Eyewear Protection

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abstract: *Sports-related eye injuries increased more than 100% in the last three years. More significant is the fact that nearly 90% could have been prevented had the athletes been wearing protective eyewear. A key to getting athletes to wear proper and protective eyewear is education. Educating not only the athletes, but coaches, parents and others involved in athletic activities is of paramount importance by the sports practitioner, because an eye injury can be very serious and have permanent consequences.*

key words: Eye; Trauma; Athletics; Sports Injury

INTRODUCTION

Knowledge in such areas as taping, bracing, and equipment fitting are all important and have to be addressed when working with athletes. Also, one area that is often utilized by the sports practitioner is education. Any individual involved with athletes, whether it be a health-care provider, coach, organizer or official, needs to have a general knowledge of how to educate athletes not only on good technique but also on safety procedures. The use of helmets, padding, mouthguards and braces are often stressed and usually managed well. However, one area of importance that is often neglected is eye protection. It is estimated that more than 100,000 sports-related eye injuries are severe enough to prompt a visit to a physician's office or emergency department each year (1). Sports-related eye injuries increased more than 100% in the last three years, moving from 41,000 to 100,000 (2). More significant is the fact that of those 100,000 injuries, 90% could have been prevented had the athlete been wearing protective eyewear (2). Preventive measures such as modification and enforcement of game rules, and the required wearing of certified eye protection have been shown to dramatically decrease the incidence of eye injury in certain sports (1). Therefore, the practitioner should have a good general knowledge of eyewear and appropriateness of wearing them in certain athletic activities.

DISCUSSION

Sports Breakdown

In the United States, baseball is the leading cause of eye trauma in children younger than 15. In the 15-to-24-year-old age range, basketball and football are the leading causes; racquet sports are responsible for most eye injuries in the group older than 24 (3). Four sports groupings account for 52.9% of the Consumer Product Safety Commission's (CPSC) known ocular injuries: basketball, baseball, swimming and pool sports, and racquet and court sports (4). Basketball eye injuries are caused mostly by an opponent's finger or elbow striking the player's eye, frequently during aggressive play under the boards (5). Baseball is estimated to cause 900,000 injuries annually; 170,000 are facial. Most baseball-related eye injuries arise from contact with the ball (6). Swimming and pool sports tally injuries from finger, elbows or feet in both competition and play (7). Risk of eye injury varies with each racquet sport. The likihood of suffering an eye injury for each 100,000 playing sessions are as follows: squash, 5.2; badminton, 3.6; tennis, 1.3; table tennis, 0.1. Racquet sports have had success with protective eyewear; however, many club-level and casual players do not wear eye guards (1). These four sports-groups makes up a little more than half of the CPSC-known ocular injuries, which still leaves a tremendous amount of eye injury suffered from all the sports events combined. Also, when analyzing the reasons for eye injury or trauma in sports, it is easy to understand how injuries could have been prevented by utilizing protective eyewear.

Eye Protection Testing Results

Proper eyewear can prevent an estimated 90% of sports- and work-related eye injuries (5). However, the wrong eyeglasses may convert blunt trauma into penetrating ocular injury and permanent visual impairment (6,7). Therefore utilizing the appropriate eyewear for a given sport is recommended. The first wave of effort by ophthalmologists to alter the incidence of eye injuries in sports in the USA was directed towards

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hockey, beginning in 1971. Baseball protection for batters was initiated in about 1980, and it is just beginning for fielders. The successful work done with these sports, as well as in racquet sports, has involved the efforts of ophthalmologists and manufacturers to identify the mechanisms of injury and develop eye protection devices that are effective and interfere minimally with play. Intensive work with manufacturers and independent standard agencies to insure quality control of eye protection devices, and with sports governing bodies to implement rules requiring eyewear, have been critically important in the process of reducing eye injuries (1). Vinger et al (8) evaluated 4 lenses that met the US standards for industrial spectacle lenses (ANSI Z87.1-1989) (9) and 7 lenses that met the standards for dress (ANSI Z80.1 - 1995) (10,11). The industrial lenses used had a minimum thickness of 3mm and were made from polycarbonate plastic, allyl resin plastic, heat-tempered glass, and chemically tempered glass. The dress lenses used were made of the same materials with the addition of high-index plastic and had center thickness ranging from 1mm to 2.2 mm. Test objects chose varied in diameter and hardness to reflect the range of potential impacts that could be encountered in industry, the military, hobbies, sports, motor vehicle crashes, assaults, and falls. Lenses were impacted with a variety of ranges from small, hard, and fast-moving (air gun pellet, golf ball) to larger soft (tennis ball), intermediate hardness (lacrosse ball), and hard (baseball). The results showed that the dress and industrial lenses made from glass, allyl resin plastic, and high-index plastic all shattered at impact energies less than those encountered from the test objects in their usual use whereas polycarbonate lenses showed adequate impact resistance. Industrial safety lenses made of glass or allyl resin plastic were more impact resistant than their dress counterparts but were unable to withstand the impact of the test objects of the usual speeds of these projectiles. Allyl resin plastic lenses were not more impact resistant then glass lenses. Allyl resin plastic dress lenses started to shatter when the velocity of a tennis ball exceeded 88 Km/h (55 mph), whereas glass lenses began to shatter at tennis ball velocity in excess of 142 Km/h (89 mph). High-index plastic lenses with a center thickness of 1 mm shattered at tennis ball velocities exceeding 64 Km/h (40 mph). When tested with a baseball at 150 Km/h (94 mph), all glass, allyl resin, and high-index lenses shattered N-polycarbonate lenses shattered; the 1.0 mm polycarbonate lens dented at the point of impact but did not crack. With a baseball at 186 Km/h (116 mph), the 1.0 mm polycarbonate lens shattered, the 1.5 mm polycarbonate lens bowed posterierly approximately 8 mm but did not shatter, and the 3.1 mm polycarbonate lenses remained intact with almost no posterier bowing. When the baseball velocity was increased to the maximum of the test apparatus, 216 Km/h (135 mph), the 3.1 mm polycarbonate lens remained intact with only approximately 4 mm of posterier bowing.

Eye Protection Recommendations

The results of the study indicate that the polycarbonate lenses is the lense of choice. The American Academy of Ophthalmology recommends that use of polycarbonate or allyl resin plastic with a center thickness of 3 mm be used for low-eye risk sports such as swimming, cross-country, running, bicycling, and track and field (12). Appropriate protective eyewear for high-eye risk sports are sports goggles with polycarbonate lenses (12). The high-eye risk sports that should utilize polycarbonate goggles are badminton, baseball, basketball, field hockey, handball, lacrosse, racquetball, soccer, softball, squash, street hockey, tennis and water polo (12). However, in high eye-risk sports like baseball, a polycarbonate face guard or other certified face protection attached to the helmet for batting and base running is recommended with the polycarbonate goggles used for fielding (12). Football players can utilize a polycarbonate shield on the helmet (12). It is recommended that these glasses be fitted by an experienced ophthalmologist, optometrist, or optician and a strap must secure the frame to the head (12).

Athletes with a high range of refractive error cannot use lenses made of polycarbonate. They may wear contact lenses (high power) protected by sports goggles with polycarbonate plano (nonprescription) lenses (12). Also, it is recommended that for sports in which a face mask or helmet with an eye protector or shield must be warn, functionally one-eyed athletes wear sports goggles with polycarbonate lenses (12).

CONCLUSION

Based on the data available, polycarbonate appears to be the lens material of choice for resistance to shattering. 3mm thick polycarbonate lenses have greater impact resistance then allyl resin plastic, high-index plastic, and glass for all projectiles tested (8). Therefore, it is important for the sports physician to be familiar with the types of sports goggles worn, as well as, the type of sports activity played by athletes whom they are seeing either in the office or as team doctor.

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