

## Awareness and Use of Mouthguards in Athletes with a High Risk of Oral Trauma in Barcelona

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### Abstract

**Background:** Dental injuries are the most common sports-related orofacial injury type. Most such injuries may be prevented through the use of a protective mouthguard.

**Aim:** This study assessed the level of knowledge about mouthguards, the relative importance attributed to mouthguards, the factors influencing mouthguard choice and use, and the incidence of dental injury among athletes in Barcelona, Spain, according to age and sport.

**Materials and Methods:** A total of 127 athletes (mean age, 33 years; range, 16–50 years) from different sports (15 rugby, 51 field hockey, 20 trial, 17 kickboxing, 12 handball, and 12 taekwondo athletes) were administered an anonymous survey of 25 items concerning their opinion and use of mouthguards. For some parameters, a visual analogue scale (0–100 mm) was used. Parameters were compared relative to the age and sport of the athletes.

**Results:** More than half of the athletes (62.42%) reported that they used mouthguards. About 80% of athletes identified a lack of information regarding the properties and benefits of mouthguards. The main drawback to mouthguard use was difficulty breathing (~60%). Price was the main consideration in mouthguard choice for users of prefabricated and boil-and-bite mouthguards. For users of custom mouthguards, a lack of information from the dentist was the main drawback for purchase. Athletes with no dental trauma history and younger athletes ascribed lower importance to mouthguard use.

**Conclusions:** Athletes, teams, and health professionals should receive training and comprehensive educational materials on oral protective devices, to improve the understanding and use of protective mouthguards.

**Keywords:** Prevention; Tooth injury; Dental trauma; Mouthguard

### Introduction

About 10% of sports accidents involve injuries to the head, including oral injuries, the severity of which greatly depends on the age of the athlete and type of sport performed [1]. Oral injuries can lead to serious functional, aesthetic, and psychological complications. In 25% of cases, tooth injury may progress to pulp necrosis or severe pain [2]. Less-severe injuries include fractures and cracks in the enamel or concussions. According to the American Dental Association (ADA), more than 200,000 oral injuries may be prevented each year through the use of sports mouthguards [3].

Although older mouthguards provided poor comfort and safety performance, mouthguards have evolved to become an essential component of high-performance sports and are regularly used by a growing number of athletes [4]. Nevertheless, many athletes will not wear a mouthguard if it is not suitable in terms of speech, breathing, and comfort [5]. Other athletes fear that mouthguard use will negatively affect exercise outcomes [6], although studies report that custom mouthguards provide advantages in exercise, including increased strength and muscle endurance [7].

The ADA and the International Academy for Sports Dentistry currently recommend mouthguard use for more than 20 contact

sports and activities [8]. Mouthguards are designed to protect the teeth, absorb energy, and minimize the prevalence and severity of dental trauma [7]. They prevent dental injuries, including dislocation, fracture, and tooth loss, by reducing the impact force in the jaw [9-11]. Because about 80% of dental injuries occur to the central incisors of the upper jaw [12-14], authors have suggested the use of a maxillary mouthguard to protect against orofacial trauma [15-17]. Sports mouthguards effectively reduce soft tissue injury, including lacerations of lips, tongue, and cheeks, because of their smooth surface. They also prevent temporomandibular joint (TMJ) injuries; mouthguard use moves the jaw slightly back and down, which creates a space between the jaw and skull and reduces the risk of impact on the TMJ [4]. Mouthguards reduce the risk of concussion, by holding the jaw separate from the skull, which reduces the risk of shock [18,19].

Three types of mouthguards are currently available. Stock mouthguards are inexpensive, prefabricated, ready-to-use mouthguards that come in limited sizes (usually small, medium, and large). These bulky mouthguards lack any retention and must be held in place by constantly biting down, which can interfere with speech and breathing. The stock mouthguard is the least protective of the mouthguard types, and its use is not recommended in the sports literature. Boil-and-bite mouthguards, as the most commonly used mouthguard type, are made from thermoplastic material. They are immersed in boiling water and formed in the mouth with the finger,

tongue, and biting pressure. However, studies of the dental arch length in high school and college athletes have shown that most boil-and-bite mouthguards do not cover all of the posterior teeth [20]. These mouthguards provide a false sense of protection due to the dramatic decrease in occlusal thickness during the molding and fabrication process. Dentist-designed custom mouthguards fulfill all of the criteria for adaptation, retention, comfort, and stability of material. They have the least interference with speaking and virtually no effect on breathing. As a result, custom mouthguards have wide support in the literature [6,7,12,15-17].

The purposes of this study were to understand the knowledge held by athletes in Barcelona, Spain, about mouthguards, the importance that they place on mouthguard use, and the factors that influence their choice and use of a mouthguard. Dental injury incidence and mouthguard use were also assessed according to the type of sport and age of the athletes.

### Materials and Methods

An anonymous survey was distributed to 127 healthy athletes (mean age, 33 years; range, 16–50 years) distributed across 6 sports (15 rugby, 20 trial, 17 kickboxing, 12 handball, 51 field hockey, and 12 taekwondo athletes). All athletes were from Barcelona, Spain. Athletes were surveyed during an event at which they were practicing their sport. Responses were collected in a database (Microsoft Office Excel) as binomial values for the yes/no questions and as multiple choices for the remaining questions. There were two items in the survey that were performed through a visual analog scale (VAS, 0 to 100 mm). These responses were included in a table and expressed in units of

millimeters. The responses were scored through the Crystal Xcelsius software package. The data were understood through graphs and the variations of the values of the variables studied.

### Results

Table 1 shows the results for mouthguard awareness and use among athletes in Barcelona, Spain. Among the 127 athletes surveyed, 94.49% were aware of the existence of sports mouthguards, including 100% of kickboxing, handball, rugby, and taekwondo athletes. Most athletes (77.95%) reported that they believed there to be a lack of information about mouthguards with regard to their use and potential benefits. Only 20.47% of athletes reported knowing information about the three types of mouthguards (stock, boil-and-bite, and custom). Most respondents (75.59%) stated that they would opt for the purchase of a fully customized mouthguard.

Overall, 62.42% of athletes reported that they used a mouthguard during their daily sports practice, including 100% of rugby athletes. The incidence of dental trauma among athletes was 55.12%, with a prevalence of 97.64% in the upper arch. Rugby had the greatest incidence of dental injuries (93.3%). In 92.91% of cases, athletes cited “protection of the teeth” as the sole aim of a mouthguard purchase. Athletes most often obtained information on mouthguards from their teammates (33.07%), followed by their coach, dentist, or advertisements. Deterrents from purchasing a mouthguard were expense (44.09%), followed by lack of information (42.54%). The main inconvenience in using a mouthguard was difficulty in breathing, identified by 57.48% of athletes. For rugby players, this value increased to 80.00%.

Sport	Question				
Are you aware of the existence of applied sports mouthguards?					
	No	Yes			
Handball (n=12)	0.00%	100%			
Hockey (n=51)	5.88%	94.12%			
Kickboxing (n=17)	0.00%	100.00%			
Rugby (n=15)	0.00%	100.00%			
Taekowndo (n=12)	0.00%	100.00%			
Trial (n=20)	20%	80%			
Total	5.51%	94.49%			
If you are aware of sports mouthguards, who gave you that information?					
	Teammates	Coach	Dentist	Advertisement	N/A
Handball (n=12)	41.67%	33.33%	8.33%	16.67%	0.00%
Hockey (n=51)	37.25%	35.29%	17.65%	3.92%	5.88%
Kickboxing (n=17)	35.29%	17.65%	23.53%	23.53%	0.00%
Rugby (n=15)	33.33%	46.67%	13.33%	6.67%	0.00%
Taekowndo (n=12)	16.67%	25.00%	25.00%	33.33%	0.00%
Trial (n=20)	25.00%	5.00%	30.00%	20.00%	20.00%

Total	33.07%	28.35%	19.69%	13.39%	5.51%
Do you use a mouthguard during your daily sports practice?					
	No	Yes			
Handball (n=12)	33.33%	66.67%			
Hockey (n=51)	37.25%	62.75%			
Kickboxing (n=17)	11.76%	88.24%			
Rugby (n=15)	0.00%	100.00%			
Taekowndo (n=12)	58.33%	41.67%			
Trial (n=20)	85.00%	15.00%			
Total	38.58%	61.42%			

**Table 1:** Responses to the questionnaire, according to type of sport

The importance of mouthguard use was rated as 7.72/10 in the overall sample analysis. Mouthguard importance was rated highest by rugby players (9.38/10) and lowest by hockey players (7,08/10). The importance of using a fully customized mouthguard was rated as 5.09/10. More than half of all athletes (50.39%), especially those involved in taekwondo (6.83/10), reported that custom mouthguard use was associated with increased performance. The importance of mouthguard use increased with age (from 5.80 at 16 years to 9.25 at 37 years).

## Discussion

We surveyed 127 athletes from different sports in Barcelona, Spain, concerning their opinions and use of mouthguards. More than half of the athletes reportedly used a mouthguard and had experienced dental injuries during performance of their sport. Rugby athletes experienced the highest level of dental injuries, as well as the greatest use of mouthguards. Boil-and-bite mouthguards were more commonly used than custom guards. Users of stock and boil-and-bite mouthguards were most likely to obtain information about mouthguards from teammates. Users of custom mouthguards cited the dentist as the main source of information, and they were more likely to have greater concern for protection and increased performance. As the age of the athlete increased, awareness of the importance of mouthguard use increased. Older athletes in all sports identified the protection of the teeth as the main purpose of all mouthguard types.

The use of mouthguards in contact sports is imperative because of the aesthetic and functional consequences of injuries to the maxillary region [21,22]. As important factors that influence mouthguard use, the convenience and efficiency of the mouthguard have been studied extensively. Effective protection is the objective pursued by every athlete who purchases a mouthguard. There is a universal belief that thicker protectors provide more security while also being more uncomfortable, a belief that influences athlete preference [22]. In many cases, this belief is the result of advertising, which affects whether an athlete will purchase an established protector. In the present study, advertising served as the main information source for athletes who did not choose to purchase custom guards. The fact that advertisements highlight product affordability is consistent with this result.

Studies have shown that fully customized mouthguards are the best choice for athletes, and that dentists should indicate their use. Similar to our findings, previous studies have reported that athletes who use custom mouthguards are more likely to be informed of the benefits, indications, and properties of the mouthguard by their dentist [22,23]. Kenyon and Loos compared custom and boil-and-bite mouthguards in terms of comfort, use, adjustment, and patient preferences. They found significant differences in 14 of the 17 characteristics, with the custom mouthguard showing better results [24]. These findings are consistent with our results.

Zadik and Levin [5] suggested that if an athlete is not comfortable with a mouthguard with regard to speech, phonetics, and retention, then the athlete will not likely use the mouthguard. These drawbacks are also reflected in the present study. In 2005, Chapman performed a review of mouthguard use to increase professional awareness and interest, and to stimulate dentists to become involved as sporting club consultants [4]. However, mouthguards are now considered essential in high-performance contact sports and are regularly used by a growing number of athletes [2]. In the present study, we found mouthguard usage rates of up to 100%, depending on the sport, and an overall usage rate of over 60%.

## Conclusion

The most important finding of this study was the lack of information among athletes in various disciplines concerning the types of mouthguards. Future studies should focus on encouraging the use of fully customized mouthguards, to increase both protection and sports performance.

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