Use of Mouthguards in Sports: Friend or Foe when it comes to Oral Health?

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Introduction

Participating in sports is a commonality, beginning in childhood, and spreading throughout the world. Although playing sports provides countless benefits to an athlete's health, there are also a variety of risks an athlete endures. Unfortunately, athletes are at risk to suffer from various injuries, with one of the most common consisting of traumatic dental injuries, accounting for 13% to 39% of all dental injuries.[1] The most common safety precaution used by athletes is wearing a mouthguard during competition. Mouthguards distribute impact forces more widely because of their increased surface area, resulting in decreased stress on a single tooth.[2] Although mouthguards are widely known, they are still widely underutilized. The American Dental Association (ADA) estimates that approximately 200,000 injuries could be prevented via the utilization of mouthguards each year in high school and college football alone.[3] The primary purpose of this study is to evaluate how mouthguards decrease the risk of dental injury, perceptions of athletes on mouthguard use, and compare future directions to increase the use of mouthguards in sports.

	 Stock	 Boil-and-Bite	 Custom Made
Cost	$5-10	$15-25	$50-300+
Advantages	• Least expensive • Readily available • Bimaxillary: increased hard and soft tissue protection	• Cost effective • Readily available • Some offer good fit, thickness, and protection • Interpretable instruction • Suitable to offer entire teams • Bimaxillary: increased hard and soft tissue protection	• Superior fit • Low chance of gagging • Best force distribution • Allows for easy breathing and talking • Optimum thickness • Customizable • Bimaxillary: increased hard and soft tissue protection
Disadvantages	• Poor fit • Likely to have issues breathing and talking • Not adjustable • Unequal force distribution • May not be optimum thickness • Patient must bite together to hold mouthguard in place which potentially could result in TMJ issues	• Not the best fit • May not extend to cover all teeth • May not be optimum thickness • Not the proper reproduction of the dental arch and occulusion	• Most expensive option • Requires impression • Fabrication method may result in sub-optimum thickness

Table 1. A breakdown of the cost, advantages, and disadvantages of the market's three prevalent types of mouthguards (stock, boil-and-bite, and custom made).[4,5]

Methods

For this literature review, a range of databases was used such as EBSCOhost, Google Search, Google Scholar, NCBI, PubMed, Web of Science, and Wiley Online Library. The search strategy used was a combination of terms such as "advantages", "athlete", "avulsions", "disadvantages", "injury prevention", "mouthguard safety", "mouthguard side effects in oral health", "oral health", "performance", "preventative", "sports", "sports dentistry", "tooth fractures", "tooth injury", and "traumatic dental injury". Studies selected were published between October 2017, and February 2022. A total of 14 studies met the criteria to be included. Only English-language articles were considered for this research.

	Inclusion	Exclusion
Time Period	Literature published between 2017-2023	Literature published prior to 2017
Language	English	Non-English
Mouthguard Types	Stock pre-formed Boil-and-Bite Custom made	All other preventative apparatuses used in sports (ie. face guards or helmets)
Sport Types	All contact sports and any sport with a high risk of dental injury	Sports with little to no risk of obtaining dental injury
Article Type	Journal Articles, Systematic Review, Peer-reviewed Articles	All other Articles
Article Criteria	Mouthguard use or non-use and sports related dental injury	Mouthguards and other types of injury

Table 2. Inclusion and Exclusion methods for articles chosen and dismissed.

Results

How Mouthguards Decrease the Risk of Dental Injury

A total of 4,417 athletes participated in the studies compiled in Table 3. 28% of the total participants wore a mouthguard almost always or a majority of the time, 72% of the athletes did not utilize a mouthguard, and 33% had obtained a dental injury.[6,7,8,9,10] Although not every study reported if the dental injury obtained was while wearing a mouthguard or not, the three studies that did had an average of 16% of the dental injuries occurring while wearing a mouthguard.[7,8,10] The two most common dental injuries reported in their respective studies were socket bleeding (14%) followed by fractured tooth (9%) and mobility (58%) followed by crown fracture (36.4%).[7,10]

Study	Participants (n=)	Use MG	No MG	Experienced Dental Injury	Injury Type	Obtained injury while wearing a MG	Obtained injury not wearing a MG
Zamora-Olave et.al	347	1%	99%	58%	Not specified	n/a	n/a
Bergman et.al	100	28%	72%	49%	• Socket Bleeding: 14% • Tooth Luxation: 4% • Fractured Tooth: 9% • Tooth Avulsion: 5%	28%	72%
Fernandes et.al	3397	63%	37%	27%	Not specified	8%	60%
Monterio Monnerat Tinoco et.al	217	26%	74%	16%	Not specified	n/a	n/a
Mojarad et.al	356	24%	76%	15%	• Crown Fracture: 36.4% • Mobility: 58% • Avulsion: 5.6%	12%	17%

Table 3. A portrayal of data from five different studies that incorporated 4,417 participants. Mouthguard (MG) use, dental injury percentage and type, and if the injury was obtained while wearing a mouthguard.

Perceptions of Athletes on Mouthguard Use

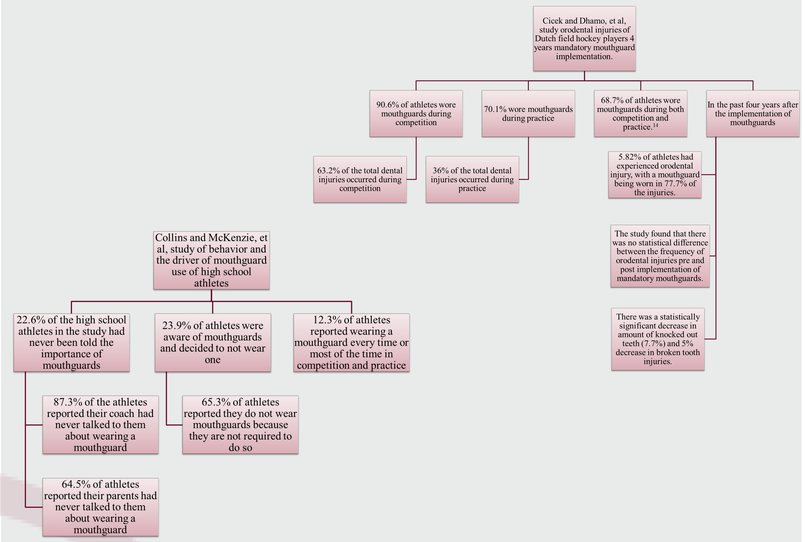
There were 2,346 participants that participated in five different articles, portrayed in Table 4. The range of athletes that wore mouthguards all the time or the majority of the time was 3% to 28%, that changed with the sport being played and age. [4,7,9,11,12] The most common reasons that athletes did not wear mouthguards were not knowing the importance of mouthguards, impaired communication, impaired breathing, and finding mouthguards uncomfortable.[4,7,9,11,12]

Study	Participants (n=)	Wear MG	Don't wear MG	Reasons for not using a MG
Collins et.al	1638	12%	88%	87.3%- Coach never communicated the importance of a MG 65.3%- Not required to wear a MG 61.5%- Impaired breathing and communication 22.6%- Have not heard of a MG
Shore et.al	128	14%	86%	39.2%- Impaired Communication 8.3%- Impaired breathing
Bergman et.al	100	28%	72%	29%- Nobody avised them to utilize a MG 24%- Uncomfortable 27.9%- Impaired Communication 21.2%- Impaired breathing 19.1%- Aesthetics
Monterio Monnerat Tinoco et.al	217	26%	74%	32.3%- Not Necessary 29.5%- Impaired Breathing 21.7%- Impaired Communication 18.9%- Cost
Hacquin et.al	263	3%	97%	48.7%- Uncomfortable 42.6%- Impaired Speaking 35.1%- Imparied Breathing 26.4%- Unnecessary 1.2%- Cost

Table 4. A portrayal of data from five different studies that incorporated 2,346 participants. The percentage of athletes that wear or don't wear mouthguards was recorded along with the major reasons athletes did not wear mouthguards.

According to Table 4, 8.3% to 61.5% of athletes choose to not wear a mouthguard due to have experienced impaired breathing while wearing a mouthguard.[4,7,9,11,12] A systematic review and meta-analysis published in 2016 analyzed the data of 14 studies on the effect of mouthguards on cardiopulmonary capacity ($VO_{2\ max}$ or VE_{max}). Although an overall decrease in cardiopulmonary capacity was found, custom mouthguards were determined to be low risk for influencing cardiopulmonary capacity.[13]

Future Directions



More research on the importance of mouthguards must be completed to better understand how the type of mouthguard influences risk of dental injury compared to not wearing a mouthguard. It is also important to note that there are conflicting studies on if mouthguards reduce the risk of concussion, which could influence the mandating of mouthguards in contact sports and the proper education of coaches and student athletes.

Conclusion

Wearing a mouthguard in sports is able to increase protection, decrease the risk of obtaining dental injuries, and decrease the severity of potential dental injuries. A large portion of athletes do not wear mouthguards for a variety of reasons including not having knowledge of mouthguards, mouthguards not being mandatory, and impaired breathing and communication. More time must be spent education and advocation of the use of mouthguards in sports.

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