urges mandatory eye protection in organized sports participation, current guidelines for Little League teams fail to address proper ocular protection.<sup>30</sup> Currently, Little League International requires batters and base runners to wear helmets approved by the National Operating Committee on Standards for Athletic Equipment (NOCSAE) (Figure 3).<sup>31</sup> Although catchers are also required to wear face masks, these masks have wide openings near the orbits and are advised against by the American Society for Testing and Materials (ASTM).<sup>25</sup> While ocular protection can be added to both of these items, neither is mandated by Little League International. Despite many similarities between softball and baseball, it is worth noting that softball sees a large majority of children wear masks for eye protection while baseball does not. Currently, Little League offers no explanation for the lack of required eye protection, but this could be due to several reasons: a larger ball in softball can cause more damage to the head, the unique underhand pitching motion in softball can be difficult to predict its path, and a shorter pitching distance for softball leaves fielders less time to react to the fast ball speeds.

The introduction of mandatory eye protection in baseball may provide adequate safety measures against ocular trauma.<sup>6</sup> Both squash, racquetball, and hockey have already introduced goggles and visors to their protocols and have seen a dramatically reduced rate of ocular injury. In fact, after the 2013 mandate by the National Hockey League to wear half visors, a decline in eye injuries, particularly direct puck sticks, was observed.<sup>4</sup> Similarly, all competitive tournaments for squash and racquetball require goggle protection from all participants which has resulted in a zero-incidence rate of ocular injury.<sup>4</sup> Currently, ASTM has performance standards for eyewear in high-risk sports including baseball. These measures include protective eyewear that is impact-resistant with accompanying prescription and non-prescription polycarbonate lenses. Despite the introduction of these efforts as well as evidence for the protective roles ASTM-guided eye protection plays in ocular trauma, Little League International has yet to incorporate these measures into their sportswear regulations.

## Conclusion

This study adds to previous literature on pediatric ocular trauma from sports. Our study adds to the current literature by confirming that in the United States, baseball is one of the highest risk sports for youth in regard to impaired VA and necessity for surgical intervention. Greater emphasis on ocular protection may prevent ocular trauma in young athletes, especially those who participate in baseball. Sports are enjoyed by youth around the world, and our study highlights the importance of tracking the VA impairment risks involved in youth sports and their influence on ocular trauma outcomes. Parents, educators, and coaches with children involved in sports participation may view these results along with others and weigh the benefits of sport participation with the risk of ocular trauma.

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## Credit Author Statement

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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