

## Mouthguards Shielding the Athletic Smile: A Mini-Review

Nishita Rana<sup>1\*</sup>, Namita Singh<sup>1</sup>, Gurdeep Singh<sup>2</sup>

<sup>1</sup>Christian Dental College, Ludhiana, Punjab, India

<sup>2</sup>Oman Dental College, Muscat, Oman

\***Corresponding author:** Nishita Rana, nishirana.28@gmail.com, MDS Pedodontist, Christian Dental College, Brown Road, Ludhiana, Punjab, India

**Citation:** Rana N, Singh N, Singh G (2021) Mouthguards Shielding the Athletic Smile: A Mini-Review. Dent Adv Res 6: 180. DOI: 10.29011/2574-7347.100080

**Received Date:** 14 August, 2021; **Accepted Date:** 20 August, 2021; **Published Date:** 25 August, 2021

### Abstract

**Background:** The contemporary world is becoming fitness and health conscious; consequently, an increasing number of individuals are indulging in sports and associated activities. Nonetheless, involvement in sports increases the risk of severe dental and maxillofacial injuries, affecting the individual's quality of life. The most effective way to prevent such injuries is to wear a properly fitted mouthguard, an intraoral device worn over the teeth.

**Aim:** This article aims to shed light on mouthguards, their types, characteristics, current fabrication and their significance in preventing oro-facial injuries in sports.

**Conclusion:** Sports-related dental traumas and other athletic activities establish a linkage between sports and dentistry. Thus, Mouthguards have proven to be an integral component in injury prevention.

**Keywords:** Mouthguards; Oro-Facial Traumas; Preventive Mode; Sports Dentistry

### Introduction

People's lifestyles are evolving, and their interest in sports is increasing on a global scale. The Olympics and Paralympics have been successful in encouraging and expanding sports participation. Currently from Tokyo Olympics, it has been observed that more young people are engaged in sports and considering sports as a profession. Tokyo Olympics are being hailed as the first gender-balanced games, with a record-breaking 49 % of female athletes competing. It has been reported that sports activities increases the risk of accidents and trauma [1]. Sports activities carry six times higher risk than work related accidents and three times higher risk than traffic accidents [2]. Unlike other injuries, a single severe trauma to the dentition may never completely heal and result in an oro-facial irreversible affliction for a lifetime. Sports related trauma represent major health concerns in society because of their high prevalence, expensive, time-consuming treatment, and psychological impact [3,4].

Sports dentistry is a forthcoming branch of sports medicine that combines dentistry and athletics to provide composite skills for management prevention, education, and research of sports-related oro-facial traumas and concomitant maxillofacial injuries [5]. Many dentists have amalgamated their passion for sports with their careers as sports dentists. A mouthguard is an essential element for protecting intraoral structures and should be part of

an athlete's standard equipment from a young age. A mouthguard is a resilient appliance that protects by isolating the cheeks and lips from the teeth, reducing the risk of soft-tissue injury and preventing violent contact between opposing arches [6].

### Chronicles of Mouthguards

Mouthguards have a long and illustrious history. As the saying goes, necessity is the mother of innovation, and boxers were the first to use the concept of mouth protectors against trauma. They referred to it as gum shields. Boxers clenched materials like cotton, tapes, sponges, and tiny bits of wood between their teeth, assuming they would function as shock absorbers. Unfortunately, these were ineffective and impaired respiration and speech [7,8]. Seeing this issue, Woolf Krause applied strips of a natural rubber resin, gutta-percha, over the maxillary incisors of boxers in 1892, which was further modified by his son Philip Krause, an amateur boxer, utilizing Vella rubber in 1921. This was known as the Krause appliance. Jacob Marks invented a custom-fitted mouthguard in the early 1900s [8]. In 1916, a Chicago dentist named Thomas A. Carlos created the first personalized mouthguard worn by professional athletes [9]. McTigue was winning a boxing match in 1927 when a chipped tooth sliced his lip, forcing him to surrender the match. As a corollary, mouthguards became a cornerstone in preventing sports-related trauma and a part of dental literature. The first resin acrylic mouthguard was described in detail by Dr Lilyquist in 1948. The American Dental Association (ADA) began promoting mouthguards and undertaking research in the 1940s [10]. The ADA advocated the use of latex mouthguards in all

contact sports in the late 1960s. In 1973, the National Collegiate Athletic Association (NCAA) made mouthguards required in collegiate football. The American Academy of Pediatric Dentistry (AAPD) recommends a mouthguard for all children and youth participating in any organized sports activities. Currently ADA recommends use of mouthguards in 29 sports Table 1 [11-13].

Contact Sports	Basketball Martial Arts Handball Water polo Boxing Rugby Hockey Wrestling Football Soccer Lacrosse Rodeo
Limited Contact Sports	Acrobatics Softball Skydiving Softball Field Events Volleyball Baseball Skiing Gymnastics Skateboarding
Non-Contact Sports	Squash Weightlifting Bicycling Surfing Shot Put In-Line Skating

**Table 1:** Sports for which the ADA recommends a properly-fitted mouth guard.

**Statistics and common risk factors of sports related injuries**

Sports activities contribute to nearly one-third of all dental injuries [9]. According to the ADA, 50% of all sports-related injuries occur in and around the mouth and could be prevented by orofacial protectors while playing [14]. Literature suggests that sports-related maxillofacial injuries are more common among children aged 7 to 11 years old. Sports-related dental injuries account for 13–39 % of all the dental trauma, with 11–18 % typically associated with collision sports. Approximately 50-90% of the injuries affect the maxillary incisors, while males are more susceptible [15,16]. Certain risk factors can be accountable for broadly classified as extrinsic and intrinsic factors. Extrinsic factors include training blunders, improper competition preparation methods, environmental circumstances, and playing surface quality. Participants’ age, gender, protrusive maxillary teeth, comorbidities such as cerebral palsy and epilepsy, participants with increased body mass and nutritional status are all contributing intrinsic factors [16,17]. According to studies, the usage of mouthguards reduced orofacial injuries in football to 7 %, but in basketball, where mouthguards are not used regularly, 40 % of orofacial injuries occur. When a mouthguard is not worn, the risk of an oro-facial sports trauma is 1.6 to 1.9 times higher [9,14]. Ferreira, et al. in a systematic review provides evidence for sports professionals to promote the use of custom-made mouthguards to prevent injury and that these devices do not hinder performance [13].

**Fabrication and types of mouthguard**

he nature of the impact, such as hard or soft objects, and intraoral characteristics of the mouth should also be considered while designing the mouthguards. They are typically made up of thermoplastic ethylene vinyl acetate (EVA), but varying in cost, adaptability, comfort, level of contact with dentist, and safety

efficacy. Requisites for an ideal mouthguards Table 2 [11,12]. The American Society for Testing and Materials recognises three categories of mouthguards Table 3 [12,18].

According to the ADA Council of Scientific Affairs and the Council on Advocacy for Access and Prevention mouth protector should have specifications
<ul style="list-style-type: none"> <li>• A thickness of 4 to 5mm is recommended for adequate protection.</li> <li>• Should be properly fitted to the wearer’s mouth and accurately adapted to oral structures.</li> <li>• Should be made of resilient material approved by FDA and cover all remaining teeth on one arch, customarily the maxillary.</li> <li>• Stay in place comfortably and securely.</li> <li>• Must be physiologically compatible with the wearer.</li> <li>• Should be relatively easy to clean.</li> <li>• Must Have high-impact energy absorption and reduce transmitted forces upon impact.</li> </ul>

**Table 2:** Requisites for an ideal mouthguards.

ANSI/ADA Standard No. 99:2001	
Type 1	Custom Made
Type 2	Mouth Formed/Boil and Bite
Type 3	Stock Mouthguard

**Table 3:** Classification of Mouthguards.

**Stock mouthguards:** These are commercially available in different colours and sizes. They are low-cost, prefabricated, bulky ready-to-wear models with poor retention and adaptability over hard and soft tissue. For protection, they must be clenched between teeth, which interfere with breathing and speaking. They are the least protective and undesirable [19].

**Mouth formed:** They are available in two varieties: the shell-liner mouthguard and thermoplastic, boil-and-bite model. The shell-liner mouthguard consists of a polyvinyl chloride outer shell that fits loosely over the dentition and an inner lining of plasticized acrylic gel or silicone rubber. A boil-and-bite mouthguard is made by softening it in hot water, cooling it briefly, then inserting it in the mouth and adapting it using finger, tongue, and biting pressure. As they are formed at body temperature, they readily distort and wear off. They often lack proper thickness and extension, leading to lesser protection and retention [9,12].

**Custom made:** They are the most costly, most comfortable, best-fitting and custom-designed and the least interfering with speech and breathing mouthguards that dentist highly recommends. They can be designed for both standard and malocclusion patients in dental offices and laboratories. Custom Vacuum-Formed Mouthguards (CVFMs) and Pressure-Laminated Mouthguards are

the two varieties available (PLMs). CVFM is the most frequently used and manufactured mouthguard by dentistry professionals. After a dentist takes an impression, it is constructed from a stone cast of the mouth, generally of the maxillary arch. Thermoplastic material is adapted over the cast with a unique vacuum machine, chemically fusing at high heat and pressure with machines. Following that, the mouth guard is cut and polished to ensure appropriate tooth and gum adaptation. All posterior teeth should be covered, and the muscles attachment unimpeded. They have an excellent cushioning effect [20].

It can be made up of a single layer or several layers. They are placed on the mandibular arch for patients with Class III malocclusion [9]. An inter-proximal filling mouthguard is designed for spaced dentition [19]. A better aerobic mouth guard can be fabricated for individuals with dry mouth and poor oral hygiene to provide better osmosis to generate an aerobic condition and disperse shock [21]. It can also construct for the edentulous patient without compensating for aesthetic and safety. Padilla reported that custom mouthguards offer the best protection for children's teeth during all types of sporting activities [22].

#### **Functions of mouthguard**

**Preventing dental and orofacial trauma:** It acts as a buffer between hard and soft tissues preventing lacerations, bruising of lips, cheeks and tongue during impact. It also provides a cushioning effect redistributing the force of the blow over all the teeth. Mandible is made elastic preventing fracture to the unsupported angle of lower jaw [23].

**Preventing concussion:** Stenger, et al. and Sturat, et al. stated that a mouth protector provides a positive reinforcement against head and neck injuries. They also concluded that a mouthguard in situ, altered the mandibular position on lateral skull radiographs, so that the condyles were distracted from their fossae [24,25]. However, the data on mouthguards shielding against concussion and spinal injuries is inconsistent, and no conclusions can be drawn [26].

**Psychological effect:** Psychologically, the player is much more confident that they will incur less injuries [23].

#### **Maintenance of mouthguard**

The use of a mouthguard stimulates microbial growth that leads to the formation of biofilms, which causes caries and tooth wear. Hence, regular cleaning and maintenance of mouthguard with rinse the mouth guard in soap and warm water after each use or disinfection with chlorhexidine. It should be stored in a well-ventilated plastic storage box, away from direct sunlight as heat may damage it. Proper oral hygiene should be maintained. Regular dental and medical check-ups are recommended. Mouthguards should be replaced in 8 to 12 months for growing children and for adults after 2 years [19].

#### **Barriers to use**

- Besides the cost of a mouthguard, one of the most common impediment is a lack of awareness among sports-related professionals. Tinoco, et al. reported that the primary reasons for not wearing mouthguards were too much hassle and unawareness among athletes in a pre-Olympic competition [27]. Self-adjusting and stock mouthguards are chosen by a majority of the population since they are inexpensive and eliminates the need for a dentist appointment. They are, however, ill-fitted, bulky, and make breathing difficult [23]. Recent studies have debunked the misconception and misunderstanding about mouthguards in sports about the influence on breathing and performance. Prefabricated or custom-built mouthguards have no impact on an athlete's aerobic performance [28].

#### **Conclusion**

Athletes of all ages should be recommended to wear a custom-fitted mouthguard when participating in any sport or recreational activity that pose a threat of orofacial injuries. Both throughout practice and tournaments, they must be worn. The dentist plays a paramount role in the athlete's support team. Athletes should get specific advice from their sports dentists about preventing sports-related injuries, malocclusion, and the usage of mouth protectors. A unique educational program emphasizing mouthguards, as the first-aid strategy for oral trauma, should be implemented on a broad scale to raise awareness and motivation among athletes, and coaches. The frequency of sports-related dentofacial injuries can be decreased if the standards for optimum safety, design, comfort, and benefits are established and presided by wearers.

#### **References**

1. Andersson L (2013) Epidemiology of traumatic dental injuries. Journal of endodontics 1: S2-5.
2. Muhtarogullari M, Demiralp B, Ertan A (2004) Non-surgical treatment of sports-related temporomandibular joint disorders in basketball players. Dental Traumatology 20: 338-343.
3. Echlin PS, Upshur RE, Peck DM, Skopelja EN (2005) Craniomaxillofacial injury in sport: a review of prevention research. British journal of sports medicine 39: 254-263.
4. Petersen PE (2003) The World Oral Health Report 2003: continuous improvement of oral health in the 21st century-the approach of the WHO Global Oral Health Programme. Community Dentistry and oral epidemiology 31: 3-24.
5. Saini R (2011) Sports dentistry. National journal of maxillofacial surgery 2:129-131.
6. Babu NA, Anjuga EP, Masthan KM (2019) Sports Dentistry--A Current Update. Indian Journal of Public Health Research & Development 10: 3208-3211.
7. Knapik JJ, Marshall SW, Lee RB, Darakjy SS, Jones SB, et al. (2007) Mouthguards in sport activities history, physical properties and injury prevention effectiveness. Sports medicine 37: 117-144.

8. Pontsa Pt. Mouth guards prevent dental trauma in sports. The dent-liner 12.
9. Hegde V, Kiran DN, Anupama A (2012) Mouthguard in Sports: A Review. Indian Journal of Stomatology 3.
10. Pawar PG, Suryawanshi MM, Patil AK, Purnale PS, Ali FM (2013) Importance of mouth guards in sports: a review. Journal of Evolution of Medical and Dental Sciences 2: 8903-8908.
11. American Dental Association (2016) Orofacial Protectors (Trans.1994:654; 1995:613; 2016:322). American Dental Association, Current Policies 1954-2017. 181.
12. ADA Council on Access Prevention and Interprofessional Relations, ADA Council on Scientific Affairs (2006) Using mouthguards to reduce the incidence and severity of sports-related oral injuries. J Am Dent Assoc 137: 1712-1720.
13. Ferreira GB, Guimaraes LS, Fernandes CP, Dias RB, Coto NP, et al. (2019) Is there enough evidence that mouthguards do not affect athletic performance? A systematic literature review. International dental journal 69: 25-34.
14. Cornwell H (2005) Dental trauma due to sport in the pediatric patient. Journal of the California Dental Association 33: 457-461.
15. Diab N, Mourino AP (1997) Parental attitudes toward mouthguards. Pediatric dentistry 19: 455-460.
16. Ramagoni NK, Singamaneni VK, Rao SR, Karthikeyan J (2014) Sports dentistry: A review. Journal of International Society of Preventive & Community Dentistry 4: S139-146.
17. Ghone U, Sarode GS, Sarode S, Patil S (2021) Revisiting Sports Dentistry with a Critical Appraisal. The Journal of Contemporary Dental Practice 22: 105-106.
18. American Society for Testing and Materials. Standard Practice for Care and Use of Athletic Mouth Protectors. ASTM F697- 00. Philadelphia, PA: American Society for Testing and Materials; reapproved 2006
19. Zunjarrao BV, et al. (2018) Mouthguard a Preventive Mode in Sports Dentistry. A Review. Acta Scientific Dental Sciences 12: 160.
20. Deogade SC, Dube G, Sumathi K, Dube P, Katare U, et al. (2016) Sports dentistry and mouthguards. Journal of Advances in Medicine and Medical Research 11: 1-10.
21. Hurley EP (2013) inventor. Aerobic mouthguard adapted to permit larger oral osmosis while diffusing larger oral shock. United States patent application US 13/374,559.
22. Padilla R (2006) Twenty-fifth Annual Symposium of the Academy for Sports Dentistry.
23. Ranalli DN (2002) Sports dentistry and dental traumatology. Dental Traumatology 18: 231-236.
24. Stenger JM, Lawton EA, Wright JM, Ricketts J (1987) Mouthguards: protection against shock to head, neck and teeth. Basal facts 9: 133-139.
25. Stuart MJ, Smith AM, Malo-Ortiguera SA, Fischer TL, Larson DR (2002) A comparison of facial protection and the incidence of head, neck, and facial injuries in Junior A hockey players: a function of individual playing time. The American Journal of Sports Medicine 30: 39-44.
26. McCrory P (2001) Do mouthguards prevent concussion?. British journal of sports medicine 35: 81-82.
27. Tinoco JM, Sassone LM, Stevens RH, Martins DD, Grangeiro Neto JA, et al. (2021) Mouthguard use and attitudes regarding dental trauma among elite cross - country mountain biking and field hockey athletes. Dental traumatology 37: 307-313.
28. Newsome P, Owen S, Reaney D (2010) The dentist's role in the prevention of sports-related oro-facial injuries. Int Dent SA 12: 50-58.