

## Oral trauma in adolescent athletes: a study of mouth protectors

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### Abstract

*The purpose of this study was to determine the extent of mouth protector use, as well as the amount and type of oral trauma associated with and without mouth guard wear in adolescent athletes. Coaches' perceptions and regulations involving the use of mouth protectors also were examined. Interviews were collected from 2470 junior and senior high school football players with all oral trauma being documented, regardless of the sport during which the injury occurred. Nine per cent of all players suffered from some form of oral injury while another 3% reported a loss of consciousness. Seventy-five per cent of the injuries occurred while not wearing mouth guards, and of this total 40% occurred during baseball and basketball. Fifty-six per cent of all concussions were suffered while not wearing mouth guards. Despite the ability of mouth protectors to significantly help reduce oral injuries, trauma related to sports is more prevalent than previously reported. This study supports the recommendation of mandatory mouth guards in baseball and basketball.*

### Introduction

While the use of mouth protectors has been advocated for more than 20 years, the athletic community as a whole has not fully accepted their use. Mouth guards have proven to reduce greatly the number and severity of traumatic oral injuries to participants in football and hockey, but their acceptance in most other sports has been almost non-existent.

Historically, the need for adequate mouth protection while participating in athletics came to the forefront in 1962 when the National Alliance Football Rules Committee passed mandatory legislation that all high school and collegiate football participants must wear some form of mouth protector (Bureau of Health Education and Audiovisual Services Council on Dental Materials, Instruments, and Equipment. Mouth protector and sports team dentists. *J Am Dent Assoc* 109(1):84-87,1984). This rule also included the use of face masks. College football participants were protected

when The National Collegiate Athletic Association later passed a similar rule. W.D. Heintz (1968) reported that with mouth protection there were an estimated 25,000 to 50,000 fewer injuries during the 1967 football season.

Prior to the mandatory use of a face mask and mouth protector, oral trauma was reported to comprise 50% of all football injuries (Heintz 1968). With the introduction of the face mask, oral trauma was cut in half, and mouth protectors were reported to nearly eliminate the remaining portion. The incidence of facial and dental injury per 100 players reportedly decreased from 2.26% prior to mandatory face masks and mouth protectors to 0.3% in 1966. More recent studies show the prevalence of oral injury while participating in football is actually much greater (Garon et al. 1986). Garon et al. (1986) reported that 3.9% of the adolescent football players surveyed suffered some type of oral trauma while wearing a mouth guard.

Mouth protectors help reduce the likelihood of oral trauma and concussion by a number of mechanisms (Seals et al. 1986). Josell and Abram (1982) report that by separating the soft tissue and the teeth, the mouth protector may prevent laceration and bruising of the lips and cheeks during impact. Also, they write that mouth guards will cushion and distribute the impact during a direct frontal blow which might otherwise cause fracture or dislocation of anterior teeth. Mouth guards may prevent the teeth in opposing arches from traumatic contact, which could fracture the teeth or damage their supporting structures. In addition, Josell and Abrams (1982) report that mouth guards may help prevent concussions, cerebral hemorrhage, and possibly death, by separating the jaws, thus preventing the condyles from being displaced up and backward against the wall of the glenoid fossa.

Despite the reported reduction of oral injuries related to football and ice hockey, other sports continue to have a high potential for oral trauma. Baseball and

basketball have been reported to have a significant potential for producing trauma to hard and soft oral tissues (Garon et al. 1986). Furthermore, current mouth protectors worn by the majority of high school athletes still would appear to be insufficient to adequately protect the soft tissue (Garon et al. 1986). The purpose of this study was to determine the extent of mouth protector use as well as the amount and type of oral trauma associated with and without mouth guard wear in high school athletes. The study also was designed to evaluate the attitudes of high school football coaches regarding the usefulness of mouth guards and their criteria for selecting a specific mouth protector.

## Methods and Materials

A total of 2470 interviews were collected representing 21 junior and senior high schools that participated in a preseason medical and dental screening at The Children's Hospital of Alabama. The interviews were taken from individuals who participated in organized football during one or more of the 1984, 1985, and 1986 seasons. This represents cross-sectional data of this population with no attempt made for following participants longitudinally. Each athlete received complete physical and oral examinations. The oral examination was performed with tongue blades and artificial light. Both hard and soft oral tissues were examined to identify caries, dental fractures, or oral disease which could affect the athlete's performance.

Prior to the oral examination, each player was asked a series of questions concerning his use of mouth protectors and any history of oral trauma while participating in sports. Each player also was questioned regarding any history of loss of consciousness while participating in any sport. Positive responses to prior trauma were qualified concerning the type and location of the injury, the sport during which the injury occurred, and whether the athlete was wearing a mouth protector at the time of injury.

In addition to the player interviews, 21 high school football coaches were interviewed and questioned concerning their attitudes toward mouth protector use by their teams. These asked: why a mouth protector is used; when is it required; the types of mouth protector used; the major reason for choosing a specific mouth protector; the players' acceptance of a mouth protector; and personal feeling as to whether mouth guards prevent oral injury.

Relationships between mouth protector use, hard or soft oral tissue trauma, and concussions were evaluated statistically using Chi-square analyses, accepting  $P < 0.01$  as significant.

## Results

The players ranged in age from 10 to 18 years, with the mean age being 15 years 5 months. Although the study was conducted on junior and senior high school football players, many of them also participated in other organized and unorganized sports. Therefore, all oral trauma documented by these players was noted regardless of the sport during which the injury occurred. Only sports-related injuries were recorded which included injuries sustained while playing football, baseball, basketball, swimming, ice hockey, and unorganized football, to name a few. Tables 1 and 2 list the different sports in which oral trauma and concussions were sustained over the three-year study.

Of the 2470 interviews conducted over the three-year period, there were 222 oral injuries noted, indicating that 9% of all players suffered some form of oral injury while participating in a sport. Sixty-four (3%) of the individuals reported a loss of consciousness while participating in some form of sport activity. The total number of traumatic injuries occurring while not wearing a mouth protector was 167, or 75% of the injuries recorded. Of this total, 40% of the injuries documented occurred during baseball and basketball,

**Table 1. Total Oral Injuries**

<i>Sport</i>	<i>With* Mouth Guard</i>	<i>Without* Mouth Guard</i>	<i>Total</i>
Football	52	53	105
Unorganized football	0	13	13
Baseball	0	31	31
Basketball	2	36	38
Swimming	0	6	6
Ice hockey	0	2	2
Wrestling	0	6	6
Bicycling	0	8	8
Boxing	1	1	2
Volleyball	0	1	1
Surfing	0	1	1
Motocross	0	1	1
Water skiing	0	1	1
Roller skating	0	1	1
Skateboarding	0	2	2
Weight training	0	1	1
Fishing	0	1	1
Karate	0	1	1
Softball	0	1	1
	55	167	222

\* N for the population wearing a mouth guard = 2167 interviews.

° N for the population not wearing a mouth guard = 303 interviews.

**Table 2. Concussions**

<i>Sport</i>	<i>With* Mouth Guard</i>	<i>Without* Mouth Guard</i>	<i>Total</i>
Football	27	19	46
Unorganized football	0	3	3
Baseball	1	10	11
Motocross	0	1	1
Water skiing	0	1	1
Bicycling	0	1	1
Wrestling	0	1	1
	28	36	64

Total Number of Injuries

$$222 + 64 = 286$$

Total Oral Injuries      Concussions      Total No. of Injuries

\* N for the population wearing a mouth guard = 2167 interviews.

° N for the population not wearing a mouth guard = 303 interviews.

and while the players were not wearing mouth protectors. The total number of concussions or losses of consciousness suffered by individuals not wearing a mouth protector was 36. This figure represents 56% of the 64 concussions. There were significantly fewer concussions while wearing mouth protectors ( $P = 0.0001$ ). When combining the total number of injuries with the total number of concussions (203 of 286—71%), traumatic experiences were suffered while not wearing a mouth protector.

A substantial incidence of the oral trauma not associated with mouth protector use was seen among participants in baseball, basketball, and unorganized football. Table 3 lists the types of oral trauma incurred by the athletes, with lacerations, fractured teeth, luxated teeth, and avulsed teeth being the most common. Table 3 also compares the amount of hard and soft tissue trauma with the use of mouth protector wear. When considering the risk of soft tissue trauma to any individual within the population, mouth protectors reduce the potential for injury by a multiple of 7.6. Specifically, only 41 individuals out of 2167 (95% of the 2470) wearing a mouth guard had soft tissue trauma, whereas 54 of 303 participants not wearing mouth protectors received injury to the soft tissue. Participants not wearing mouth protectors were almost 60 times more likely to sustain hard tissue trauma than those who wear mouth protectors. The prevalence of both soft and hard tissue injuries was significantly lower while wearing mouth protectors ( $P = 0.0001$ ).

Table 4 (page 212) presents the coaches' opinions on mouth protector use. The majority of coaches required the use of mouth protectors at all times for football, including scheduled games and practice. The mouth protector used by most teams was a stock protector with

**Table 3. Types of Oral Trauma**

<i>Injury</i>	<i>With* M. Protector</i>	<i>Without* M. Protector</i>	<i>Total</i>
Laceration	38	47	85
Fractured teeth	7	78	85
Avulsed	1	12	13
Luxated	3	19	22
Hematomas	3	7	10
Mandibular fracture	1	2	3
TMJ stiffness	1	1	2
Paresthesia	1	0	1
Fractured porcelain crown	0	1	1
	55	167	222

the primary reason for its selection being cost. Most coaches felt that mouth protectors reduce oral trauma; however, mouth protector selection was based on the cost of the appliance versus the degree of oral protection.

## Discussion

The results of this study and several other studies can be summarized broadly by stating that mouth protectors will greatly reduce the likelihood of oral injury (Seals 1985; Garon et al. 1986). This is due to spreading the force of impact over all the teeth covered by the mouth protector. Mouth protectors also prevent the traumatic contact between the maxillary and mandibular teeth (Josell and Abrams 1982).

It is apparent that oral injury has been reduced in football due to mandatory enforcement of mouth protector wearing. However, Table 1 shows that more than half (53%) of the oral injuries and a quarter (28%) of the concussions were reported in other sports. Baseball, basketball, and unorganized football show a high percentage of oral trauma, with only a few of the players wearing mouth protectors. Since the survey principally included football players, the exact risk of oral trauma suffered during participation in other sports cannot be definitely calculated. This study, however, does corroborate the study done by Davis and Knott (1984) which found that more than twice the number of injuries occurred in non-contact sports compared to contact sports.

Due to the diversity of sports that can produce oral trauma, it is recommended that mouth protectors be worn by all individuals participating in baseball, basketball, rugby, field hockey, squash, racketball, tennis, lacrosse, karate, judo, volleyball, and touch football. In addition, youth baseball generates a large number of oral facial and head injuries, yet mouth protectors are not required (Overview of sports-related

**Table 4. Coaches' Questionnaire**

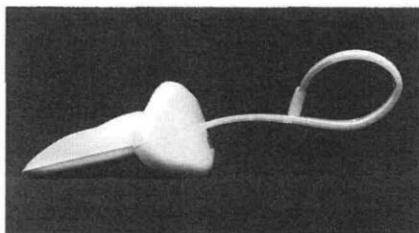
1. What sport(s) do you coach?	
Football .....	100%
Football and others .....	35%
2. In what sports(s) do you require participants to wear mouth guards?	
Football .....	100%
Other sports .....	16%
3. Why do you require the use of a mouth guard?	
School rule .....	58%
Coaches rule .....	42%
4. When is mouth guard use required?	
All times (games and practices) .....	95%
Games only .....	5%
5. What types of mouth guards does your team use?	
Mouth-formed .....	30%
Stock .....	60%
Custom .....	10%
6. What influences your choice of mouth guard types?	
Cost .....	46%
Convenience .....	27%
Quality and degree of oral protection .....	27%
7. How do you rate your players' acceptance of mouth guards?	
Very favorable .....	54%
Favorable .....	32%
Dislike .....	14%
8. Do you feel that mouth guards prevent oral injuries?	
Yes .....	95%
No .....	5%
9. Would you like more information on the different types of mouth guards available?	
Yes .....	95%
No .....	5%

injuries to persons 5-14 years of age. Washington, D.C., U.S. Consumer Product Safety Commission, 1981). Castaldi (1986) has reported that youth baseball generates by far the greatest number of oral facial and head injuries compared to any other sport. These observations are probably best explained by the lack of protective wear required for baseball players.

The results of this study also indicate the need for football players to have better soft tissue protection. In the athletes who suffered soft tissue laceration, 44% were wearing a mouth protector at the time of injury. Increased protection could be achieved by complete intraoral soft tissue coverage with extra oral lip and cheek coverage (Figs 1a and b). Several stock mouth protectors are commercially available with perioral shields. Perioral shields also can be added easily to custom mouth protectors.

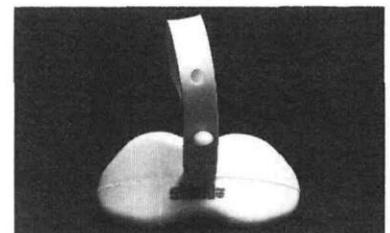
The usefulness of a mouth protector also was noted by the number of athletes suffering from loss of consciousness. Mouth protectors alone do not account for the overall difference in concussion rates between wearers and non-wearers since other protective equipment, such as helmets or face guards, would not necessarily be worn during baseball. However, even in organized football, a disproportionate number of concussions occurred while players were not wearing mouth protectors. This indicates that mouth protectors are very effective at reducing concussions.

The result of the coaches' questionnaire reveals that 95% of the coaches feel that mouth protectors prevent oral injuries. Their main criterion for selection of a mouth protector was cost. The least important reasons for selection of a mouth protector were quality and the degree of oral protection. All coaches required their athletes to wear mouth protectors while playing football, but only 16% require participants to wear a mouth protector in other sports. Coaches and parents must be made aware of the high potential for oral injury in sports such as baseball and basketball, which do not have mandatory mouth protector rules. Seals et al. (1984) report that 72% of schools in Texas were using sales representatives as a major source of information



**Fig 1a.** Lateral view of a stock mouth protector with a perioral shield.

**Fig 1b.** Frontal view of the same mouth guard showing complete perioral coverage. (Mouth guard provided by Shield Manufacturing, Tanawanda, NY 14151).



concerning mouth protectors. It also was noted that only 4% of more than 16,000 athletes surveyed had mouth protectors fitted by a dentist.

Most coaches (86%) rate their players' acceptance of the mouth protector as favorable or very favorable in football. Thus, most are wearing their oral protector while playing football; however, many appear not to see a reason for protection in other sports. Finally, most coaches would like additional information on the different types of mouth protectors currently available and which designs offer maximum protection. Dentists should be more involved in providing information to coaches, and in questioning the patients as to their participation in sports so that adequate oral protection can be recommended.

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## Hepatitis B is spreading

Hepatitis B, a viral liver disease, is such a health and economic threat in the United States that authorities are considering inoculating all newborns or children.

A spokesman for the Centers for Disease Control said nearly all intravenous drug users are infected with Hepatitis B, and about 300,000 new cases of the disease occur each year. Only half of those infected show clinical symptoms. Between 6 and 10 percent of symptoms are very slight, but the carrier is able to spread the disease.

The disease is thought to cause about 5,000 deaths a year, either directly or indirectly. Treatment costs have reached \$1 million per day.

Hepatitis B is spread mainly through exchange of body fluids, as in sexual contact, the sharing of narcotic needles or from a mother giving birth passing it on to her child. The disease has a long incubation period—several months—but the serious effects, such as liver failure or cancer, may not appear for decades in chronic carriers.

Up to now, the vaccine against Hepatitis B has been recommended only for healthcare workers and those at high risk. The vaccine can prevent the disease, but it cannot cure it once a patient is infected. And the vaccine is expensive—about \$120 for the recommended three-shot series.

The CDC has proposed that consideration be given to universal use of the Hepatitis B vaccine among newborn infants and children. But such a program would not have a noticeable effect on the spread of the disease for 10 to 30 years.