

OFFICIAL BUT UNFORMATTED

Policy on Prevention of Sports-related Orofacial Injuries

Review Council

Council on Clinical Affairs

Latest Revision

2018

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 originally developed by the Clinical Affairs Committee and adopted in 1991. This document is a revision of the previous version, revised in 2013. The revision of this policy is based upon a review of current dental and medical literature related to orofacial injuries, including their prevention. Database searches were performed using the terms: sports injuries, injury prevention, dental injuries, orofacial injuries. Seventy-seven references were chosen from this method and from references within selected articles. The policies, recommendations, and listed references of the Academy for Sports Dentistry (**ASD**) and the International Association of Dental Traumatology (**IADT**) 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 facial injuries.^{1,2} From 1990-2003, there was an average of 22,000 dental injuries annually in children less than 18 years of age.³ This was approximately 31.6 dental injuries per 100,000 children and adolescents. In 2007, it was reported that approximately 46 million youths in the United States were involved in "some form of sports" over the past decade.⁴ It has been estimated that 30 million children in the U.S. participate in organized sport programs.⁵ 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 systemic review reported between 10-61 percent of athletes reported experiencing dental trauma.⁶ A 10 year study of 3,385 craniomaxillofacial trauma cases presenting to an oral and maxillofacial surgery department found 31.8 percent of injuries in children occurred during sports activities.⁷ Children ages 17 years and younger represented 80.6 percent of the total (sport and not-sport related) dental injuries that presented that presented to U.S. emergency rooms from 1990-2003.³ In all age groups, males were more likely to have dental injuries than females.³

It has been demonstrated that dental and facial injuries can be reduced significantly by introducing mandatory protective equipment.^{8,9} Currently in the United States, high school football, lacrosse and ice hockey require protective equipment.¹⁰ Popular sports such as baseball, basketball, soccer, softball, wrestling, volleyball, and gymnastics lag far behind in injury protection for girls and boys. Baseball and basketball have been shown to have the highest incidence of sports-related dental injuries in children seven to 17 years of age.¹ More specifically, baseball accounted for the most dental injuries within the seven to 12 year old age group, while basketball was the most frequent sport associated with dental injuries in the 13 to 17 year age group.³ Youths participating in leisure activities such as skateboarding, inline or roller skating, and bicycling also benefit from appropriate protective equipment.¹¹⁻¹⁴ 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).³

The use of the trampoline provides specialized training for certain sports. However, when used recreationally, a significant number of head and neck injuries occurs, with head injuries most commonly a result of falls.¹⁵ The American Academy of Pediatrics (**AAP**) recommends practitioners advise patients and their families against recreational trampoline use and discuss that current safety measures have not decreased injury rates significantly.¹⁵ The AAP also states that practitioners "should only endorse use of trampolines as part of a structured training program with appropriate coaching, supervision, and safety measures in place".¹⁵

Studies of dental and orofacial athletic injuries are reported throughout the medical and dental literature.¹⁶⁻¹⁹ Injury rates 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.¹⁶⁻²⁰ Rates of traumatic dental injuries also differ in regards to the athlete's level of competition; less-professional athletes exhibit a higher prevalence of sports-related injuries.¹⁸ Most of the current data regarding injuries comes from the National High School Sports-Related Injury Surveillance Study and captures information such as exposure (competition vs practice), the injury, and details of the event and type of protective equipment used.²¹ Data from this source found that in 2016-2017 school year, of the 699,441 injuries reported during competition, 223,623 (32 percent) occurred to the head/face, and another 91,410 occurred during practice.²¹ A similar study using this database followed athletes from 2008-2014 and found the rate of dental injuries in competition was three times higher than in practice.²¹ For the majority of these reported injuries, the athlete was not wearing a mouthguard.²⁰ Review of this database found the highest rates of dental injuries in high school athletes occurred in girls' field hockey and boys' basketball.²⁰ 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.^{7,12,17,18}

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.^{22,23} The yearly costs of all injuries, including orofacial injuries, sustained by young athletes have been estimated to be 500 million dollars²⁴ and as high as 1.8 billion dollars.⁵ 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.²⁵ 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.²⁶⁻²⁹

The majority of sport-related dental and orofacial injuries affect the upper lip, maxilla, and maxillary incisors, with 50 to 90 percent of dental injuries involving the maxillary incisors.^{16,17,25,30} The most common injuries in order of incidence are lacerations, crown fractures, and avulsions.⁷ Crown fractures are the most common injury to permanent teeth,^{31,32} followed by subluxations and avulsions.³² While use of a mouthguard can protect the upper incisors, it may not protect against soft tissue injuries. However, studies have shown that even with a mouthguard in place, dentoalveolar injuries still can occur.³³

Identifying patients who participate in sports and recreational activities allows the healthcare provider to recommend and implement preventive protocols for individuals at risk for orofacial injuries. In 2000, a predictive index was developed to identify the risk factors involved in various sports.³⁴ This index is based upon a defined set of risk factors that predict the chance of injury including demographic information (age, gender, dental occlusion), protective equipment (type/usage), velocity and intensity of the sport, level of activity and exposure time, level of coaching and type of sports organization, whether the player is a focus of attention in a contact or non-contact sport, history of previous sports-related injury, and the situation (e.g., practice vs game).³⁴ Behavioral risk factors (e.g., hyperactivity) also have been associated significantly with injuries affecting the face and/or teeth.^{35,36}

While this predictive index looked at contact versus non-contact sport as a factor, non-contact sports can carry significant risk. 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 percent of all dental injuries sustained by baseball, softball and field hockey players are due to player-object contact.²⁰

The frequency of dental trauma is significantly higher for children with increased overjet (greater than 6 millimeters) and inadequate lip coverage.^{37,38} 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 three millimeters has the potential to reduce the severity of traumatic injuries to permanent incisors.³⁷

Although some sports-related traumatic injuries are unavoidable, most can be prevented.³⁹⁻⁴¹ Helmets, facemasks, and mouthguards have been shown to reduce both the frequency and severity of dental and orofacial trauma.³⁹ While facemasks may not significantly reduce the risk of orofacial trauma due to player-player contact, they might have a significant effect with player-object contact.⁹ The protective and positive results of wearing a mouthguard have been demonstrated in numerous epidemiological surveys and tests.^{18,42-46} 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.¹⁰ Several states have attempted to increase the number of sports which mandate mouthguard use, with various degrees of success and acceptance. Four states (Maine, Massachusetts, Minnesota, and New Hampshire) have been successful in increasing the number of sports requiring mouthguard use to include sports such as soccer, wrestling, and basketball.^{41,47,48} It is likely that the mandated mouthguard rule 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.^{47,49} Regardless of the relatively limited use of mouthguards in sports, the American Dental Association and International Academy of Sports Dentistry currently recommend the use of mouthguards in 29 sports or activities.⁵⁰

Initially used by professional boxers, the mouthguard has been used as a protective device since the early 1900s.^{6,17,51} 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."⁵² 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."⁵³ 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.⁵⁴ The mouthguard acts as a buffer between the soft and hard dento-oral structure to prevent soft tissue injuries by separating the teeth from the tissues.⁵⁴ Recent data suggests that a properly fitted mouthguard of 3.0 millimeter 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.⁵⁵

The American Society for Testing and Materials (ASTM) classifies mouthguards by three categories⁵⁶:

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.³⁹ 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.⁵⁶ A mandibular mouthguard is recommended for individuals with a Class III malocclusion. The custom-fabricated type is superior in retention, protection, and comfort.^{39,54,57-60} When this type is not available, the mouth-formed mouthguard is preferable to the stock or preformed mouthguard.⁶⁰⁻⁶³
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.⁵² Available commercially at department and sporting-goods stores as well as online, these are the most commonly used among athletes but vary greatly in protection, retention, comfort, and cost.^{39,42}
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.⁴⁵ 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.⁵⁰ Despite these shortcomings, the stock mouthguard could be the only option possible for patients with particular clinical presentations (e.g., use of orthodontic brackets and appliances, periods of rapidly changing occlusion during mixed dentition).^{42,60,64}

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."⁶⁵ During fabrication of the mouthguard, it is recommended to establish proper anterior occlusion of the maxillary and mandibular arches as this will prevent or reduce injury by better absorbing and distributing the force of impact.⁶⁵ The practitioner also should consider the patient's vertical dimension of occlusion, personal com-fort, and breathing ability.⁶³ 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.^{55,66}

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 an important role in the acquisition 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 three types of mouthguards by seven and eight-year-old children playing soccer, only 24 percent 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 percent never wore the mouthguard, 32 percent wore it occasionally, 15.9 percent wore it initially but quit wearing it after one month, and only 23.2 percent wore the mouthguard when needed.⁶⁹

Attitudes of officials, coaches, parents, and players about wearing mouthguards influence their usage.⁴⁹ 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.^{49,70} However, surveys of parents regarding the indications for mouthguard usage reveal a lack of complete understanding of the benefits of mouthguard use.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 (AAO) reported that 67 percent of parents stated their children do not wear a mouthguard during organized sports.⁷² The survey also found that 84 percent do not wear mouthguards while participating in organized sports because it is not required, even though other protective equipment such as helmets and shoulder pads is mandatory.⁷² Players' perceptions of mouthguard use and comfort largely determine their compliance and enthusiasm.^{56,73-75} 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.⁷⁶ 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.^{56,61,77} 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, for recommendations for immediate management of sports-related injuries (e.g., avulsed teeth).
- Continuation of research in development of a comfort-able, efficacious, and cost-effective sports mouthguard to facilitate more widespread use of this proven protective device.
- Dentists of all specialties, including pediatric and general 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, encourages them 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 fabrication of custom-fitting mouthguards.

References

1. Castaldi CR. Sports-related oral and facial injuries in the young athlete: A new challenge for the pediatric dentist. *Pediatr Dent* 1986;8(4):311-6.
2. Castaldi CR. Athletic mouthguards: History and present status. *Sports Med Digest* 1988;10:1-2.
3. Stewart GB, Shields BJ, Fields S, Comstock RD, Smith GA. Consumer products and activities associated with dental injuries to children treated in United States emergency departments 1990-2003. *Dental Traumatol* 2009;25(4):399-405.
4. Barron M, Powell J. Fundamentals of injury prevention in youth sports. *J Pediatr Dent Care* 2005;11(2):10-2.
5. Adirim T, Cheng T. Overview of injuries in the young athlete. *Sports Med* 2003;33(1):75-81.
6. Knapik JJ, Marshall SW, Lee RB, et al. Mouthguards in sport activities: History, physical properties and injury prevention effectiveness. *Sports Med* 2007;37(2):117-4..
7. Gassner R, Tuli T, Hachl O, Moreira R, Ulmer H. Craniomaxillofacial trauma in children: A review of 3,385 cases with 6,060 injuries in 10 years. *J Oral Maxillofac Surg* 2004;62(4):399-407.
8. Black AM, Patton DA, Eliason PH, Emery CA. Prevention of sport-related facial injuries. *Clin Sports Med* 2017;36(2):257-78.

9. Carniol ET, Shaigany K, Svider PF, et al. "Beaned": A 5-year analysis of baseball-related injuries of the face. *Otolaryn-Head Neck Surg* 2015;153(6):957-61.
10. National Federation of State High School Associations, Sports Medicine Advisory Committee. Position statement and recommendations for mouthguard use in sports. 2014. Available at: "<http://www.nfhs.org/media/1014750/mouthguard-nfhs-smac-position-statement-october-2014.pdf>". Accessed: March 16, 2018. (Archived by WebCite® at: "<http://www.webcitation.org/6xy6zdy5x>")
11. Tesini DA, Soporowski NJ. Epidemiology of orofacial sports-related injuries. *Dent Clin North Am* 2000;44(1):1-18.
12. Ranalli DN. Prevention of sports-related dental traumatic injuries. *Dent Clin North Am* 2000;44(1):35-51.
13. Finnoff JT, Laskowski ER, Altman KC, Diehl NW. Barriers to bicycle helmet use. *Pediatrics* 2001;108(1):4-10.
14. Fasciglione D, Persic R, Pohl Y, Fillippi A. Dental injuries in inline skating – Level of information and prevention. *Dent Traumatol* 2007;23(3):143-8.
15. Council on Sports Medicine and Fitness American Academy of Pediatrics, Briskin S, LaBotz M. Policy statement on trampoline safety in childhood and adolescence. *Pediatrics* 2012;130(4):774-9. Reaffirmed July, 2015.
16. Kumamoto D, Maeda Y. Global trends and epidemiology of sports injuries. *J Pediatr Dent Care* 2005;11(2):15-25.
17. Kumamoto D, Maeda Y. A literature review of sports-related orofacial trauma. *Gen Dent* 2004;52(3):270-80.
18. Glendor U. Aetiology and risk factors related to traumatic dental injuries: A review of the literature. *Dental Traumatol* 2009;25(1):19-31.
19. Huang B, Wagner M, Croucher R, Hector M. Activities related to the occurrence of traumatic dental injuries in 15- to 18-year-olds. *Dental Traumatol* 2009;25(1):64-8.
20. Collins CL, McKenzie LB, Ferketich AK, Andridge R, Xiang H, Comstock RD. Dental injuries sustained by high school athletes in the United States, from 2008/2009 through 2013/2014 academic years. *Dent Traumatol* 2016;32(2):121-7.
21. Colorado School of Public Health, Program for Injury Prevention, Education and Research. High School RIO. Reporting Information Online. Available at: "<http://www.ucdenver.edu/academics/colleges/PublicHealth/research/ResearchProjects/piper/projects/RIO/Documents/2016-17.pdf>". Accessed June 29, 2018. (Archived by WebCite® at: "<http://www.webcitation.org/70XdhrVS9>")
22. Cortes M, Marcenés W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health-related quality of life in 12-14-year old children. *Community Dent and Oral Epidemiol* 2002;30(3):193-8.
23. Berger TD, Kenny DJ, Casas MJ, Barrett EJ, Lawrence HP. Effects of severe dentoalveolar trauma on the quality-of-life of children and parents. *Dent Traumatol* 2009;25(5):462-9.
24. Welch CI, Thomson WM, Kenned R. ACC claims for sports-related dental trauma from 1999-2008: A retrospective analysis. *N Z Dent J* 2010;106(2):137-42.
25. Piccininni P, Clough A, Padilla R, Piccininni G. Dental and orofacial injuries. *Clin Sports Med* 2017;36(2):369-405.
26. Sane J, Ylipaavalniemi P, Turtola L, Niemi T, Laaka V. Traumatic injuries among university students in Finland. *J Am Coll Health* 1997;46(1):21-4.
27. Ngyuyen PM, Kenny DJ, Barret EJ. Socio-economic burden of permanent incisor replantation on children and parents. *Dent Traumatol* 2004;20(3):123-33.
28. Gift HC, Reisine ST, Larach DC. The social impact of dental problems and visits. *Am J Public Health* 1992; 82(12):1663-8.
29. McIntyre JD, Lee JY, Trope M, Vann WF. Elementary school staff knowledge about dental injuries. *Dent Traumatol* 2008;24(3):289-98.
30. Takeda T, Ishigami K, Nakajima K, et al. Are all mouth-guards the same and safe to use? Part 2. The influence of anterior occlusion against a direct impact on maxillary incisors. *Dent Traumatol* 2008;24(3):360-5.
31. Ranalli DN. Dental injuries in sports. *Curr Sports Med Rep* 2005;4(1):12-7.
32. Cohenca N, Roges RA, Roges R. The incidence and severity of dental trauma in intercollegiate athletes. *J Am Dent Assoc* 2007; 138(8):1121-6.
33. Labella CR, Smith BW, Sigurdsson A. Effect of mouthguards on dental injuries and concussion in college basketball. *Med Sci Sports Exerc* 2002;34(1):41-4.

34. Fos P, Pinkham JR, Ranalli DN. Prediction of sports-related dental traumatic injuries. *Dent Clin North Am* 2000;44(1):19-33.
35. Laloo R. Risk factors for major injuries to the face and teeth. *Dent Traumatol* 2003;19(1):12-4.
36. Sabuncuoglu O. Traumatic dental injuries and attention-deficit/hyperactivity disorder: Is there a link? *Dental Traumatol* 2007;23(3):137-42.
37. Bauss O, Rohling J, Schweska-Polly R. Prevalence of traumatic injuries to the permanent incisors in candidates for orthodontic treatment. *Dent Traumatol* 2004;20(2): 61-6.
38. Forsberg C, Tedestam G. Etiological and predisposing factors related to traumatic injuries to permanent teeth. *Swed Dent J* 1993;17(5):183-90.
39. Ranalli DN. Sports dentistry in general practice. *Gen Dent* 2000;48(2):158-64.
40. 1st World Congress of Sports Injury Prevention. Abstracts. *Br J Sports Med* 2005;39:373-408.
41. Mills S. Can we mandate prevention? *J Pediatr Dent Care* 2005;11(2):7-8.
42. American Dental Association Council on Access, Prevention, and Interprofessional Relations and Council on Scientific Affairs. Statement on athletic mouthguards. Available at: "https://www.ada.org/~media/ADA/Science%20and%20Research/Files/SCI_Statement%20on%20Athletic%20Mouthguards_2016Oct24.pdf?la=en". Accessed June 29, 2018. (Archived by WebCite® at: "<http://www.webcitation.org/6xy6JSRzl>")
43. Ranalli, DN. Sports dentistry and dental traumatology. *Dental Traumatol* 2002;18(5):231-6.
44. Ozawa T, Tomotaka T, Ishigami K, et al. Shock absorption ability of mouthguard against forceful, traumatic mandibular closure. *Dent Traumatol* 2014;30(3):204-10.
45. Maeda Y, Kumamoto D, Yagi K, Ikebe K. Effectiveness and fabrication of mouthguards. *Dental Traumatol* 2009; 25(6):556-64.
46. Takeda T, Ishigami K, Mishima O, et al. Easy fabrication of a new type of mouthguard incorporating a hard insert and space and offering improved shock absorption ability. *Dental Traumatol* 2011;27(6):489-95.
47. Mills SC. Mandatory mouthguard rules for high school athletes in the United States. *Gen Dent* 2015;63(6):35-40.
48. Kumamoto D. Establishing a mouthguard program in your community. *Gen Dent* 2000;48:160-4.
49. Gardiner D, Ranalli DN. Attitudinal factors influencing mouthguard utilization. *Dent Clin North Am* 2000;44(1):53-65.
50. American Dental Association. The importance of using mouthguards: Tips for keeping your smile safe. *J Am Dent Assoc* 2004;135(7):1061.
51. Mayer C. Tooth protectors for boxers. *Oral Hyg* 1930;20:298-9.
52. Newsome P, Tran D, Cooke M. The role of the mouthguard in the prevention of sports-related dental injuries: A review. *Int J Paediatr Dent* 2001;11(6):396-404.
53. Biasca N, Wirth S, Tegner Y. The avoidability of head and neck injuries in ice hockey: A historical review. *Br J Sports Med* 2002;36(6):410-27.
54. Deogade SC, Dube G, Sumathi K, Dube P, Katare U, Katare D. Sports dentistry and mouthguards. *Brit J Med Med Res* 2016; 11(6):1-10.
55. Winters J, DeMont R. Role of mouthguards in reducing mild traumatic brain injury/concussion incidence in high school athletes. *Gen Dent* 2014;62(3):34-8.
56. American Society for Testing and Materials. ASTM F697-16. Standard practice for care and use of athletic mouth protectors. ASTM International. West Conshohocken, Pa: 2016, Available at: "<https://www.astm.org/Standards/F697.htm>".
57. McClelland C, Kinirons M, Geary L. A preliminary study of patient comfort associated with customised mouth-guards. *Br J Sports Med* 1999;33(3):186-9.
58. Warnet L, Greasley A. Transient forces generated by projectiles on variable quality mouthguards monitored by instrumented impact testing. *Br J Sports Med* 2001;35 (4):257-62.
59. Greasley A, Imlach G, Karet B. Application of a standard test to the in vitro performance of mouthguards. *Br J Sports Med* 1998;32(1):17-9.
60. Duddy FA, Weissman J, Lee, RA Sr, Paranipe A, Johnson JD, Cohenca N. Influence of different types of mouth-guards on strength and performance of collegiate athletes: A controlled-randomized trial. *Dent Traumatol* 2012; 28(4):263-7.
61. Patrick DG, van Noort R, Found MS. Scale of protection and the various types of sports mouthguard. *Br J Sports Med* 2005;39(5):278-81..
62. Bureau of Dental Health Education and Bureau of Economic Research and Statistics. Evaluation of mouth protectors used by high school football players. *J Am Dent Assoc* 1964;68(3):430-42.
63. DeYoung AK, Robinson E, Godwin WC. Comparing comfort and wearability: Custom-made vs. self-adapted mouthguards. *J Am Dent Assoc* 1994;125(8):1112-8.

64. Ranalli DN. Prevention of craniofacial injuries in football. *Dent Clin North Am* 1991;35(4):627-45.
65. Academy for Sports Dentistry. Position statement: A properly fitted mouthguard 2010. Available at:
“http://www.academyforsportsdentistry.org/index.php?option=com_content&view=article&id=51:position-statements&catid=20:site-content&Itemid=111”. Accessed June 30, 2018. (Archived by WebCite® at <http://www.webcitation.org/70Yz37CXc>)
66. Waliko T, Bir C, Godwin W, King A. Relationship between temporomandibular joint dynamics and mouth-guards: Feasibility of a test method. *Dent Traumatol* 2004;20(5):255-60.
67. Croll T, Castaldi CR. Custom sports mouthguard modified for orthodontic patients and children in the transitional dentition. *Pediatr Dent* 2004;26(5):417-20.
68. Walker J. Parents plus: Getting mouthguards into kids’ mouths. *J Pediatr Dent Care* 2005;11(2):39-40.
69. Matalon V, Brin I, Moskovitz M, Ram D. Compliance of children and youngsters in the use of mouthguards. *Dental Traumatol* 2008;24(4):462-7.
70. Diab N, Mourino A. Parental attitudes toward mouth-guards. *Pediatr Dent* 1997;19(8):455-60.
71. Khodae M, Fetters MD, Gorenflo DW. Football (soccer) safety equipment use and parental attitudes toward safety equipment in a community youth sports program. *Res Sports Med* 2011;19(2):129-43.
72. American Dental Association. Play it safe: Prevent facial injuries with simple sports safety precautions. April 2013. Available at: “<https://www.ada.org/en/press-room/news-releases/2013-archive/april/play-it-safe-prevent-facial-injuries-with-simple-s>”. Accessed July 5, 2018. (Archived by WebCite® at: “<http://www.webcitation.org/70gePWqz0>”)
73. Walker J, Jakobsen J, Brown S. Attitudes concerning mouthguard use in 7- to 8-year-old children. *J Dent Child* 2002;69(2):207-11.
74. Raaii F, Vaidya N, Vaidya K, et al. Patterns of mouth-guard utilization among atom and pee wee minor ice hockey players: A pilot study. *Clin J Sport Med* 2011;21 (4):320-4.
75. Gawlak D, Mańka-Malara K, Kamiński T, Łuniewska M, Mierzwińska-Nastalska E. Comparative evaluation of custom and standard boil and bite (self-adapted) mouthguards and their effect on the functioning of the oral cavity. *Dent Traumatol* 2016;32(5):416-20.
76. Academy for Sports Dentistry. Position statement: Mouth-guard mandates. 2010. Available at: “<https://asd.memberclicks.net/position-statement>”. Accessed: June 30, 2018. (Archived by WebCite® at: “<http://www.webcitation.org/70Yz37CXc>”)
77. Woodmansey K. Athletic mouth guards prevent orofacial injuries: A review. *Gen Dent* 1999;47(1):64-9.