

Orofacial trauma and the use of mouth guards in professional athletes from different combat sports

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Abstract

Orofacial injuries resulting from sports practice occur frequently, especially in contact sports. The highest frequency of damage involves tooth support structures, tooth loss, tooth fractures, soft tissue lacerations, mandibular displacement and bone fractures. Thus, the use of mouthguard becomes essential for the prevention of dental trauma. The aim of the study was to verify the occurrence of oral injuries in athletes, evaluate the use of mouthguards and relate the occurrences of mouth injuries with the type of mouthguard used in fight academies in Belo Horizonte, city in the state of Minas Gerais – Brazil. The study was carried out with practitioners of various combat sports, who answered a questionnaire with questions about their history of orofacial trauma and use of mouthguards. Data were collected, tabulated and submitted to statistical analysis. The prevalence of trauma and orofacial injuries in athletes practicing combat sports was approximately 25% and 95.9% of the participants reported that they considered it important to use it, even when they were not using the equipment. Most combat sports athletes do not use the type III mouth protectors made by the dentist as a form of prevention, which contributes to the high occurrence of orofacial injuries in practitioners of these modalities.

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INTRODUCTION

Orofacial injuries often occur during sports and affect a considerable portion of the population, and can cause irreparable tooth loss, both at the time of the accident and afterwards, due to sequelae such as root resorption (Coto et al., 2012). Orofacial injuries have been increasingly recurrent and the number of sports accidents that result in trauma has become a major concern in several countries (Caciones et al., 2018).

Injuries are reported in almost all sports, being more frequent in combat sports (Iona et al., 2019; de Araújo et al., 2021). In some sports fight modalities, which are linked to blows to the opponent in different parts of the body and face, the prevalence of orofacial trauma reaches 80%, even with a recommendation on the use of protective equipment (Shirani et al., 2010).

The highest frequency of damage involves tooth support structures, tooth loss, dental fracture, soft tissue lacerations, mandibular displacement and bone fractures (Young et al., 2015; Petrovic et al., 2016).

Sports injuries have a particularity that differs them from other injuries because they can be prevented (Oliveira et al., 2020), with the possibility of drastically reducing the levels of their occurrence through the use of mouthguards that promote the protection of structures dental and periodontal (Caglar et al., 2009).

Mouthguards are intraoral devices that are used with the aim of minimizing the chances of damaging the stomatognathic system (Ashley et al., 2015). They can be made of different materials and help to absorb the shock experienced by a blow to the face, keeping the soft tissue away from the teeth, avoiding violent contact between antagonists and dissipating the forces received during the impact (Parker et al., 2017; Fernandes et al., 2019).

Considering that dental trauma frequently occurs during the practice of combat sports (Polmann et al., 2019; Pereira et al., 2021), causing damage to athletes and that the use of mouthguards can drastically reduce the number of traumas and their severity, the objective since work was to verify the occurrence of oral injuries in athletes, evaluate the use of mouthguards and relate the occurrences of mouth injuries with the type of mouthguard used in fight academies in Belo Horizonte, city in the state of Minas Gerais – Brazil.

MATERIALS AND METHODS

Initially, a selection of fight academies in the Municipalities of Belo Horizonte, MG, was carried out. Afterwards, the researchers contacted those responsible, obtaining consent to carry out the research. A questionnaire (CAAE number: 47783221.8.0000.0075) structured by the researchers was applied, containing 8 multiple-choice questions to combat sports practitioners from June 2018 to August 2019. The questionnaire was pre-tested on 10 participants with the objective of identifying problems of understanding in the questions that would justify changes in the wording. Questionnaires used in the pre-test were not included in the final study sample.

To characterize the sample, questions about age, gender, and practiced martial art were included. The other questions were directed to the occurrence of orofacial trauma in combat sports, if they had any type of trauma and/or lacerations during sports practice and the anatomical site affected.

They were also asked about the knowledge, importance and use of mouthguards, as well as the type of device used.

Sample

The sample consisted of 218 combat sports practitioners of both sexes, aged between 18 and 37 years, who competed in sports tournaments of Boxing (20), Muay Thai (76), Kung-Fu (21), Jiu- Jitsu (62), Kickboxing (17), Taekendow (12) and others (10) (Sanda, MMA, Judo) in gyms in Belo Horizonte - MG.

Collect

Data were collected through the application of a questionnaire consisting of multiple-choice questions related to the theme, with the inclusion criterion being considered to be a professional athlete and/or combat sports amateur, over 18 years of age, of both sexes. The study exclusion criteria correspond to questionnaires that did not have the correct record about the trauma that occurred or that were not filled out correctly about gender, age or use of mouthguards.

Data analysis

Data were presented using descriptive and inferential statistics, using the Chi-square test at a 5% significance level ($p < 0.05$), to establish a relationship between variables of interest.

RESULTS

The evaluated sample represented data from combat sports athletes, male and female. The vast majority of available records correspond to Muay Thai athletes (34.9%).

Overall, the data analyzed presented a considerable and relevant value in relation to the occurrence of orofacial injuries, with 24.3% of the athletes reported having some type of trauma to the face (TABLE 1).

Table 1. Sample characteristics.

Variable	Number of athletes	
	n	(%)
Gender		
Female	67	30,07%
Male	151	69,03%
Sport		
Muay Thai	76	34,9%
Jiu-Jitsu	62	28,4%
Kick Boxing	17	7,8%
Taekendow	12	5,5%
Kung Fu	21	9,6%
Boxing	20	9,2%
Others (MMA, SANDA AND JUDÓ)	10	4,6%
Trauma report		
Suffered some type of orofacial trauma	53	24,3%
Unreported trauma	165	75,7%

Regarding the affected anatomical site, we observed that dental fractures and nasal fractures present the highest frequency (9.2% $P < 0.0001$ and 8.3% $P < 0.0001$, respectively). Mandibular bone fractures and maxillary bone fractures also had a significant prevalence (6.9% $P < 0.0001$ and 4.6% $P < 0.0001$ respectively) (TABLE 2).

Table 2: Distribution of traumas by anatomical site

Anatomical site	Estimates (%)	P
Tooth fracture	9,2%	$P < 0,0001$
Nasal fracture	8,3%	$P < 0,0001$
Jaw fracture	4,6%	$P < 0,0001$
Mandibular fracture	6,9%	$P < 0,0001$
Chin fracture	0,9%	$P < 0,0001$
Others	7,8%	$P < 0,0001$

Regarding soft tissue laceration, we observed a high prevalence. (66.1% $P < 0.0001$). Lacerations on the lips and tongue are the most frequent (54.6% $P = 0.1981$ and 27.1% $P < 0.0001$ respectively) (TABLE 3).

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Table 3: Distribution of lacerations by anatomical site

Anatomical site	Estimates (%)	P value
Lips	54,6%	P = 0,1981
Mucosa	14,2%	P < 0,0001
Tongue	27,1%	P < 0,0001
Others	1,8%	P < 0,0001

Considering the distribution of orofacial traumas by the sport practiced by the athletes, we noticed a higher prevalence of occurrences in Jiu-Jitsu (29.3%), followed by Muay Thai (21.5%) (TABLE 4).

Table 4: Distribution of orofacial injuries by sport.

SPORT	PREVALENCE OF INJURIES	
	n	%
Muay Thai	16	21,04%
Jiu-Jitsu	18	29,03%
Kick Boxing	2	11,73%
Taekendow	2	16,67%
Kung Fu	5	23,88%
Boxing	5	25%
Others (MMA, SANDA AND JUDÓ)	5	50%

The results showed that of the 218 athletes interviewed, 131 (about 60.1%) $P = 0.0184$ used mouthguards and 82 (37.6%) did not use mouthguards during competitions, only 5 reported using mouthguards sometimes (2.3%) (TABLE 5).

Table 5: Athletes using mouthguards in combat sports.

ATHLETES	WITH MOUTH GUARDS		WITHOUT MOUTH GUARDS		SPORADICALLY	
	n	%	n	%	n	%
218	131	60,1%	82	37,6%	5	2,3%

Of the combat sports athletes who use mouthguards, 20 (14.71%) $P = 0.6075$ use type I (stock) protectors, 105 (77.21%) $P = 0.1488$ use type II (boils and bites) and only 13 (9.56%) $P = 0.1383$ use type III (made to measure) (TABLE 6).

Table 6: Types of mouthguards used in combat sports

TYPE OF MOUTH GUARD	TYPE I		TYPE II		TYPE III	
	n	%	n	%	n	%
NUMBER OF ATHLETES	20	14,71%	105	77,21%	13	9,56%

The sports that showed the greatest use of mouthguards are those that have its mandatory use, such as Boxing, MMA and Sanda (considered as others in this research) 85% and 90% respectively (TABLE 7).

Table 7: Distribution of use of mouthguards by sport

SPORT	USE OF THE MOUTH GUARD	
	n	%
Muay Thai	49	64,47%
Jiu-Jitsu	32	51,61%
Kick Boxing	9	52,94%
Taekendow	8	66,67%
Kung Fu	7	33,33%
Boxing	17	85%
Others (MMA, SANDA AND JUDÓ)	9	90%

Regarding the use of mouthguards and soft tissue lacerations, 57.32% of the athletes who did not use mouthguards had lacerations (TABLE 8).

Table 8: Use of mouthguards related to trauma and orofacial lacerations.

Use of mouthguard	Using mouthguard		Not using mouthguard		Using sporadically	
	n	%	n	%	n	%
INJURIES	34	25,95%	63	76,83%	0	0
LACERATIONS	94	71,76%	47	57,32%	3	60%

A decrease in orofacial trauma and lacerations is observed when comparing Type I and Type II protectors to the protector made by a dentist: Type III (TABLE 9).

Table 9: Orofacial injuries and lacerations distributed by type of mouthguard.

TYPE OF MOUTH GUARD	TYPE I		TYPE II		TYPE III	
	n	%	n	%	n	%
INJURIES	5	25%	26	24,76%	1	7,69%
LACERATIONS	15	75%	72	68,57%	1	7,68%

When asked if they recognized the importance of using a mouthguard during sports practice, 95.9% of the participants reported that they considered it important to use it, even when they were not using the equipment.

DISCUSSION

According to the National South Sports Safety Foundation (NYSSF), 2006, every athlete who is engaged in contact sports has a 10% chance of suffering

injuries, with a 33% to 56% chance that injuries of the same type will occur throughout of your career. In addition, 10% of traumas from sports practices occur in the head, and 14% to 39% of dental injuries occur during sports practice (Sane, Ylipaavalniemi, 1988), corroborating the present study, in which 24.3% of the athletes reported having already suffered some orofacial trauma. In the study by Iona et al., 2019, the presence of orofacial injuries was reported in 25.3% of the athletes and 19.34% of these athletes had combined soft tissue injuries and dental injuries.

In the present study, 9.2% of dental traumas and 4.6% of jaw fractures and 7.8% of other injuries were reported, considering all combat sports evaluated in this study. In the study by Ferrari et al., 2002, the prevalence of dental injuries in professional and semi-professional combat sports athletes, considering Jiu-Jitsu and Judo, was 32.1%. In the study by Galic et al., 2018, the prevalence of orofacial injuries in amateur Karate and Taekwondo athletes was 100%. As reported by Horri et al., 2016, the estimated prevalence of dental trauma in adolescents between 11 and 18 years old who practice combat sports was 37.8% and the estimated prevalence of orofacial fractures was 52%. According to the work carried out by Tulunoglu et al., 2006, among professional and amateur Boxing and Taekwondo athletes, the prevalence of dental injuries, soft tissue injuries in the oral cavity and orofacial trauma was 22.3%, 19, 7% and 41.9%, respectively. In the present study in question, in Jiu-Jitsu, 29.03% of the athletes reported having already suffered orofacial injury. Also within this combat sports modality, Ferrari et al., 2002 reported a prevalence of 41.2% of dental injuries in professional and semi-professional Jiu-Jitsu athletes.

The results of the present study regarding the most frequent types of injuries during the championships, with 95.9% of soft tissue lacerations (54.6% in the lips, 14.2% in the mucosa and 27.1% in the tongue) and 6.9% of mandibular fractures are similar to the findings of Diab and Mourino, 1997, so that the most frequent injuries were 77% of soft tissue, about 22% of hard tissue and 1% of mandibular fractures, similar to the findings de Sane and Ylipaavalniemi, 1988, according to which there were 60% soft tissue injuries, 16% tooth trauma, 9% mandible fracture.

According to the data from this study, 37.6% of combat sports athletes do not use mouthguards. These data are in line with studies of other contact sports modalities, such as the work by Bergman et al., 2017, according to which only 28% of professional Handball athletes use mouthguards during sports practice. As reported by Frontera et al., 2011, only 1% of athletes on a basketball team who suffered orofacial injuries were using mouthguards at the time of trauma. In the study by Padilha et al., 2021, 61.9% of the athletes

on a Rugby team were not using mouthguards during the occurrence of an orofacial trauma.

The widespread use of Type I and Type II mouthguards, as described in this study (Table 6), is due to the fact that the cost is much lower and that they are easily purchased in sporting goods stores (Glendor, 2013). On the other hand, these protectors do not guarantee protection against trauma and lacerations, mainly because they do not guarantee good adaptation and comfort for the athletes (Duarte-Pereira et al., 2008). According to Tuna, Ozel, 2014, currently more than 90% of mouthguards used in sports are purchased in stores (Type IE Type II), while about 10% are made to order, diagnosed and designed by a dental professional, corroborating the present study, since 91.92% of the athletes reported using type I and II protectors (14.71%, 77.21% respectively) and only 9.56% used the ideal type III protector. In the study by Bergman et al., 2017, athletes who regularly used mouthguards were 5.55 times less likely to suffer a dental injury compared to players who did not use mouthguards.

Regarding the use of mouthguards and soft tissue lacerations, soft tissue lacerations were observed in 57.32% of the athletes who did not use mouthguards and 71.76% of those who used them reported lacerations, this is explained by the large number of athletes who used type I and II mouthguards. In addition, 76.83% of athletes who did not use mouthguards had orofacial trauma. In the study by Galic et al., 2018, of the 58 athletes who participated in karate, 29.3% suffered an orofacial injury and 17.2% suffered a dental injury. In the study by Vidovic et al., 2015, which included 484 Taekwondo athletes, the incidence of dental trauma was 20%. In this study, the incidence of orofacial and dental injuries in Taekwondo athletes was lower than in other sports investigated (14% orofacial trauma and 3.5% dental injuries), which can be explained by a higher rate of mouthguard use in taekwondo athletes (78%).

These findings are similar to the data from the present study, which showed the use of mouthguards by 66.67% of Taekwondo athletes, and the number of lacerations and traumas was much lower in athletes who used the type III mouthguard, made by the surgeon dentist.

In the present study, 95.9% of athletes reported that they consider the use of mouthguards important during sports practice, even when they are not using the equipment. This data is similar to the findings of Tiryaki et al., 2017, according to which 83.5% of the athletes indicated that they were aware of the use of mouthguards, although 93.7% of the athletes did not use the mouthguards. According to Ma, 2008, more than 80% of athletes reported knowing that the mouthguard can prevent the occurrence of dental trauma during basketball practice in training and competition.

The American Society for Testing and Materials (ASTM) (2016) classifies mouthguards into 3 categories:

A. TYPE I - Stock or universal (“stock”).

They are protectors that have a standard measure (P, M and G), made of latex or polyvinyl chloride, have low cost and are easily found in sporting goods stores. They fit poorly, are difficult to use, offer little protection, can be dislodged during use, are held in place by occlusion, and there is no evidence that they redistribute impact. Therefore, they are less efficient, but widely used, due to their low cost and not needing a dentist.

B. TYPE II - Made in the mouth, pre-fabricated or "mouthformed".

They are also purchased at sporting goods stores. It should be immersed in hot water and then fitted into the arch and pressed with the fingers to form it. The boiling process reduces the thickness, reducing safety and effectiveness in protection. The adaptation is poor even after the cooking process and it is necessary to clench your teeth to keep it in position.

C. TYPE III - Made to measure or made to order (“custom-made”).

Custom-made or custom-made protectors are designed and manufactured to meet the individual needs of the athlete and fulfill all criteria of fit, retention, comfort and material stability. They are manufactured with a material that allows the inclusion of semi-rigid or flexible layers in the protector (Coto et al., 2012).

The material of choice for making mouthguards is EVA (copolymer of ethylene and vinyl acetate), which has in its composition the vinyl acetate: non-toxic in nature, with good elasticity and easy to handle. Thus, these intraoral protection devices allow for protection, communication, breathing, and hydration, without prejudice to the athlete's sporting performance (Gialain et al., 2016).

Mouthguards, in addition to their protective capacity, also act to stabilize bone fractures and avulsed teeth; support of adjacent teeth, so that users of removable dentures can remove them during sport, preventing possible fractures and accidental swallowing or inhalation of fragments and allow the athlete to perform movements with more confidence (Gialain et al., 2014).

These protectors should be used whenever the individual participates in sports activities that involve the possibility of falls, sudden physical contact or collision with flying objects, such as martial arts (Tiwari, 2014). That is, these devices are essential in the practice of contact sports (Ilia et al., 2014).

Poor oral health conditions, as well as the occurrence of trauma and dental fractures can affect the athlete's performance, take him out of competitions and bring damage to the quality of life (Dias et al., 2022).

This study suggests a considerable prevalence of orofacial injuries in combat sports athletes and highlights the fundamental importance in preventing these injuries, based on the use of mouthguards. These findings encourage further research on this population, aiming to understand which type of mouthguard is most used in each of the combat sports, as well as the performance of other professionals in related areas and the technical committee, in order to enhance knowledge about the conditions of prevention and promotion of oral health of the athlete patient.

CONCLUSION

It can be concluded that the prevalence of trauma and orofacial injuries in athletes practicing combat sports was approximately 25%.

Most combat sports athletes do not use the type III mouthguard made by the dentist as a form of prevention, which contributes to the high occurrence of orofacial injuries in practitioners of these modalities.

Potential conflict of interest

No conflicts of interest with potential potential for this article have been reported.

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