Awareness and use of mouthguards in risk sports by Spanish children between 6 and 18 years of age

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Abstract

Aim To investigate awareness and frequency of use of mouthguards in children and adolescents who engage in high-risk sports in various federated sports clubs in different provinces of Catalonia (Spain).

Materials and methods A total of 207 athletes aged between 6 and 18 years who belonged to one of the various official sports clubs across Catalonia (Spain) took part in the study. The participants completed a survey that included 13 anonymous questions to assess their awareness and use of a mouthguard while engaging in high-risk sports, the person who recommended its use, and among other variables, the dental history of sports-related injuries. Statistical analysis was performed using the chi-square test; Fisher's exact test and analysis of variance (ANOVA) were used to determine the relationships among the variables. A p-value of 0.05 and a 95% reliability were considered statistically significant.

Results A total of 207 questionnaires were completed by 101 female athletes (48.8%) and 106 male athletes (51.2%) with an average age of 11.57±3.1 years. A total of 78.7% (n=163) of these athletes were federated. Of the total sample, 16.4% (n=34) had sustained some form of sports-related orofacial injury; 86% (n=178) knew what a mouthguard was, although only 27% (n=56) had ever used one.

Conclusions Use of a mouthguard as a preventive measure in sport was very low. One of the main reasons for this was the large amount of disinformation about this type of protection. It would be beneficial to enforce mandatory use of mouthguards in all high-risk sports.

KEYWORDS Contact sports; Dental trauma; Mouthguard; Prevention; Tooth injury; Sports-related injury; Orofacial trauma; Tooth.

Introduction

An ever-increasing number of children and adolescents are participating in sports activities [Council, 2018]. The popularity of organised youth sports and the high level of competitiveness have resulted in a significant number of facial and dental injuries [Adirim and Cheng, 2003; Stewart et al., 2009; Malmgren et al., 2012; Council, 2018], the latter being frequent according to Diangelis et al. [2012]. The guidelines of the American Academy of Pediatric Dentistry [Council, 2018] reveal statistically significant figures in terms of their incidence and prevalence. Therefore, sports-related injuries are now considered a global health problem [Barron and Powell, 2005; Caine and Purcell, 2015; Deogade et al., 2016; Vriend et al., 2017].

Dental trauma is currently the second most common cause of dental care. In the near future, traumatic injury will become the main indication for dental care [Adirim and Cheng, 2003; Kenyon and Loos, 2005; Knapik et al., 2007]. An understanding of the cause of traumatic dental injuries provides the basis for establishing a range of preventive actions [Knapik et al., 2007], with age, type of sport, and frequency of playing sports for leisure or competition being the main risk factors, in addition to dental occlusion and history of dental trauma [Kenyon and Loos, 2005; Caine and Purcell, 2015; Lloyd et al., 2017; Vriend et al., 2017]. Positive correlations have been shown between the frequency of dental trauma in the upper incisors and the following predisposing oral factors: anterior cross-bite, labial interposition, increased protrusion, Angle Class II Division 1 malocclusion, increased overbite of up to 7 mm, and labial incompetence [Brin et al., 2000; Council, 2013; Tuna and Ozel, 2014].

According to Stewart et al. [2009], baseball is the primary cause of most sports-related dental injuries among children under the age of 12, with basketball being the most common sport to involve oral injuries in the 13–17-year age group [Glendor, 2008; Stewart et al., 2009; Council, 2018]. According to the 2008 ranking proposed by the International Dental Federation (IDF) [Glendor, 2008], high-risk sports for dental trauma include football, ice hockey, inline rollerblading, rugby and football; sports such as handball, water polo, squash and gymnastics are classified as medium-risk. In high-risk sports, such as rugby and football, athletes have a 10% chance of injury during the playing season and a 50% chance of injury during their playing careers [Glendor, 2008]. Given that trauma is so common in high-risk contact sports, the population must be made aware of the need to avoid these injuries as far as possible [ADA, 2006; Parker et al., 2017].

Sports injuries differ from other dental injuries in that they are more easily preventable, meaning that their prevalence can be reduced when appropriate prevention measures are taken with the use of specially designed protectors, or mouthguards, for each sport [Gardiner and Ranalli, 2000; Mills, 2015]. Many studies have demonstrated the efficacy of the use of mouthguards in sport [Gardiner et al., 2000; ADA, 2004; Mills, 2015; Deogade et al., 2016]. However, few sports have regulations requiring their use [Knapik et al., 2007; Caine and Purcell, 2015; Council, 2018]. Several federations have attempted, with varying degrees of success and acceptance, to extend the number of sports in which the use of a mouthguard would be mandatory [Gardiner and Ranalli, 2000; Malmgren et al., 2012; Mills, 2015; Lloyd et al 2017; Council, 2018]. It is likely that the mandatory use of oral protection has not been expanded in sports due to complaints by athletes and the opinions of parents and coaches that mouthguards interfere both with the way sports are played and with the pleasure of practising them [Gardiner and Ranalli, 2000; Mills, 2015]. Despite the relatively limited use of mouthguards in sports, the American Dental Association (ADA) and the International Academy of Sports Dentistry currently recommend their use in 29 sports [ADA, 2004]. The main problem, however, is that in most cases dentists do not know what sports their patients practise. Parents should be asked routinely about their child's sports activities and information should be obtained to provide appropriate risk-prevention advice [Panzarini et al., 2005; Al-Jame et al., 2007]. There are currently three types of mouthguard: non-adaptable or pre-fabricated, adaptable (reusable) and custom-made [Kenyon and Loos, 2005; Fakhruddin et al., 2007; Biagi et al., 2010; Golem and Arent, 2015; Council, 2018], the last being the protector that offers the most benefit to athletes [Chowdhury et al., 2015; Otsugu et al., 2021]. Parents, teachers, trainers and other non-dental professionals can play an important role in managing dental-related injuries and improving their prognosis [Shamarao et al., 2014].

There are no reliable figures in Spain regarding mouthguard use, both generally and in Catalan sports club federations. The reasons why an athlete decides to use a mouthguard (or not) and the recommendations and type of guard used are not clear. The aim of this research was therefore to investigate awareness and frequency of mouthguard use among children and young people aged between 6 and 18 years when practising high-risk sports in official sports clubs in various Catalan provinces (Spain).

Materials and methods

This cross-sectional descriptive study was approved by the Ethics Committee for Clinical Research (CEIC) of the International University of Catalonia (UIC) in September 2019 (Code approval: TFG-2019/2020-77). It was carried out between October 2019 and February 2020 by the Department of Paediatric Dentistry of the Faculty of Dentistry of the UIC.

Informed consent was given by all parents or guardians of children who participated in the study after they had been informed about its nature. The inclusion criteria were all children aged between 6 and 18 years who practised high-risk sports in officially recognised sports clubs located near the UIC. The clubs were selected according to the risk of sports-related injuries and their willingness to take part in the study. The survey was either emailed directly to the participants, whose addresses were supplied by the clubs to which they belonged, or sent indirectly to the participants via the dental clinics associated with the clubs. The high-risk sports selected were hockey, football, basketball, karate, rollerblading and others, including athletics, trial-bike, lacrosse, surfing, triathlon, fencing, boxing, handball, volleyball, cycling, swimming, and synchronised swimming. Child athletes who were not members of official sports clubs but who practised sports for leisure and/or had physical or mental disabilities were excluded.

Both an online and a paper version of the survey were designed using the Google Docs application. The two versions were anonymous. Once the questionnaire had been finalised, a link to it was emailed to most of the participants, while some athletes completed the paper version at the dental clinics.

The survey included 13 multiple-choice questions, divided into three sections as follows.

- General information on the participants.
- History of dental injuries.
- Knowledge and use of a mouthguard.

The responses to the survey were exported from Microsoft Excel®. Statistical analysis was performed with SPSS® IBM (Statistical Package for the Social Sciences) version 9.5.0.0 for Macintosh (SPSS Inc. Chicago, Illinois, USA) 25.0. Proportions were compared using the chi-square test; contingency variables less than five were measured with the Fisher exact test; and dependent and independent variables were compared using analysis of variance (ANOVA). Data were expressed with frequency and percentage tables.

A random sample of 207 individuals was required to obtain 95% confidence and 7% accuracy with a predicted population percentage of 50%. The percentage of replenishments required was expected to be 5%. A p-value of 0.05 and a 95% reliability level were considered statistically significant.

Results

Of the 250 young athletes who received the self-administered survey, 207 completed it within the 5-month study period, with a response rate of 82.8%. The sample comprised 101 female (48.8%) and 106 male (51.2%) athletes. The average age of participants was 11.57±3.1 years. All the surveys were completed correctly, therefore no participants were excluded at this point.

Table 1 describes the general characteristics of the athletes who took part in the survey: age, gender, type of sport, frequency of sport, whether it was a federated sport, history of sports-related injury, and knowledge of someone who had undergone trauma.

Table 2 describes the knowledge and use of the mouthguard, its practicality, whether the participant knew of someone who used one, importance and frequency of use, whether they were recommended to use one, and whether they would recommend one themselves.

The results of the descriptive study are detailed below.

Prevalence of trauma during sport

Of the total study sample, 34 athletes (16.4%) had sustained a dental-related injury while playing sport: 41.2% (n=14) were female and 58.8% (n=20) were male.

No statistically significant association (p=0.354) was observed between the frequency of injury during sport and

	n	Relative frequency (%)
Gender		
Female	101	48.8%
Male	106	51.2%
Age		
6–8 years	46	21.9%
9–12 years	79	38.2%
13–15 years	58	28%
16–18 years	24	11.5%
Sport practised		
Hockey	30	14.5%
Rugby	1	0.5%
Football	56	27.1%
Basketball	15	7.2%
Karate or other martial arts	14	6.8%
Rollerblading	61	29.5%
Other	30	14.5%
Frequency of practice		
Once a week	66	31.9%
2 or 3 times a week	89	43%
4 to 5 times a week	43	20.8%
Every day	9	4.3%
Federated		
Yes	163	78.7%
No	44	21.3%
History of traumatic injuries		
Yes	48	23.2%
No	159	76.8%
History of sports injuries		
Yes	34	16.4%
No	173	83.6%
Knowledge of someone who has suffered trauma		
Yes	100	48.3%
No	107	51.7%

TABLE 1 General information about the athletes.

	n	Relative frequency (%)
Knowledge of mouthguard		
Yes	178	85.9%
No	29	14.1%
Knowledge of the utility		
Yes	179	86.5%
No	28	13.5%
Use of mouthguard		
Always	23	11.1%
Never	138	66.7%
Sometimes	33	15.9%
I don't know what it is	13	6.3%
Knowing someone who uses a mouthguard		
Yes	99	47.8%
No	108	52.2%
Importance of mouthguard use		
Yes, always	128	61.8%
No, never	24	11.6%
Yes, but it's annoying and athletes do not wear it	42	20.3%
It serves no purpose	13	6.3%
Type of mouthguard		
Pre-fabricated	23	11.1%
Adaptable	20	9.6%
Custom-made	13	6.2%
Does not use mouthguard	151	72.9%
Person who recommended it		
No one	127	61.4%
Companions	24	11.6%
Parents or legal guardian	23	11.1%
The Federation	2	1%
The sports club	5	2.4%
The coach	9	4.3%
The dentist	17	8.2%
Recommendation of a mouthguard		
Yes	162	78.3%
No	45	21.7%

TABLE 2 Data on the use and awareness of mouthguards.

the gender of the athlete.

The bivariate study analysed possible relationships between the study variables.

- Mouthguard use according to gender: Statistically significant associations (p=0.023) were found between participants who claimed to use a mouthguard (always or sometimes) and gender. Of the total number of girls surveyed (n=101), 35.7% (n=36) wore a mouthguard, compared with 18.8% (n=20) of boys (n=106).
- Mouthguard use and history of dental-related injury during sports: There were statistically significant associations between mouthguard use and history of sports-related injury (p<0.001). Of the 34 athletes who indicated that they had sustained some type of dental injury while playing sport, 55.9% (n=19) had worn a mouthguard as opposed to 44.1% (n=15) who had not. Of the 173 respondents who had never sustained a dental-related injury during sports, 21.4% (n=37) said they had used a mouthguard as opposed to 78.6% (n=136) who had never wore one (Table 3). Comparison of children who have had some trauma while practicing sports (n=34) and the type of mouthguard they used showed statistically significant differences (p<0.001): 20.5% (n = 7) were pre-fabricated mouthguard, 23.5% (n = 8) adaptable mouthguard, 11.8% (n = 4) custom-made mouthguard, and 44.1% (n = 15) of the children who had sustained some trauma during practice sports did not use a mouthguard (Table 3).

Mouthguard use and sport

A comparison of mouthguard use according to sport showed statistically significant differences (p<0.001). A total of 30 children (14.5%) in the sample played hockey. Of these, 50% (n=15) always or sometimes used a mouthguard, while the other 50% (n=15) never used one. The only participant who played rugby always wore a mouthguard. Of the 56 football players, 7.2% (n=4) used a mouthguard at all times, while 85.7% (n=48) claimed that they had never worn one, and 7.2% (n=4) did not know what a mouthguard was. Of

	Trauma during sports practice				
	Yes		No		
Use	n	%	n	%	p
Always	8	23.5%	15	8.7%	<0.001
Never	15	44.1%	123	71.1%	
Sometimes	11	32.4%	22	12.7%	
I don't know what it is	0	0%	13	7.5%	
	Trauma during sports practice				
	Yes		No		
Type of mouthguard	n	%	n	%	p
Pre-fabricated	7	20.5%	16	14.5%	<0.001
Adaptable	8	32.4%	12	9.2%	
Custom-made	4	11.8%	9	5.2%	
Does not use mouthguard	15	35.3%	136	71.1%	
	Knowledge				
Use	Yes	No			
	n	%	n	%	p
Always	23	12.9%	0	0%	<0.001
Never	125	70.2%	13	44.8%	
Sometimes	29	16.3%	4	13.8%	
I don't know what it is	1	0.6%	12	41.4%	

	Frequency of playing sport								
Use	1 time a week		2 or 3 times a week		4 or 5 times a week		Every day		
	n	%	n	%	n	%	n	%	p
Always	12	18.2%	6	6.7%	5	11.6%	0	0%	0.005
Never	31	47%	69	67.4%	29	67.4%	9	100%	
Sometimes	19	28.8%	9	10.1%	5	11.6%	0	0%	
I don't know what it is	4	6.1%	5	5.6%	4	9.3%	0	0%	
Fisher Test									

TABLE 3 Distribution of athletes according to mouthguard use with trauma during sports practice, awareness of mouthguards, and frequency with which they play sport.

the 15 participants who played basketball, 13.3% (n=2) sometimes used one, 80% (n=12) never wore one, and only 1 player (6.7%) did not know what a mouthguard was. Of the 14 athletes who practised karate or other martial arts, 35.7% (n=5) responded that they used a mouthguard, while 57.1% (n=8) said that they never used one, and 1 respondent (7.1%) did not know what a mouthguard was. Of the 61 rollerbladers, 44.2% (n=27) said that they wore a mouthguard at all times, compared with 44.3% (n=27) who said they never used one, and 11.5% (n=7) who did not know what a mouthguard was. Among the 30 athletes who played other sports, only 6.7% (n=2) reported that they used a mouthguard when boxing or playing lacrosse, while 93.3% (n=28) said that they never used one when cycling, playing handball, or during athletics or other sports (Table 1).

Use and knowledge of mouthguards

Comparison of participants' awareness of mouthguards and their use showed statistically significant differences (p=0.000). In total, 85.9% of participants (n=178) said they knew what a mouthguard was versus 14.1% (n=29) who reported that they did not. In terms of use, 27% (n=56) of the participants always or almost always wore a mouthguard as opposed to 73% (n=151) who never used one or did not know what a mouthguard was. A total of 178 athletes responded that they knew what a mouthguard was: 29.2% (n=52) always or almost always wore one, whereas 70.8% (n=126) said they never used one (Table 3).

Frequency of sport activity and use of mouthguard

There were statistically significant differences (p=0.005) with respect to the frequency of sports practice and mouthguard use. For example, 66 athletes answered that they practised a sport once a week; among them, 46.9% (n=31) said that they always or sometimes wore a mouthguard, 46.9% (n=31) never used one, and 6.1% (n=4) did not know what it was. Of the 89 athletes who played sport 2 or 3 times a week, 16.8% (n=15) always or sometimes wore a mouthguard compared with 67.4% (n=69) who never used one. Of the 43 children who practised sports 4 or 5 times a week, 23.2% (n=10) always or sometimes wore a mouthguard compared with 67.4% (n=29) who never used one. Of the 9 players who played sport every day, 100% never wore a mouthguard (Table 3).

Regarding the type of mouthguard, 11.1% (n=23) used a pre-fabricated one, 9.6% (n=20) a mouth-formed "boil and bite", 6.2% (n=13) a custom-made mouthguard, and 72.9% (n=151) never used a mouthguard (Table 2).

Importance of using a mouthguard

Comparison of mouthguard use with the perceived importance of using one showed statistically significant associations (p=0.000). Of the 128 players who recognised the importance of always using a mouthguard, 27.3% (n=35) always or sometimes wore one, compared with 70.3% (n=90) who never used one, and 2.3% (n=3) who did not know what a mouthguard was. Of the 24 who claimed that mouthguard use was not important during sports, only 4.2% (n=1) said they sometimes used one, compared with 70.8% (n=17) who never wore a mouthguard, and 25% (n=6) who did not know what one was. Of the 42 athletes who acknowledged the importance of using a mouthguard but resented wearing one, 45.3% (n=19) always or sometimes used one as opposed to 50% (n=21) who never wore one, and 4.8% (n=2) who did not know what a mouthguard was.

Mouthguard recommendation

Results concerning the recommendation to wear a mouthguard yielded statistically significant differences (p=0.000). Of the 207 athletes surveyed, 61.4% (n=127) reported that no one had recommended them to wear a mouthguard; 11.6% (n=24) said their fellow athletes had recommended its use; 11.1% (n=23) replied that their parents and/or legal guardians had recommended that they use a mouthguard; 1% (n=2) said the federation recommended mouthguard use; 2.4% (n=5) responded that their sports club recommended its use, while 4.3% (n=9) mentioned their

coach and 8.2% (n=17) their dentist.

When mouthguard use was related to an athlete's recommendation, statistically significant differences were shown (p=0.000). Hence, 78.3% (n=162) of the sample said they would recommend the use of a mouthguard when playing sport, compared with 21.7% (n=45) who said they would not recommend one. Of the 162 athletes who would recommend a mouthguard, only 33.3% (n=54) used one during sports, compared with 64.2% (n=104) who never wore one, and 2.5% (n=4) who did not know what a mouthguard was. Of the 45 participants who would not recommend a mouthguard, 4.4% (n=2) sometimes wore one; 75.6% (n=34) never used one, and 20% (n=9) did not know what a mouthguard was.

Discussion

The results of this study showed that of the 207 respondents, 48 (23.2%) had sustained a dental injury, and 34 (16.4%) of these injuries had occurred during sports activity. Galic et al. [2018] found that of the 229 athletes they surveyed, 58 (25.3%) had sustained one or multiple sports-related orofacial injuries, and 31 of these athletes (13.5%) experienced some dental-related injury during sports. In a 10-year longitudinal follow-up study at the department of orofacial and maxillofacial surgery of the University Hospital of Innsbruck (Austria), Gassner et al. [2004] evaluated 3,385 cases of maxillofacial skull trauma, in which 31.8% of injuries to children occurred during sports activities [Knapik et al., 2019]. The statistics vary, but numerous studies [Glendor, 2008; Ilia et al., 2014; Shamarao et al., 2014] have reported that dental and orofacial injuries regularly occur as a result of sports, concluding that participation in sports carries a considerable risk of such injuries. In a study to determine the prevalence of dental injuries and mouthguard use in 225 rugby players, Ilia et al. [2014] showed that 146 (64.9%) of them sustained mainly orofacial injuries [Ilia et al. 2014]. Previous studies [Gassner et al., 2004; Bailey et al., 2015; Golem and Arent, 2015; Afrashtehfar et al., 2017; Golem et al., 2017; Galic et al., 2018; Knapik et al., 2019] have found that the prevalence of sports-related dental injuries varies according to the frequency of practice, the type of sport, and the attitudes and habits of the athletes regarding their decision to use a mouthguard or not.

Dhillon et al. [2014] observed a higher incidence of sports-related dental injuries in the 8–11-year-old age group. Many studies have indicated that boys are more likely than girls to sustain injuries [Gardiner et al., 2000; Knapik et al, 2007; ADA, 2013; Dhillon et al., 2014]. In the present study, we observed that the highest percentage of dental injuries was between the ages of 8 and 15 years, but no statistically significant differences were found with respect to injury according to gender.

In a survey conducted in conjunction with two public health departments in Ontario, Canada, Fakhruddin et al. [2007] assessed the frequency of mouthguard use in schools among children aged 12–14 years. They found that only 5.5% of the children wore a mouthguard during school sports and 20.2% wore one in sports league events. The results of that study are similar to those observed in the present study, in which of the 207 participants, 27% (n=56) sometimes or always used a mouthguard.

Galic et al. [2018] found that the highest percentage of athletes using mouthguards were taekwondo athletes (73.7%), followed by karate (70.7%), handball (14.5%) and water polo (5.1%). Most dental injuries were sustained during water polo, at 18.6%, followed by karate with 17.2%, handball with 21.8%, and taekwondo with 3.5%. In this study, we observed that the sport with the highest prevalence of dental injuries was football at 35.3%, followed by rollerblading at 29.4% and hockey at 14.7%. Statistically significant differences were shown regarding mouthguard use according to sport: hockey at 50% and rollerblading at 44.2% were the sports in which mouthguard use was most frequent, while 85.7% of football players and 80% of basketball players never wore one.

Lloyd et al. [2017] and other authors [Fakhruddin et al., 2007; Galic et al., 2018] have confirmed that mouthguards play a crucial role in preventing dental and facial injuries, making their use highly recommended for all sports activities where there is a risk of trauma to teeth and associated structures.

As for the importance of mouthguard use, the results of the present study show that 61.8% of athletes considered mouthguard use during sports to be important. However, only 11.1% wore one all the time and 20.3% thought that they should wear one but they regard it as annoying and therefore do not use it. Galic et al. [2018] found that although most of the athletes in their study were aware that the use of a mouthguard significantly reduces the incidence of dental injuries, only 94 athletes (41%) used one. According to Hersberger et al. [2012], 42% of water polo players were aware of the benefits of using a mouthguard for preventing trauma, but only 7.7% wore one.

The high proportion of poorly adjusted protectors and the lack of use of individualised mouthguards among athletes appear to be impediments to wearing one [Fakhruddin et al., 2007; Matalon et al., 2008; Hersberger et al., 2012; Galic et al., 2018]. In evaluating the type of mouthguard used by athletes, our study found that 11.1% were pre-fabricated, 9.6% adaptable, and 6.2% custom-made. The Academy for Sports Dentistry (ASD) and the International Association of Dental Traumatology (IADT) recommend the use of custom-made mouthguard, or type III [Matalon et al., 2008; Biagi et al., 2010; Council, 2013; Chowdhury et al., 2015; Golem and Arent, 2015; Afrashtehfar et al., 2017; Golem et al., 2017; Council, 2018; Galic et al., 2018; Otsugu et al., 2021]. This type of mouthguard adapts and fits perfectly to each player's dental anatomy, providing the athlete with greater comfort and safety. This mouthguard has great advantages and reliability over other protectors in safeguarding dental health [Matalon et al., 2008; Biagi et al., 2010; Chowdhury et al., 2015; Golem et al., 2015; Afrashtehfar et al., 2017; Golem et al., 2017; Lloyd et al., 2017; Council, 2018; Galic et al., 2018; Otsugu et al., 2021]. Many authors [Fakhruddin et al., 2007; Matalon et al., 2008; Hersberger et al., 2012; Chowdhury et al., 2015; Galic et al., 2018; Otsugu et al., 2021] have observed the possibility that poorly customised mouthguards could cause speech and breathing problems. This, together with the fact that they are uncomfortable and not very aesthetic, was an impediment to their use. The most common reasons why athletes did not use a mouthguard were: 37% thought it unnecessary, 21.5% felt it was uncomfortable, and 5.2% believed that it interfered with breathing or communication [Fakhruddin et al., 2007; Hersberger et al., 2012; Chowdhury et al., 2015; Galic et al., 2018; Otsugu et al., 2021]. Our study found that 73% never used one because they did not like it. According to the athletes, the protector prevented them from breathing or speaking properly, and they felt uncomfortable. Boffano et al. [2012] noted that mouthguard use in rugby players caused problems

with speech, lip closure, breathing and swallowing. They were therefore considered unnecessary or inconvenient [Bailey et al., 2015; Chowdhury et al., 2015; Golem and Arent, 2015; Golem et al., 2017; Otsugu et al., 2021].

When comparing mouthguard use with the frequency of its use in sport activity, the present study showed that the higher the frequency of sports practice the lower the rate of mouthguard use, as mouthguard use was greater in sports played less frequently. No previous studies were found to evaluate the frequency of sport practice with use of mouthguard.

In a study in which children received a mouthguard at no cost, Matalon et al. [2008] found that 29% never used it, 32% used it occasionally, 15.9% wore it at first but stopped doing so after a month, and only 23.2% used it when necessary. Therefore, the non-use of the mouthguard was not exclusively due to economic factors, but the protector's lack of adaptability and its non-mandatory use was also a factor. Only 21% of parents participating in the study attributed the lack of mouthguard use to an economic problem [Matalon et al., 2008].

According to the American Academy of Pediatric Dentistry (AAPD) [Council, 2018], mouthguard use during sports represents an effective protective system [Kumamoto and Maeda et al., 2004; Mills, 2015; Council, 2018]. However, few sports have regulations requiring their use [Kumamoto and Maeda, 2004; Mills, 2015; Council, 2018]. The National Federation of State High School Associations (NFHS) recommends oral protection only for football, ice hockey, lacrosse, field hockey and for wrestlers who use braces [Kumamoto and Maeda, 2004; Council, 2018]. It is likely that the mandatory oral protection rule has not been extended to other sports because of complaints from athletes, parents and coaches that mouthguards interfere with the practice and pleasure of sport [Gardiner and Ranalli, 2000; ADA, 2004; Lannan, 2005; Mills, 2015].

A study commissioned by the American Association of Orthodontists (AAO) in the United States on a sample of 1,022 athletes over the age of 18 reported that 67% of parents said that their sons and daughters did not wear a mouthguard when playing organised sports [Council, 2013]. It also found that 84% of players did not use a mouthguard in organised sports because it was not mandatory, although the use of other protective equipment such as helmets and shoulder pads was [Council, 2013]. Players' perceptions of oral protection use and comfort largely determine compliance [Matalon et al., 2008; Council, 2013]. Federations, trainers, parents and/or legal guardians also influenced athletes regarding mouthguard use, with results similar to those found in the present study [Matalon et al., 2008; Council 2013].

Parents and coaches have a big influence on mouthguard use. However, surveys in the study by Matalon et al. [2008] showed that some parents were ignorant of the importance of mouthguard use. Hence, that study determined that 77% of the parents were unaware of the existence of this device prior to the study [Matalon et al., 2008]. In addition, 47.9% stated that the dentist had not offered them the possibility of a custom-made mouthguard, 20.8% indicated that their child had never owned a mouthguard owing to its cost, and 39.6% said they would not have a protector made because their child would not use one [Pribble et al., 2004; Matalon et al., 2008]. These results can be extrapolated to those obtained in the present study, in which we observed that although 78.7% (n=163) of the athletes were federated, the federation, the sports club, and the coach had rarely recommended mouthguard use. There was a greater involvement of parents and legal guardians in this question. However, when the federation, sports club or coach recommended mouthguard use, athletes did use one. It is important also to highlight the influence of parents or the child's sports partner in the use of the protector, as their opinion has more influence and impact than that of a dentist.

Pribble et al. [2004] note that very few health professionals recommend oral protection for sports players. Tuna and Ozel [2014] consider that dentists have a key role to play in informing athletes, trainers and patients together with their parents on the importance of prevention, treatment and diagnosis of sports-related orofacial injuries. All the authors cited in the present study insist that dental professionals should regularly ask parents and patients about their involvement in sports and inform them about the risk of sports-related injuries and available prevention strategies, as it is fully demonstrated that mouthguards offer considerable protection against such dental injuries [Kumamoto and Maeda, 2004; Pribble et al., 2004; Matalon et al., 2008; Hersberger et al., 2012; Council, 2013; Dhillon et al., 2014; Tuna and Ozel, 2014; Bailey et al., 2015; Chowdhury et al., 2015; Golem et al., 2015; Afrashtehfar et al., 2017; Golem et al., 2017; Galic et al., 2018; Knapik et al., 2019; Otsugu et al., 2021].

Although our study provides key data on the knowledge and use of mouthguards in a population not previously considered, it also had a number of limitations. The main limitation was the use of a self-administered questionnaire as a research tool, because it can generate differences between objective results and the subjective experience of mouthguard use. However, the results obtained are valuable for formulating strategies to prevent young athletes from sustaining orofacial injuries during sports practice, thus making sports safer. In addition, the anonymisation of the survey implied a risk that a respondent could take the survey more than once. Another limitation concerns the impossibility of verifying the answers given by the athletes. Although non-professional athletes are most at risk of injury during sport [Ilia et al., 2014; Afrashtehfar et al., 2017; Galic et al., 2018], it was decided that the sample should be composed of athletes belonging to official sports clubs in order to try to make the reliability of the survey responses high due to the knowledge that athletes could have about the use of mouthguards, as well as the different types of these available. Finally, the sample was probably too small to cover all sports with a high risk of dental trauma. Therefore, given that the study was limited to a small community, it would be useful to extend it to other populations, such as non-professional athletes.

Conclusions

The results of this study indicate that only 27% of the children and adolescents surveyed who belong to official sports clubs use a mouthguard when playing sport in the different regions of Catalonia (Spain).

The higher the frequency of sports practice, the lower the use of the mouthguard among athletes in the sample studied.

Most players in the sample acknowledged the importance of a mouthguard and even recommend its use during sport, even though they do not use one.

Given the importance of helping to reduce the number of sports-related oral injuries, it is recommended that federations,

trainers, parents or other peers can and should influence mouthguard use.

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