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Orofacial trauma in Brazilian basketball players and level of information concerning trauma and mouthguards

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Abstract – Orofacial injuries are increasingly considered a public health problem in high impact sports. The purposes of this study were: to assess orofacial trauma (OT) history in basketball players, in relation to wearing mouthguards (MG), facial types, presence of mouth breathing and player's position in the game, also to check athletes' level of knowledge about trauma and MGs. Questionnaires were given to category A-1 adult athletes registered in 2006/07 in the State of São Paulo and Brazilian Basketball Confederation Championships, and National Team members. Of the total sample ($n = 388$), 50% of athletes sustained orofacial injuries; dental trauma accounted for 69.7%, with emphasis on maxillary central incisors, followed by soft tissue (60.8%), in which lip injuries were the most prevalent. No relationship was found between trauma history and player's position ($P = 0.19$), facial type ($P = 0.97$), presence of mouth breathing ($P = 0.98$), but there was statistically significant association between the prevalence of OT and lack of MG use ($P \leq 0.0001$). Of all the athletes affected, only 1% wore a MG at the time of the trauma, 26.5% did not know about the MGs and 10.6% did not know their functions. When trauma occurred, 79.6% replied one must look for the tooth at the accident site, 50% knew it must be stored in liquid, as replantation was possible (62.3%) and 75.8% believed elapsed time could influence prognosis. Basketball is a high impact sport with high prevalence of OT, particularly maxillary central incisor and lip injuries, but athletes did not use MGs. There should be more educational campaigns to inform players about orofacial injuries and their prevention in Brazilian basketball.

Orofacial trauma (OT) is considered a public health problem (1) in high impact sports. OT or any injury during sporting activities, depending on its severity, can exclude the athlete from important competitions, with personal and professional consequences (2). Various studies have observed that sporting accidents are responsible for six times more facial injuries than work-related accidents, and three times more injuries than violence or traffic accidents (3). In fracture ranking, facial accidents in Olympic Games participants rank fifth place (4), and over 5 million teeth are lost each year during sports activities.

Some of the risk factors can be related to trauma in general, such as: age under 15 years, or from 15 to 24 years, male gender (6), mandibular retrognathism and prognathism and presence of mouth breathing (4), professional competition level (7), player in an offensive position in the game (8, 9), fixed orthodontic appliance wear (10) and non-use of protective equipment (11–14).

In basketball the rules have developed significantly, and the game has become very fast with a very aggressive defense system, which increases body contact among players (15), resulting in greater possibility of traumatic accidents. At present, basketball is one of the most popular sports in the world and according to the International Basketball Federation (FIBA), 11% of the world population plays basketball, totaling 450 million registered participants (16).

In Brazil, the National Sports Administration Agencies also show the increasing popularity of this sport, listing a total of 289,576 athletes in various categories, the most significant number being in the State of São Paulo, which contains 12.5% (36,067) of all the basketball players in the country. The prevalence of OT in athletes ranges from 23 to 86%, considering intra- and extra-oral tissue lacerations, fractures, luxation and tooth avulsion, mandibular dislocation or fracture and cerebral concussion (7, 10, 12, 17–19).

In view of the high prevalence of OT observed during sporting practice, particularly in basketball, it becomes important to include a dentist as a member of the sporting technical commission, thereby encouraging that the athletes' oral health is maintained, and that they are made aware of the need to use a mouthguard (MG). Despite this, it is observed that in sports in general, and in the basketball teams in Brazil, the dentist is not yet included as a member of the team (20).

Since 2005, the National Congress in Brazil has been debating Bill 5391/05, with the object of making it mandatory for qualified dentists to be present to attend dental emergencies at sporting events, and holding the promoters responsible if this condition were not met. In 2007, the Social Security and Family Commission of the Federal Chamber approved a substitute for this Bill, arguing about the importance of oral health, particularly in cases of trauma or loss of teeth by sportsmen/women, and prioritizing preventive action by dentists in sporting bodies, as well as hiring these professionals to follow-up athletes with regard to guidance and first aid attendance. Currently, the above-mentioned bills have not yet received final approval.

In studies conducted in Brazil (1, 2, 13) a clear relationship is observed between the use and non-use of the MG and the occurrence of trauma, considering that the majority of athletes who present these injuries resist using the preventive equipment, mainly because there is still no law that makes it mandatory to use the mouthguard during the practice of contact sports, particularly basketball.

Compared with other major collision sports such as ice hockey, American football and boxing, basketball presents the highest prevalence of OT (2, 21, 22). As from 1962, The National Alliance Football Rules Committee established rules for the mandatory use of MGs in American football by middle school athletes, and in 1973 by college and university players. In 1975, USA hockey determined the same mandatory MG use for Hockey. Since then, an important decrease has been observed in the prevalence of OT in these sports (22–24). The *Academy for Sports Dentistry* lists 40 contact sports in which MG use is indicated, basketball being among them, but in Brazil, boxing is the only sport that demands mandatory MG use (21, 22). Traumatic accidents in basketball happen constantly as a result of impact with an object (glasses, ring or ball), falling, players colliding with elbows or hands (6, 25), generally while running, dribbling, attempting to regain a lost ball, or intercepting a pass, or during the mechanics of movement in rebound, block or shooting.

According to the 'National Youth Sports Safety Foundation', a North American agency dedicated to research related to preventing sporting trauma during contact sports activities, athletes have up to 10% to greater chance of suffering an orofacial lesion in a season, and 33% to 56% probability during the course of their careers (23). It is essential to adopt preventive methods for this high impact sport, to minimize OT that can compromise an athlete's career (2), as well as generate high estimated costs of treating sporting injuries. Taking into consideration the growing number of sports practitioners seeking improved quality of life, and the high prevalence of OT found in basketball, the purpose of this study was to verify the prevalence of these injuries during basketball in Brazil, the factors possibly related to it, and to analyze the level of athletes' knowledge about trauma occurrence and MG use as a preventive measure.

Material and methods

This study was conducted in accordance with the precepts determined by resolution 196/96 of the National Health Council of the Ministry of Health published on October 10, 1996, and approved by the Dentistry Professional Ethics Code, Protocol Number 06/138, and by the Brazilian Basketball Confederation (CBB).

All the male basketball players, members of teams enrolled in the São Paulo and Brazilian championships in the Adult Category A-1 category, and Adult, Juvenile, Cadet Brazilian National teams, São Paulo State cadet teams in the year 2006/07, who signed the term of free and informed consent, were considered participants in the sample. Only men were studied, because in Brazil, there are only a small number of women in basketball. For this research, a cross-sectional observational descriptive study was conducted by means of questionnaires, personally handed to 445 athletes, of whom 388 returned the completed questionnaires, all of which were suitable and were used in this study. The participants and the Brazilian Basketball Confederation received an informational letter that emphasized the relationship of dentistry with the sport, and thus the importance of the research was shown, which contributed to a non-reply rate of 12.1%.

The questionnaire (Table 1) was previously tested in a population similar to that of the sample, but with volunteers who did not participate in the study. The athlete's name did not appear in the heading, only the team and the player's position, which guaranteed anonymity. The questions endeavored to collect information related to OT history, type of injuries sustained while playing basketball (2, 13, 24), types of impact (2, 26), predisposing factors to trauma (19, 21, 27), athlete/dentist relationship (24), level of knowledge about trauma (6, 9, 10) and MG wear (5, 13).

The results were compiled and quantified in percentages, and the associations were examined by the chi-square or exact Fischer's tests through the BIOESTAT 4.0 program (Mamirauá Maintainable Development Institute, Belém, Pará, Brazil). Associations that presented *P*-values (probability of significance) ≤0.05 (5%) in bicaudal distribution were considered statistically significant.

Results

The 388 players participating in the sample presented means with regard to age, height and weight respectively, of 23.2 years (±5.11), 1.95 m (±0.09) and 93.60 Kg (±14.53). Of the total sample, 50% (n = 194) sustained OT while playing basketball and of these, 76.8% (n = 149) occurred during training sessions and 72.2% (n = 140) during competitions. Table 2 shows details of the types of OT the athletes sustained: dental trauma accounted for 69.7% (n = 135), with emphasis on maxillary central incisors (MCI) (69.6%), followed by soft tissue (60.8%; n = 118), in which lip injuries were the most prevalent, and mandibular trauma (20.1%; n = 39). In the dental trauma reports, 52.6% (n = 71) of the teeth presented fractures, followed by luxation, intrusion, avulsion and partial extrusion, and the most

Table 1. Questionnaire

SÃO LEOPOLDO MANDIC SCHOOL OF DENTISTRY

Guidance: This questionnaire about **Sporting Dentistry** refers to the dissertation for Master's degree in Social Dentistry. Please, answer all the items. When in doubt, choose the first option you thought of. Bear in mind your own perceptions and personal feelings when answering the questionnaire. Your information will be kept confidential, as it is impossible to recover the respondent's identity.

FOR RESEARCHER'S USE

Team:		**Position:**	
Race:	**Age:**	**Height:**	**Weight:**

I - FACTORS RELATED TO ORAL HEALTH — **Date when filled out:** _____/_____/_____

1. Check the drawing that resembles your facial types:

2. Do you have difficulty with breathing through your nose from day to day? ( ) Yes ( ) No

3. How does an oral problem (caries, bad breath, infection, toothache) affect your relationship with other people?
( ) Don't know/ Did not inform ( ) Doesn't affect ( ) A little ( ) More or less ( ) Very much

4. Do you think an oral problem ***can or cannot*** diminish an athlete's physical resistance? ( ) Don't know ( ) It can ( ) It can't

5. Have you missed training or a game due to an oral problem (caries, bad breath, infection, toothache or oral trauma)? ( ) Yes ( ) No

II - ATHLETE/DENTIST RELATIONSHIP

6. Do you think *it's important or not* for your team to have a dental surgeon in the team setup? ( ) Yes ( ) No

7. Have you ever been informed by a dental surgeon about oral or dental trauma and use a mouthguard? ( ) Yes ( ) No

8. To maintain your oral health, do you go to:
( ) The TEAM'S Dentist (Health Plan or Private) ( ) A PUBLIC SERVICE Dentist
( ) PRIVATE Dentist ( ) I don't go to the Dentist. Why?_____

III - DURING BASKETBALL PRACTICE....

9. How long have you been playing professional basketball? _____

10. Have you ever suffered any type of oral trauma? ( ) Yes ( ) No
If the answer is YES, answer questions 11 to 19. If the answer is NO, go on to question 20:

11. Where were you struck? ( ) Lip ( ) Tongue ( ) Cheek ( ) Gum ( ) Jaw ( ) Tooth
If the trauma affected a tooth, check one or more of the alternatives below, otherwise, go on to question 12:
a) The affected tooth was:
( ) Maxillary Central Incisor (Top front tooth) ( ) Another tooth
b) What happened to the tooth?
( ) It broke (fracture) ( ) It was only hurt (luxation) ( ) It was displaced inward (intrusion)
( ) It was displaced outward (extrusion) ( ) It fell out completely (avulsion)

12. In the situations described below, check how many times you have suffered oral trauma.

In training:	( ) 1 time	( ) 2 or 3 times	( ) 4 or 5 times	( ) More than 5 times
In games:	( ) 1 time	( ) 2 or 3 times	( ) 4 or 5 times	( ) More than 5 times
In the last season:	( ) 1 time	( ) 2 or 3 times	( ) 4 or 5 times	( ) More than 5 times
In your entire career:	( ) 1 time	( ) 2 or 3 times	( ) 4 or 5 times	( ) More than 5 times

13. Were using a mouthguard when you were hit? ( ) Yes ( ) No

14. I was using a fixed orthodontic appliance at the time of the trauma:
a) Lip, Tongue, gum or cheek: ( ) Yes ( ) No b) Of the tooth: ( ) Yes ( ) No

15. Was there bleeding and/or pain at the time of the trauma, which did not allow you to continue playing? ( ) Yes ( ) No

16. How did the accident happen? (Check one or more alternatives) ( ) Contact with another player ( ) Collision with the ball
( ) Impact with the board or ring ( ) Falling (impact with the floor) ( ) Others:_____

17. Who attended you at the place of the accident (sports stadium)?
( ) Head coach ( ) Physical trainer or physiotherapist ( ) Doctor responsible for the team
( ) Dentist responsible for the team ( ) There was no attendance at the time

Table 1. Continued

18. How long after the oral trauma occurred did you go to the dentist? ( ) Immediately ( ) 1 hour later ( ) 6 hours later ( ) 1 month or more ( ) Did not go
19. In the first training sessions after suffering the trauma, did you feel insecure about playing basketball? ( ) Yes ( ) No
IV - INFORMATION AS REGARDS TRAUMA AND ITS PREVENTION
20. Do you think that the tooth that fractured or fell out completely, should or shouldn't be looked for at the place (court)? ( ) Don't know ( ) It should ( ) It shouldn't
21. When found, should the tooth be put into a receptacle with liquid, or not? ( ) Don't know ( ) It should ( ) It shouldn't
22. In your opinion, can a tooth lost by trauma be replaced, or not? ( ) Don't know ( ) It can ( ) It can't
23. Do you think that the time taken to be attended influences the treatment of a dental trauma, or not? ( ) Don't know ( ) It influences ( ) It doesn't influence
24. Do you know any of the mouthguards mentioned below? Check one or more alternatives: ( ) I don't know ( ) Type I - bought at a sports goods shop in sizes S, M and L (stock or prefabricated) ( ) Type II - bought at a sports goods shop, the type you have to boil and bite to adapt it to your mouth (boil-bite) ( ) Type III - made by a dentist (individualized)
25. Check the alternative(s) you think are right about the mouthguard: ( ) I don't know ( ) Protects your teeth from impact with the ball, floor, opponent, table or other obstacle. ( ) Protects the gum, tongue, cheek and lips from injuries. ( ) Avoids fracturing your teeth or makes it difficult. ( ) Avoids the direct impact of your top teeth with the bottom ones. ( ) Mouthguard could be swallowed by the athlete in case of violent impact.
26. Do you think it's necessary to use a mouthguard? ( ) Yes ( ) No
27. Do you use a mouthguard? ( ) Yes ( ) No Only answer the following questions if the answer is YES:
28. How long have you been using a mouthguard? ( ) 1 year ( ) 2 years or longer ( ) Since I started my career as professional athlete ( ) Since I suffered a dental traumatism
29. Who encouraged you to use it? ( ) Head coach ( ) Colleague ( ) Parents ( ) Dentist

Table 2. Frequency of orofacial injuries reported by type

Type of orofacial injury	Frequency	
	n	%
Tissues softy		
Lips	103	87.3
Tongue	41	34.7
Cheek	32	27.4
Gum	17	14.5
Mandibular	39	20.1
Teeth		
Maxillary central incisors (MCI)	94	69.6
All other teeth except MCIs	43	31.9

Table 3. Prevalence of dental trauma reported by type

	Maxillary central incisors (MCI) only		All other teeth In the mouth except MCIs	
	n	%	*n*	%
Fracture	50	70.4	23	32.4
Luxation	26	66.7	15	38.7
Intrusion	16	80.0	6	30.0
Avulsion	8	80.0	2	20.0
Extrusion	1	100.0	0	0.0

affected teeth were always the MCI, as shown in Table 3. Among the 194 athletes who sustained OT, 91.8% (n = 178) were as a result of contact with another player, and the remainder presented other types of impact (Table 4).

At the time of the trauma, 34% (n = 66) of the players did not receive any type of emergency service, 38.7% (n = 75) were helped by the physical trainer or physiotherapist who accompanied the team, and only 4.1% (n = 8) received first aid at the hands of a dentist (Fig. 1). Some players (42.8%; n = 83) presented bleeding that prevented them from staying in the game, and 32.5% (n = 63) said they felt insecure about playing post-trauma; and the association between these two factors was statistically significant (χ^2 = 13.22; d.f. = 1; P = 0.0003).

As a result of various factors, 85.3% (n = 331) of the athletes said that the presence of a dentist on the team was important, as 73.5% (n = 285) had sought private dental attendance. Although few athletes (n = 89, 22.3%) related that an oral problem might cause them to stop training or playing, 66% (n = 256) knew that

Table 4. Types of impact suffered by player at time of the trauma

Types of impact	Frequency	
	n	%
Contact with other player	178	91.8
Falling	11	5.67
Blow from the ball	10	5.15
Collision with the glasses or ring	1	0.52
Other causes	3	1.55

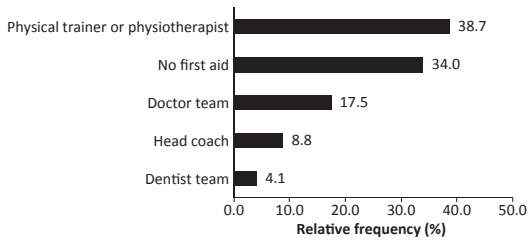

Fig. 1. Individuals responsible for providing first aid at time of the trauma.

this could diminish their physical strength, and 55.7% (n = 216) affirmed that oral health problems would not affect their social relationships. While there was no statistically significant association between the prevalence of OT and the player's position in the game, facial types and presence of mouth breathing, there was a statistically significant association between OT prevalence and MG use (Table 5).

Of all the athletes affected, only 1% (n = 2) wore a MG at the time of the trauma, and currently only 7% (n = 27) reported wearing a MG during basketball practice, although 65.5% (n = 254) thought it was necessary to do so. The major reason the athletes gave for using a MG was previous experience of OT (n = 11; 40.7%) and 74.1% (n = 20) were encouraged to do so by the dentist.

In the questions about the athletes' level of knowledge about MG, 26.6% (n = 103) replied that they did not know the different types of MG, 38.4% (n = 149) knew the type I or 'stock' MG, 48.7% (n = 189) the type II or 'boil-bite' MG and 50% (n = 194) the type III or 'professionally fitted' MG as shown in Fig. 2. Of all the players participating in the sample, 47.4% (n = 184) had been informed by a dentist about MG and how to act in the event of a trauma. The opinions of the participants about the functions of the MG are expressed in Fig. 3 it is worth pointing out that 10.6% reported that they knew nothing about the functions of a MG.

The athletes' level of knowledge about how to act in the event of a dental trauma: whether or not they should look for the fractured tooth fragment or tooth that sustained avulsion, and store it; whether or not it could

Table 5. Association between prevalence of orofacial trauma and risk factors

Risk factors		With trauma		Without trauma		Chi-square (d.f.)*	*P*-values
		n	%	*n*	%		
Player's position	1- guard	42	21.6	38	19.6	6.17 (4)	0.19
	2- shooting guard	28	14.4	25	12.9		
	3- small forward	35	18.0	53	27.3		
	4- power forward	34	17.5	23	11.9		
	5- center	53	27.3	53	27.3		
Mouth breathing	Yes	32	16.5	32	16.5	0.00 (1)	0.98
	No	160	82.5	161	83.0		
Facial types	Normal	154	79.4	153	78.9	0.05 (2)	0.97
	Retrognathism	21	10.8	20	10.3		
	Prognathism	17	8.7	18	9.3		
Mouthguard	Yes	2	1.0	25	12.4	21.06 (1)	<0.0001
	No	192	99.0	169	87.1		

*d.f., degrees of freedom.

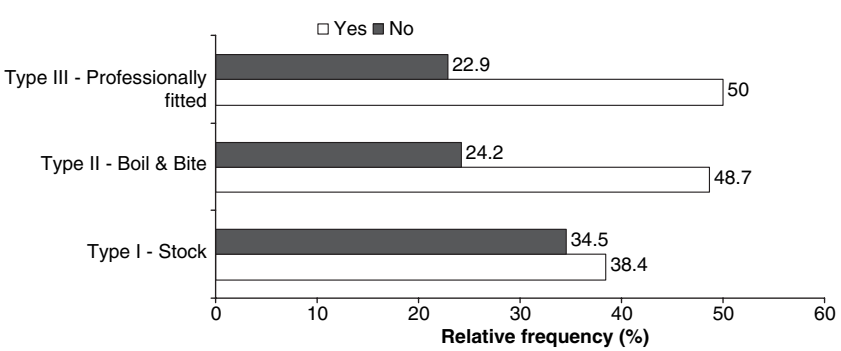

Fig. 2. Knowledge concerning types of mouthguard.

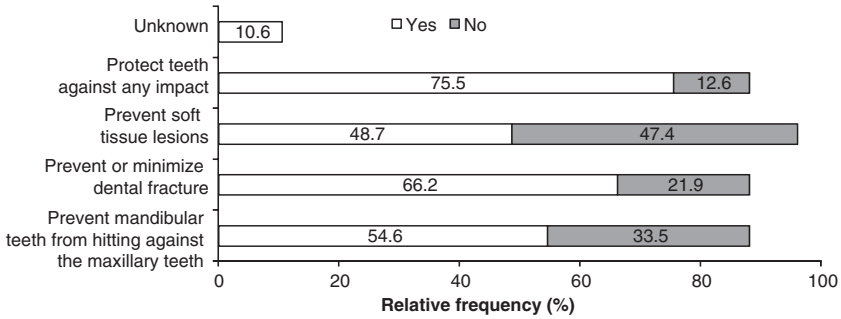

Fig. 3. Knowledge about functions of a mouthguard.

be reimplanted; and whether the time elapsed between trauma and the time of attendance could influence the prognosis (Fig. 4).

Discussion

The occurrence of orofacial lesions resulting from contact sports activities has been widely reported (7, 10, 12, 17–19) and more recently in Brazil (1, 2, 13). Because of the growing number of players, and basketball being considered a high impact sport, basketball is among the sporting activities that most report cases of OT (22).

In the present study, the findings as regards the prevalence of OT were considered significant, noting that half the players have sustained some type of injury while playing basketball. This result was close to that found in the study of Kvittem et al. (10), higher than the percentage given by various authors (7, 12, 18, 19, 29) and only lower than the data of Berg et al. (17) who, in the year 1998, in Arizona, related the highest prevalence (85.4%) among the above-mentioned studies. This can be justified by the methodology applied, in which a large sample consisting only of coaches (n = 1043) participated in the study, who had in the course of their long career had witnessed a large number of athletes who had sustained some type of trauma.

It should be pointed out that only one study (25) showed low prevalence of orofacial injuries in six sporting modalities, among them basketball, and verified that occurrence in games (68.6%) was higher than in training sessions (31.3%), differing from the present study and Kvittem et al. (10), in which the injuries occurred in equal proportion. In Brazil, to date research has investigated samples comprising various sporting modalities, including basketball, but the results have shown lower orofacial injury rates than those found in the present study, which was designed to study only basketball.

Among the common lesions, dental trauma and tissue lacerations are outstanding (8, 12, 13, 17, 21, 28–30), and it was interesting to find that lip injuries were prominent among the soft tissue lesions. As regards dental trauma, the literature shows that the anterior maxillary region is the most affected (2), with emphasis on the MCI, and the predominant type of injury is tooth fracture (7, 8, 17, 19, 25, 28), these results being confirmed in the present study. Other dental injuries were also related, such as luxation, intrusion, extrusion and avulsion, as well as mandibular injuries. Avulsions are more severe and although there are fewer of them, they are always relevant data (5, 7, 12, 22).

In sports it is very common for a player with bleeding as a result of trauma, particularly in the face or mouth, because on impact, the teeth cut the oral tissues. It is known that in competitive sports, as a rule and as a safety measure, an athlete who is bleeding cannot stay on the court. Previous experience of trauma is capable of generating psychological trauma (4), and particularly when accompanied by bleeding, the player feels insecure about playing, as shown in the present study.

In view of the high prevalence of OT among basketball players, and the presence of bleeding at the time of trauma, first aid is necessary. If a player who is important to the team has to leave the game, this could compromise the satisfactory result of the game. Nevertheless, it was observed that at the time of the traumatic accident, some players received no emergency care, as also shown in the study of D′Annibale (2),

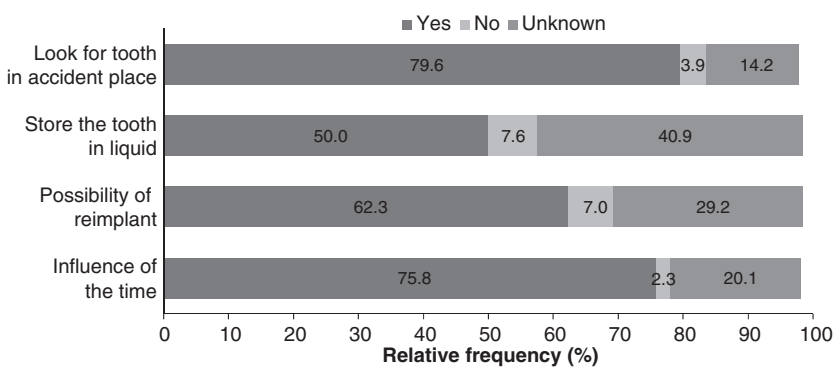

Fig. 4. Attitude regarding dental trauma.

In Brazil, it is known that the dentist does not form part of the team group and although 18.11% of players seek dental attendance after the trauma (2), in the present study it was verified that athletes rarely receive first aid at the hands of a dentist. Fast and adequate attendance is recommended, because it would help to prevent or minimize the psychological and/or physiological damage and sequelae a player might sustain as a result of the trauma.

It is very important for educational campaigns to extend to the sports federations and all the team members who normally accompany a team, such as the doctor, head coach, and particularly the physiotherapist and physical trainer, as they are the health professionals who provide the athlete with attendance in the various emergency situations. The data of the present study confirm the reports of Rodrigues (31), who affirmed that the majority of athletes think that the presence of a dentist in the team structure is important, but they seek private dental attendance, as very few teams offer their athletes this health service.

A sports dentist has several important functions that can help the athlete have a better performance in his sporting activity, as well as prevent oral problems from increasing the chances of the athlete sustaining an OT (32). Carious teeth, large or unsatisfactory restorations, poorly positioned teeth could make a tooth more susceptible to fracture (4, 33). Although the questionnaires made it evident that athletes are concerned about their oral health in some ways, as only few of them do not go to the dentist, it was not possible to determine these relationships, as it was not the object of this study to assess the athletes' oral health, which would demand careful clinical examination. It is suggested that a study should be conducted to determine to what extent oral problems could interfere in an athlete's physical output and compromise his professional career.

Some factors that could be predisposing to OT, according to the literature, were analyzed in this study. The association between the prevalence of OT and the athlete's position in the game was not significant, as the guard, shooting guard, small forward, power forward and center all had the same chance of sustaining OT. Although basketball specifies a certain place for each player, they all form part of a very fast offensive system and generally, man-to-man defense and changes of position occur constantly. That is why basketball players in any position are constantly susceptible to sustaining lesions in the orofacial region, whereas football players in the position of offensive player and goalkeeper present greater predisposition to trauma (8).

The relationship of OT, particularly trauma in MCI, with the mandibular retrognathism and prognathism and presence of mouth breathing was not significant. Generally, the mouth breather individual presents mandibular retrognathism, with vestibularization of the MCI that make it difficult to achieve lip sealing. This could increase the chances of an athlete with these characteristics of sustaining trauma in the maxillary anterior region (4). Whereas athletes with mandibular prognathism could present higher risk of mandibular fracture, particularly in the condyle area (4), however, this was not shown in the present study. Irrespective of whether athletes presented normal facial type, mandibular retrognathism or prognathism, the prevalence of OT was similar in the three groups.

It has frequently been shown that there is a low percentage of MG use among athletes at the time of trauma (11, 17, 19, 29) and it has been observed that MG use is associated with or without the presence of OT (12, 23, 25), as confirmed in the present research. This shows the importance of MG use in OT prevention during the practice of contact sports, particularly, basketball. However, some researchers (9, 13) observed that certain complaints could occur with its use (9, 13), and therefore, it is suggested that further studies should be conducted with focus on MG use, particularly in Brazil.

Frequently athletes do not avoid or prevent trauma with the use of a suitable MG, therefore it is important for athletes and coaches to know how to act in the event of trauma, particularly in cases of tooth fracture or avulsions (7, 34). The results of the present study were compared with the two above-mentioned studies, and very similar findings could be observed with regard to athletes knowing about the possibility of reimplanting an avulsed tooth. With regard to the storage medium of these teeth until they could be reimplanted, the present study showed that 50% of the athletes knew that the tooth should be kept in liquid, but the type of liquid used was not determined. Whereas, in the study of Raphael and Gregory (34), 24% of the athletes transported the tooth in liquid, but the majority used water or other unsuitable means of transport, as was also the case in the study of Perunsky et al. (7).

Time is a critical factor for a favourable replantation prognosis. In a dry medium, the replantation should ideally be performed within 10–14 min (35). If milk is used as storage medium, the procedure must be performed within a maximum of 6–8 h (36), whereas Hank's balanced saline solution (HBSS) for example, allows a longer action time; in addition to cell viability, it guarantees recomposition of the ligament fibers that sustained lesion (37).

It was observed that the majority of the athletes knew that time could influence the prognosis, but only few of them sought immediate attendance, differing from the study of Raphael and Gregory (34) who showed a high proportion (91.8%). As in the study of Perunsky et al. (7), it was verified that the replies with regard to time varied a great deal, and it was concluded that the athletes did not know what the ideal time was.

To enable the tooth to be transported more safely in Hanks solution, a special system, namely 'Save a tooth' (3M Health Care, St Paul, MN 55144-1000, USA) was developed. It allows the avulsed tooth to be placed, kept and removed delicately, without damaging it, and should always be available in schools gymnasiums, clubs, hospitals, ambulances, and at home (37, 38). As regards the athletes' level of knowledge about MG, Rodrigues (2005) and Onyeaso (2004) observed that 81.7% and 53% respectively did not know the different types of MG (24, 29). The type I MG (stock) and II (boil-bite) were outstanding as the best known and used among athletes

(12, 23, 29, 30) and in the study of Berry et al. (11) the type III MG (professionally fitted) was mentioned as the most used type.

In the present research it was observed that a large number of athletes were familiar with the MG, as in the study of D′Annibale (2), and the type II and III MGs were the best known among them. Nevertheless, in the sample of 388 basketball players, among whom the majority thought it necessary to us a MG in this sport, only 7% did so. Generally speaking, studies have shown that in basketball, the MG is hardly used (1, 2, 7, 10, 12, 18, 30), however, in sports such as American football and boxing, in which MG use is mandatory, it was observed that the athletes were more conscious of the need to use the MG (29).

One of the functions of the MG is to reduce the chances of an athlete sustaining an OT, particularly avulsions (28). The great majority of athletes are conscious of MG use to prevent orofacial injuries (9, 10, 19) and protect the teeth against any impact to prevent injuries, as was observed in the present study; but 47.4% did not know that the MG could also prevent soft tissue injuries.

Studies have observed that soft tissue lesions could possibly occur even with MG use, but the injuries are slighter (11, 12, 39). The use of MG has a significant relationship with the prevalence of dental trauma, but not with trauma in soft tissues, which may result from the use of a fixed orthodontic appliance and an unsuitable MG (39) In cases of athletes who wear fixed orthodontic appliances, the use of the type III double MG is indicated, so that the teeth can be completely protected to prevent the brackets or wires from injuring the lips, gum or cheeks at the moment of impact.

For better awareness about the importance of the MG, athletes should be provided with more information on the subject, as many of them related that they had never heard anyone talk about the MG (8, 9, 18, 31). This was proved in the present study, in which athletes also said that they did not know how to act in the event of an OT.

Conclusions

Basketball is a high impact sport with a high prevalence of OT, particularly maxillary central incisor fractures and lip injuries, and in view of this, MG use is indicated for this sport. The predisposing factors such as: the athlete's position in the team, facial types, presence of mouth breathing were not associated with the prevalence of trauma. There was statistically significant association between the prevalence of OT and MG use. The majority of athletes did not know how to act in the event of a trauma, and although they considered MG use necessary for preventing trauma, they did not use one. Inclusion of the dentist as a team member would be ideal, considering that this professional could work in benefit of the athletes' oral health and increase athletes′ awareness of how to act in the event of a trauma, as well as of MG use while playing basketball, enabling them to engage in the sport with greater safety.

References

1. Ferrari CH, de Medeiros JMF. Dental trauma prevalence and level of information concerning mouthguard usage in various sports groups. Dent Traumatol 2002;18:144–7.
2. D'Annibale AS. [Survey of buccomaxillofacial lesions in athletes of São Caetano do Sul]. Rev Assoc Paul Cir Dent 2004;58:467–72. Portuguese.
3. Muhtarogullari M, Demiralp B, Ertan A. Non-surgical treatment of sports-related temporomandibular joint disorders in basketball players. Dent Traumatol 2004;20:338–43.
4. Dias RB, Maia FAZ, Coto NP. Sports dentistry. In: Cardoso RJA, Gonçalvez EAN, editors. Endodontic trauma. São Paulo: Artes Médicas; 2002. p. 465–76.
5. Barbosa CL, Lacerda RA, Alves AC. [Pedodontists' knowledge on prevention on sports injuries]. J Bras Odontopediatr Odontol Bebê 2003;6:399–404. Portuguese.
6. Quintana Díaz JC, Giralt López BM. Facial fractures etiopathogeny in sporting accidents – Artemisa 1994-2003. Rev Int Med Ciênc Act Fís Deporte 2005;19. http://cdeporte.rediris.es/revista/revista.htm (accessed 14 Nov 2008).
7. Perunsky S, Lang B, Pohl Y, Filippi A. Level of information concerning dental injuries and their prevention in Swiss basketball – a survey among players and coaches. Dent Traumatol 2005;21:195–200.
8. Cardoso LC, Cardoso PC, Oliveira MBRG, Cardoso LC. [The situation of orofacial trauma in sportsmen/women and trainers in the sports initiation program-SMEL ABO/GO]. ABO 2004;12:214–9. Portuguese.
9. Berry DA, Miller MG, Leow W. Attitudes of central collegiate hockey association ice hockey players toward mouthguards usage. J Public Health Dent 2005;65:71–5.
10. Kvittem B, Hardie NA, Roettger M, Conry J. Incidence of orofacial injuries in high school sports. J Public Health Dent 1998;58:288–92.
11. Garon MW, Merkle A, Wright JT. Mouth protector and oral trauma: a study of adolescent football players. J Am Dent Assoc 1986;112:663–5.
12. Maestrello-de-Moya M, Primosch R. Orofacial trauma and mouth-protector wear among high school varsity basketball players. J Dent for Children 1989;56:36–9.
13. Barberini AF, Aun CE, Caldeira CL. [Orofacial injuries incidence and mouthguards use in different contact sports]. Rev Odontol UNICID 2002;14:7–14. Portuguese.
14. Harmer PA. Basketball injuries. Med Sport Sci 2005;49:31–61.
15. Ivkovic D. How to start the game. FIBA Assist Mag 2006;18:19–23.
16. Federation International of Basketball (FIBA). Key numbers. Available at website http://www.fiba.com/pages/eng/fc/FIBA/quicFact/p/openNodeIDs/1014/selNodeID/1014/quicFacts.html (accessed 14 Nov 2008).
17. Berg R, Berkey DB, Tang JMW, Altman DS, Londeree KA. Knowledge and attitudes of Arizona high-school coaches regarding. J Am Dent Assoc 1998;129:1425–32.
18. Levin L, Friedlander LD, Geiger SB. Dental and oral trauma and mouthguard use during sport activities in Israel. Dent Traumatol 2003;19:237–42.
19. Cornwell H, Messer LB, Speed H. Use of mouthguards by basketball players in Victoria, Australia. Dent Traumatol, 2003;19:193–203.
20. Ferreira A. Strategic planning for the Brazilian men's national team. FIBA Assist Mag 2006;18:11–13.
21. Flanders RA, Bhat M. The incidence of orofacial injuries in sports: a pilot study in Illinois. J Am Dent Assoc 1995;126:491–7.
22. Kumamoto D, Maeda Y. Are mouthguards necessary for basketball? CDA J 2005; 33: 463–469. http://www.cda.org/library/cda_member/pubs/journal/jour0605/kumamoto.pdf (accessed 14 Nov 2008).

23. Gardiner DM, Ranalli DN. Attitudinal factors influencing mouthguard utilization. Dent Clin North Am 2000;44: 53–65.
24. National Collegiate Athletic Association (NCAA). Fall sports – football – rules & committees, winter sports – ice hockey – rules & committees. http://www.ncaa.org/wps/portal (accessed 14 Nov 2008).
25. Sane J, Ylipaavalniemi P. Dental trauma in contact team sports. Endod Dent Traumatol 1988;4:164–9.
26. Padilla R, Lee T. Pressure-laminated athletic mouth guard: a step-by-step process. J Calif Dent Assoc 1999;27:200–9.
27. N.Y.S.S.F. National Youth Sports Safety Foundation. Sports dentistry facts: facts from the National Youth Sports Foundation for Safety. http://www.qualitydentistry.com/dental/sdentistry/s-dent.html (accessed 14 Nov 2008).
28. Onyeaso CO. Secondary athletes: a study of mouthguards. J Natl Med Assoc 2004;96:240–5.
29. Diab N, Mourino A. Parenteral attitudes toward mouthguards. Pediatr Dent 1997;19:455–60.
30. Yamada T, Sawaki Y, Tomida S, Tohnai I, Ueda M. Oral injury and mouthguard usage by athletes in Japan. Endod Dent Traumatol 1998;14:84–7.
31. Rodrigues HJG. Standard of knowledge of amateur athletes in Bauru-SP, in relation to oral health care [dissertation]. Bauru: Dentistry' school of Bauru (FOB/USP); 2005.
32. Barberini AF. Assessment of the influence of different types of mouthguard use on physical output of athletes [Dissertation in Portuguese]. São Paulo: São Paulo University; 2003.
33. Regional Council of Dentistry/ SC. Sport dentistry. http://www.odontologia.com.br/ (accessed 14 Nov 2008).
34. Raphael SL, Gregory PJ. Parental awareness of the emergency management of avulsed teeth in children. Aust Dent J 1990;35:130–3.
35. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4 factors related to periodontal ligament healing. Endod Dent Traumatol 1995;11:76–89.
36. Lindskog S, Blomlöf L, Hammarström L. Mitoses and micro-organisms in the periodontal membrane after storage in milk or saliva. Scand J Dent Res 1983;91:465–72.
37. Krasner P, Person P. Preserving avulsed teeth for replantation. J Am Dent Assoc 1992;123:80–8.
38. Melo LL. [Dental alveolar injury: etiology, diagnosis and treatment]. In: Melo LL, Sydney GB, editors. [Traumatic lesions of tooth supporting/abutment tissues]. São Paulo: Artes Médicas; 1998. p. 160–247.
39. Labella R, Smith BW, Sigurdsson A. Effect of mouthguards on dental injuries and concussions in college basketball. Med Sci Sports Exerc 2002;34:41–4.