Policy on Prevention of Sports-Related Orofacial Injuries

Latest Revision

2023

How to Cite: American Academy of Pediatric Dentistry. Policy on prevention of sports-related orofacial injuries. *The Reference Manual of Pediatric Dentistry*. American Academy of Pediatric Dentistry; 2026: 138-143.

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes the prevalence of sports-related orofacial injuries in our nation's youth and the need for prevention. This policy is intended to educate dental professionals, health care providers, and educational and athletic personnel on the prevention of sports-related orofacial injuries.

Methods

This policy was developed by the Clinical Affairs Committee, adopted in 1991[1], and last revised by the Council on Clinical Affairs in 2018[2]. The revision of this policy is based upon a review of current dental and medical literature related to orofacial injuries, including their prevention. Literature searches of PubMed/MEDLINE and Google Scholar databases were performed using the terms: *sports injuries*, *injury prevention*, *dental injuries*, *orofacial injuries*. Eighty-six articles met these criteria. The articles were evaluated by title and/or abstract and relevance to the prevention of sports-related orofacial injuries. The policies, recommendations, and listed references of the Academy for Sports Dentistry (**ASD**) and the International Association of Dental Traumatology were consulted as valuable resources in preparation of this document.

Background

The tremendous popularity of organized youth sports and the high level of competitiveness have resulted in a significant number of dental and orofacial injuries.[3,4] From 1990-2003, an average of 22,000 dental injuries occurred annually in children younger than 18 years, a rate of approximately 31.6 injuries per 100,000 children and adolescents.[5] According to a 2020 health survey, 54.1% of children ages 6 through 17 years participated in sports during the previous year.[6]

All sporting activities have an associated risk of orofacial injuries due to falls, collisions, contact with hard surfaces, and contact from sports-related equipment. A systematic review reported between 10% and 61% of athletes experienced dental trauma.[7] A 10-year study of 3,385 craniomaxillofacial trauma cases presenting to an oral and maxillofacial surgery department found 31.8% of injuries in children occurred during sports activities.[8] Children ages 17 years and younger represented 80.6% of the total (sport- and non–sport-related) dental injuries that presented to US emergency rooms from 1990-2003, with the majority presented in children younger than 7 years of age.[5] In all age groups, males were more likely to sustain dental injuries than females.[5]

Introducing mandatory protective equipment significantly reduces dental and orofacial injuries.[9,10] Sports that require protective equipment in the US include high school field hockey, football, ice hockey, and lacrosse, in addition to wrestling for athletes wearing braces.[11] Popular sports such as baseball, basketball, soccer, softball, volleyball, and gymnastics lag far behind in injury protection. Baseball accounts for most injuries in the 7- to 12-year-old age group[4]; basketball has the highest incidence of sports-related dental injuries (2.4 per 100,000 athletic exposures) for high school boys.[12] For girls' high school athletics, the highest rate of injuries (3.5 per 100,000 athletic exposures) occurs in field hockey.[12] Youth participating in other activities such as skateboarding, inline or roller skating, and bicycling also benefit from appropriate protective equipment.[13-16] A large national survey confirmed the bicycle as the most common consumer sports product related to dental injuries in children, followed by playground equipment, other riding equipment (skates, inline skates), and trampolines.[5]

The use of the trampoline provides specialized training for certain sports. With recreational use, a considerable number of head and neck injuries occurs, most often a result of falls from the trampoline.[17] As a result of injury rates and catastrophic injuries associated with home use of trampolines, the American Academy of Pediatrics strongly discourages recreational trampoline use and limits support to structured and supervised training programs having safety precautions in place.[17]

Reported rates of dental and orofacial athletic injuries vary greatly depending on the size of the sample, the sample's geographic location, the ages of the participants, and the specific sports involved in the study.[18-22] Rates of traumatic dental injuries also differ in regards to the athlete's level of competition; amateur athletes exhibit a higher prevalence of sports-related injuries than do professionals.[19] The National

ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry. **ASD:** Academy of Sports Dentistry. **ASTM:** American Society for Testing and Materials.

High School Sports-Related Injury Surveillance Study captures information such as exposure (competition vs. practice), the injury, details of the event, and type of protective equipment used.[23] Data from this source found that in 2020-2021 school year, of the 619,714 injuries reported during competition, 117,820 (19%) occurred to the head/face; another 73,818 occurred during practice.[23] A similar study using this database followed athletes from 2008-2014 and found the rate of dental injuries in competition was 3 times higher than in practice.[23] For the majority of these reported injuries, the athlete was not wearing a mouthguard.[12,18] Review of this database found the highest rates of dental injuries in high school athletes occurred in girls' field hockey and boys' basketball.[18] Although the statistics vary, many studies reported that dental and orofacial injuries occurred regularly and concluded that participation in sports carries a considerable risk of injury.[8,14,21,22]

The consequences of orofacial trauma for children and their families are substantial because of potential for pain, psychological effects, and economic implications. Children with untreated trauma to permanent teeth exhibit greater impacts on their daily living than those without any traumatic injury.[24,25] The yearly costs of all injuries, including orofacial injuries, sustained by young athletes have been estimated to be 500 million dollars[26] and as high as 1.8 billion dollars[27]. Significant costs can accrue over a patient's lifetime for restorative, endodontic, prosthodontic, implant, or surgical treatment(s) resulting from dentoalveolar trauma. It has been suggested that the lifetime cost of an avulsed tooth in a teenage athlete can reach $20,000, exceeding the maximum benefits for most insurance companies.[28] Traumatic dental injuries have additional indirect costs that include children's hours lost from school and parents' hours lost from work, consequences that disproportionately burden lower income, minority, and non-insured children.[29-32]

The majority of sport-related dental and orofacial injuries affect the upper lip, maxilla, and maxillary incisors, with 50% to 90% of dental injuries involving the maxillary incisors.[21,22,28,33] The most common injuries in order of incidence are lacerations, crown fractures, and avulsions.[8] Crown fractures are the most common injury to permanent teeth[34], followed by subluxations and avulsions.[35] Even with a mouthguard in place, dentoalveolar injuries still can occur.[36]

Identifying patients who participate in sports and recreational activities allows the health care provider to recommend and implement preventive protocols for individuals at risk for orofacial injuries. For example, basketball is one of the sports with the highest incidence of dental injury, but these injuries usually involve player-player contact whereas greater than 87% of all dental injuries sustained by baseball, softball, and field hockey players are due to player-object contact.[12]

The frequency of dental trauma is significantly higher for children with increased overjet (>3 mm in the primary dentition and greater than >5 mm in the permanent dentition) and inadequate lip coverage.[37-39] A dental professional may be able to modify these risk factors. Initiating preventive orthodontic treatment in early- to middle-mixed dentition of patients with an overjet greater than 3 mm has the potential to reduce the severity of traumatic injuries to permanent incisors.[38]

Although some sports-related traumatic injuries are unavoidable, most can be prevented.[40-42] Helmets, facemasks, and mouthguards have been shown to reduce both the frequency and severity of dental and orofacial trauma.[42] While facemasks may not significantly reduce the risk of orofacial trauma due to player-player contact, they have shown a risk reduction with player-object contact.[10] The protective and positive results of wearing a mouthguard have been demonstrated in numerous epidemiological surveys and tests.[19,43-46] However, few sports have regulations that require their use. The National Federation of State High School Associations mandates mouthguards only for football, ice hockey, lacrosse, and field hockey and for wrestlers wearing braces.[11] Several states have attempted to increase the number of sports which mandate mouthguard use, with various degrees of success and acceptance. Three states (Maine, Massachusetts, and New Hampshire) have been successful in increasing the number of sports requiring mouthguard use to include sports such as soccer, wrestling, and basketball.[47] The mandated mouthguard rule likely has not expanded to other sports due to complaints by athletes, parents, and coaches that mouthguards interfere with how the game is played and the athletes' enjoyment.[48,49] Regardless of the relatively limited use of mouthguards in sports, the American Dental Associations and International Academy of Sports Dentistry currently recommend the use of mouthguards in 29 sports or activities.[48,49]

Initially used by professional boxers, the mouthguard has been used as a protective device since the early 1900s.[7,21,50] The mouthguard, also referred to as a gumshield or mouth protector, is defined as a "resilient device or appliance placed inside the mouth to reduce oral injuries, particularly to teeth and surrounding structures."[51] The mouthguard was constructed to "protect the lips and intraoral tissues from bruising and laceration, to protect the teeth from crown fractures, root fractures, luxations, and avulsions, to protect the jaw from fracture and dislocations, and to provide support for edentulous space."[52] The mouthguard helps to prevent fractures and dislocations of teeth by providing cushioning from the blow and redistributing shock during forceful impacts and decreases the likelihood of jaw fracture by a similar mechanism and also by stabilizing the mandible.[53] The mouthguard acts as a buffer between the soft and hard dento-oral structures to prevent soft tissue injuries by separating the teeth from the tissues.[53] Data suggest that a properly fitted mouthguard of 3.0 mm thickness might reduce the incidence of concussion injuries from a blow to the jaw by positioning the jaw to absorb the impact forces which, without it, would be transmitted through the skull base to the brain.[54]

The American Society for Testing and Materials (**ASTM**) classifies mouthguards by 3 categories.[55]

1. Type I – Custom-fabricated mouthguards are produced on a dental model of the patient's mouth by either the vacuum-forming or heat-pressure lamination technique.[42] The ASTM recommends that for maximum protection, cushioning, and retention, the mouthguard should cover all teeth in at least one arch, customarily the maxillary arch, less the third molar.[55] A mandibular mouthguard is recommended for individuals with a Class III malocclusion.[56]
2. Type II – Mouth-formed, also known as boil-and-bite, mouthguards are made from a thermoplastic material adapted to the mouth by finger, tongue, and biting pressure after immersing the appliance in hot water.[51] Available commercially at department and sporting-goods stores as well as online, these are the most used among athletes but vary greatly in protection, retention, comfort, and cost.[42]
3. Type III – Stock mouthguards are purchased over-the-counter. They are designed for use without any modification and must be held in place by clenching the teeth together to provide a protective benefit.[43] Clenching a stock mouthguard in place can interfere with breathing and speaking and, for this reason, stock mouthguards are considered by many to be less protective.[57] Despite these shortcomings, the stock mouthguard could be the only option possible for patients with particular clinical presentations (eg, use of orthodontic brackets and appliances, periods of rapidly changing occlusion during mixed dentition).[58,59]

The custom-fabricated type is superior in retention, protection, and comfort.[42,53,59-62] When this type is not available, the mouth-formed mouthguard is preferable to the stock or preformed mouthguard.[59,63-65]

The ASD "recommends the use of a properly fitted mouthguard. It encourages the use of a custom fabricated mouthguard made over a dental cast and delivered under the supervision of a dentist. The ASD strongly supports and encourages a mandate for use of a properly-fitted mouthguard in all collision and contact sports."[56] During fabrication of the mouthguard, establishing proper anterior occlusion of the maxillary and mandibular arches is recommended as this will prevent or reduce injury by better absorbing and distributing the force of impact.[56] Additional considerations include the patient's vertical dimension of occlusion, personal comfort, and breathing ability.[64] By providing cushioning between the maxilla and mandible, mouthguards also may reduce the incidence or severity of condylar displacement injuries as well as the potential for concussions.[54,66]

Due to the continual shifting of teeth in orthodontic therapy, the exfoliation of primary teeth, and the eruption of permanent teeth, a custom-fabricated mouthguard may not fit the young athlete soon after the impression is obtained.[67] Several block-out methods used in both the dental operatory and laboratory may incorporate space to accommodate for future tooth movement and dental development.[67] By anticipating required space changes, a custom fabricated mouthguard may be made to endure several sports seasons.[67]

Parents play a vital role in the acquisition and use of a mouthguard for young athletes. In a 2004 national fee survey, custom mouthguards ranged from $60 to $285.54.[68] In a study to determine the acceptance of the 3 types of mouthguards by 7- and 8-year-old children playing soccer, only 24% of surveyed parents were willing to pay $25 for a custom mouthguard.[68] Thus, cost may be a barrier.[68] However, a more likely barrier may be that children do not accept mouthguard use easily. In a study of children receiving mouthguards at no cost, 29% never wore the mouthguard, 32% wore it occasionally, 15.9% wore it initially but quit wearing it after one month, and only 23.2 % wore the mouthguard when needed.[69]

Attitudes of officials, coaches, parents, and players about wearing mouthguards influence their usage.[48] Although coaches are perceived as the individuals with the greatest impact on whether or not players wear mouthguards, parents view themselves as equally responsible for maintaining mouthguard use.[48,70] However, surveys of parents regarding the indications for mouthguard usage reveal a lack of complete understanding of their benefits.[70] Compared to other forms of protective equipment, mouthguard use received only moderate parental support in youth soccer programs.[71] A 2009 survey commissioned by the American Association of Orthodontists reported that 67% of parents stated their children do not wear a mouthguard during organized sports.[72] The survey also found that 84% do not wear mouthguards while participating in organized sports because it is not required, even though other protective equipment (eg, helmets, shoulder pads) is mandatory.[72] Players' perceptions of mouthguard use and comfort largely determine their compliance and enthusiasm.[55,73-75] Although a recent systematic review found athletic performance is neither impaired nor improved when wearing a custom-made mouthguard[76], more research is needed to address gaps related to athletic performance and mouthguard use[77,78].

Realizing athletes' speech as a potential hindrance to mouthguard compliance, the ASD recommends that a properly-fitted mouthguard should provide for adequate speech commiserate with the playing status of the athlete.[56] Given the multiple reasons for lack of compliance in wearing mouthguards, the dental profession needs to influence and educate all stakeholders about the risk of sports-related orofacial injuries and available preventive strategies.[55,65,79] Routine dental visits can be an opportunity to initiate patient/parent education and make appropriate recommendations for use of a properly-fitted athletic mouthguard.

Policy statement

The AAPD encourages

- dentists to play an active role in educating the public in the use of protective equipment for the prevention of orofacial injuries during sporting and recreational activities.

- continuation of preventive practices instituted in youth, high school, and college football, lacrosse, field hockey, ice hockey, and wrestling (for wrestlers wearing braces).
- an ASTM-certified face protector be required for youth participating in baseball and softball activities.
- mandating the use of properly-fitted mouthguards in other organized sporting activities that carry risk of orofacial injury.
- coaches/administrators of organized sports to consult a dentist with expertise in orofacial injuries prior to initiating practices for a sporting season regarding recommendations for immediate management of sports-related injuries (eg, avulsed teeth).
- continuation of research in development of a comfortable, efficacious, and cost-effective sports mouthguard to facilitate more widespread use of this proven protective device.
- dentists to provide education to parents and patients regarding prevention of orofacial injuries as part of the anticipatory guidance discussed during dental visits.
- dentists to prescribe, fabricate, or provide referral for mouthguard protection for patients at increased risk for orofacial trauma.
- third-party payors to realize the benefits of mouthguards for the prevention and protection from orofacial sports-related injuries and, furthermore, to improve access to these services.
- pediatric dentists to partner with other dentists and child health professionals, school administrators, legislators, and community sports organizations to promote the broader use of mouthguards.
- pediatric dental departments to teach dental students to fabricate custom-fitted mouthguards.

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