Oral health behaviors, dental injuries and mouthguard awareness among a sample of Portuguese athletes: a cross sectional study.

Comportamientos de salud bucal, lesiones dentales y conciencia del uso de protectores bucales entre una muestra de atletas portugueses: estudio transversal.

Abstract: Aim: To determine the oral health behaviors, the prevalence of dental injuries, the level of information about first-aid procedures in the case of dental avulsion and the mouthguard awareness in a sample of Portuguese athletes. Materials and Methods: Cross-sectional research among 1,048 athletes from the district of Viseu, Portugal. A self-administered questionnaire included demographic data and questions about: I) oral hygiene habits, II) occurrence of orofacial trauma, III) use of mouthguards and IV) athletes’ knowledge regarding first-aid management in case of dental avulsion was given. The comparison between different variables was made by Chi-square test with level of significant set at p-value ≤0.05. Results: The mean age of the sample (76.24% male) was 18.14±8.17 years. Overall, the results demonstrated a low use of dental floss (25.48%) and a high number of athletes (21.94%) that had not visited a dentist in more than a year. The prevalence of dental trauma was 5.06% and the most common dental injuries experienced by athletes were crown fractures (60.38%). Nearly half of the participants (45.23%) reported not knowing how to act following a dental avulsion. The rate of mouthguard use was very low (9.73%). There was a significant relationship between the prevalence of dental injuries and the use of mouthguards (p=0.000; Cramér’s V=0.145). Conclusion: The prevalence of dental trauma in our population was low. A low number of athletes use a mouthguard and there is a lack of knowledge concerning dental trauma issues. Prevention programs and promoting actions among this population are important and should be adopted.

Keywords: Program evaluation; oral health; health promotion; follow-up studies; preventive health services.

Resumen: Objetivo: Determinar los comportamientos de salud bucal, la prevalencia de lesiones dentales, el nivel de información sobre los procedimientos de primeros auxilios en el caso de la avulsión dental y el conocimiento de los protectores bucales en una muestra de atletas portugueses. Materiales y métodos: estudio transversal de 1048 atletas del distrito de Viseu, Portugal. Se utilizó un cuestionario auto administrado que incluyó datos demográficos y preguntas sobre: I) hábitos de higiene bucal, II) ocurrencia de traumatismos orofaciales, III) uso de protectores bucales y IV) conocimiento de los atletas sobre el manejo de primeros auxilios en caso de avulsión dental. La comparación entre diferentes variables se realizó mediante la prueba de chi-cuadrado con el nivel de significancia establecido en p≤0.05. Resultados: La edad promedio de la muestra (76.24% hombres) fue de 18,14±8,17 años. En general, los resultados demostraron un bajo uso de hilo dental (25,48%) y un alto número de atletas (21,94%) que no habían visitado a un dentista en más de un año. La prevalencia de trauma dental fue de 5,06% y las lesiones dentales más comunes que experimentaron los atletas fueron las fracturas de corona (60,38%). Casi la mitad de los participantes (45,23%) informaron que no sabían cómo actuar después de una avulsión dental. La tasa de uso de protectores bucales fue muy baja (9,73%). Hubo una relación significativa entre la prevalencia de lesiones dentales y el uso de protectores bucales (p=0,000; V de Cramer=0,145). Conclusión: La prevalencia de trauma dental en nuestra población fue baja. Un número bajo de atletas usa un protector bucal y hay una falta de conocimiento sobre temas de trauma dental. Programas de prevención y acciones de promoción entre esta población son importantes y deben ser adoptados.

Palabras Clave: Traumatismos de los dientes; avulsión de diente; protectores bucales; odontología preventiva; Atletas.
INTRODUCTION.

The regular practice of sport is essential for our physical and psychological well-being, with several benefits for general health.\textsuperscript{1,2} Although athletes are very active people with apparent good physical health, there are several studies which reported that the oral health of athletes (elite and professional) is often overlooked with self-reported impacts on their quality of life, training and performance.\textsuperscript{3-6} The athletes’ nutrition and the salivary changes that occur during sports practice, for example, are risk factors for oral health and may have influence the prevalence of dental caries and dental erosion.\textsuperscript{7-12}

In addition, dental injuries (which traditionally have been the primary link between sports and dentistry) are an important risk factor for athletes and have a high prevalence during sports activities, mainly in contact sports.\textsuperscript{13,14} The type of sport, the degree of contact, gender and age of athletes determine the frequency of occurrence of these injuries in sports.\textsuperscript{15} According to the literature, the most common dental injuries during sports are dental fractures, dislocations and avulsions.\textsuperscript{16-18}

When a traumatic dental injury occurs, a correct diagnosis and coordination between all health professionals is essential to make sure the correct treatment option is undertaken to ensure an optimum prognosis.\textsuperscript{19-21} However, a lack of knowledge in dental trauma management has been found among many groups of athletes.\textsuperscript{22}

There are also many studies about the prevention of dental injuries in sports, especially in professional sports, which have been shown to be a factor in optimizing important sports and financial resources, in addition to the impact it can have on the well-being and longevity of the athletes’ careers.\textsuperscript{23-25}

Mouthguards have considered the primary device for minimizing oral injuries during sports and physical activities.\textsuperscript{26,27} However, several studies report a very low compliance rate among athletes.\textsuperscript{16-18,28-30} On the other hand, there are also some authors who report that mouthguards have little or no beneficial role in preventing dental trauma in the sporting arena.\textsuperscript{31,32}

To our knowledge, there are very few studies about dental injuries in Portuguese athletes published in the medical / dental indexed literature.

The aim of this study was to assess the oral health behavior, the prevalence of dental injuries, the level of information about first-aid procedures in the case of dental avulsion and mouthguard awareness in a sample of Portuguese athletes.

MATERIALS AND METHODS.

An observational cross-sectional research study was conducted in a sample of 1048 Portuguese athletes representing 52 sports clubs and 14 sports modalities (Table 1) from the District of Viseu, in the Centre Region of Portugal. The main inclusion criterion was that participants should be older than 12 years old.

Data collection was made by means of a questionnaire, based on other questionnaires used in previous studies\textsuperscript{16-18,28,33,34} that were translated into Portuguese by a certified translator. To assist in the interpretation of the medical terminology used, explanations were added in everyday language (e.g. avulsion = loss of a tooth by a direct impact). In this way we tried to reduce any possible bias due to the use of unfamiliar medical terms. Although other issues could be addressed in the questionnaire, this methodology was chosen in order to be able to compare the results obtained with those published by other authors.

A self-administered questionnaire with close-ended questions was delivered by the authors to the athletes who answered them autonomously.

The questionnaire enquired about:

I) oral hygiene habits,

II) occurrence of orofacial trauma,

III) use of mouthguards and

IV) athletes knowledge regarding first-aid management in case of dental avulsion. Sociodemographic information, like age and gender were also included.

Participants were requested to participate voluntary and those who accepted signed an informed written consent. Informed consent was signed by the parents or tutors of those under 18 years old.

The questionnaire was given to all athletes available during sport training, on a given day previously defined by the sport club, and they were collected immediately after they were completed.

Data was analyzed using the computerized software...
Statistical Package for Social Sciences (SPSS) 23.0 for Windows (SPSS Inc, Chicago, IL, USA). The results of this study were analyzed using descriptive statistics. The level of significance (α) was set at 5% (0.05). For the analysis of the association between qualitative variables, the Chi-squared test was used. The intensity of the relationship between the variables is given by the Cramer's V.

RESULTS.

The sample consisted of 1071 questionnaires. However, only 1048 were considered valid, the other 23 being considered invalid because they were not filled in correctly or because they were not completely filled. The final sample examined consisted of 1048 (76.24% male) athletes which accepted participating in this study.

The mean age of the sample was 18.14±8.17 (range 12-67 years), with a major group between 12-20 years old (79.68%). Concerning oral health behaviors, 61.55% (n=645) of athletes reported that they brush their teeth at least twice a day and only 3.05% (n=32) do not brush their teeth daily. After meals, only 31.87% (n=334) brush their teeth. Only 25.48% (n=267) use dental floss. In addition, 60.97% (n=639) use fluoride toothpaste, however 28.34% (n=297) did not know if their toothpaste contained fluoride.

Most of the respondents (55.16%; n=578) had had a dental appointment within the last six months. Nevertheless, 21.94% (n=230) had not visited a dentist in more than a year and the main reasons for not having a dental appointment more frequently was the fact that they only visit a dentist when pain is felt (60.72%; n=187) or they do not feel that they need a dental appointment (30.19%; n=93).

The majority of the sample (91.98%; n=964) underwent at least five sport training sessions per week and 1.05% (n=11) had more than ten training sessions. About 82.63% (n=866) trained less than 10 hours per week. When asked about for how many years they had participated in sport, 42.65% (n=447) mentioned that they had participated for between 5 and 10 years. However, 23.28% (n=244) had practiced sport for more than 10 years.

The frequency of training sessions per week (>5 training sessions and <5 training sessions) according to the prevalence of dental injuries were analyzed and the variables are significantly related (p=0.001; Cramer’s V=0.118). Also, the number of hours of training and the prevalence of dental injuries were analyzed and statistical differences were determined (p=0.001; Cramer’s V=0.118). The relationship is weak (11.8%), but significant, so the prevalence of dental injuries is higher in athletes who train more than 10 hours per week.

In this study, 91 athletes (8.68%) reported that an oral health problem had already affected their sports training and 80 (7.63%) reported that it had affected a competition event.

There were 478 athletes (45.61%) that suffered body lesions during sports training, like muscle lesions (57.74%; n=276) and bone fractures (24.06%; n=115), for example. There was a significant relationship between gender and body lesions. The incidence of ligament lesions was higher in women (p=0.010; Cramer’s V=0.114) and the incidence of bone fractures was higher in men (p=0.032; Cramer’s V=0.095). Only 11.64% (n=122) have ever had a facial lesion and the majority were soft tissue injuries (77.05%; n=94).

Regarding dental traumas, the prevalence was 5.06% (n=53) and the mean age of those who suffered dental trauma was 20.58±8.01 years. There was a statistical difference between gender and the prevalence of dental injuries, being higher among men (p=0.024; Cramer’s V=0.066). The most common dental injuries experienced by athletes were crown fractures (60.38%; n=32); Avulsions (32.08%; n=17) and lateral luxations (13.21%; n=7) were also noted, and most respondents (73.58%; n=39) reported that this had only happened once.

No statistical differences were found between sports modalities and prevalence of dental injuries; however by descriptive analysis, judo and aikido are the sports with the highest occurrences of dental injuries (13.6% and 10%, respectively). Also, there were no statistical differences between age and prevalence of dental injuries (p=0.169).

After a dental trauma, 37 athletes (69.81%) had a dental appointment, however only 43.24% (n=16) visited a dentist in the same day the trauma occurred.

Two hundred and fifty-one (23.95%) players had observed another player sustaining a dental injury during a game. Only 48.38% (n=507) of all participants were aware of the fact that an avulsed tooth can be replanted. In addition, when questioned about how to act following a dental avulsion, 45.23% (n=474) reported not knowing how to act and 41.60% (n=436) answered incorrectly about procedures
regarding storage medium for avulsed teeth (e.g. wash and disinfect the tooth) (Table 2).

Statistical differences were determined between those who observed a colleague sustaining a dental injury during sport and the knowledge about the possible recovery of a tooth after an avulsion ($p=0.000$; Cramer’s $V=0.118$). There seems to be a tendency for those who have already observed a dental injury in a colleague during sport knowing that there is a possibility of recovering an avulsed tooth.

The rate of mouthguard use among athletes, as shown in Table 3, was very low (9.73%; $n=102$). Only 2.39% ($n=25$) of the sample use a custom-made mouthguard and the others used a boil-and-bite one (6.11%; $n=64$) and stock mouthguards (1.24%; $n=13$). The main reason for not using a mouthguard was the belief that it was not necessary (86.79%; $n=821$). Other reasons like impaired communication (2.75%; $n=26$) and difficulties in breathing (4.76%; $n=45$) were rare.

After removing the sports modalities in which no one uses a mouthguard (BTT biking, aikido, athletics and swimming), statistical differences were determined between sports modalities and mouthguard awareness ($p=0.000$; Cramer’s $V=0.390$). The types of sports where the use of mouthguard is higher are rugby, karate, kenpo and hockey (58.1%, 35.6%, 35.7% and 27.3%, respectively).

Although these figures show a low compliance of mouthguard use, 64.79% ($n=679$) of respondents reported using other type of protection during training sessions, like shin and knee protection devices (41.51%; $n=435$ and 17.27%; $n=181$, respectively).

### Table 1. Distribution of athletes according to sports modalities.

| Sports Modalities    | Frequency | %   |
|----------------------|-----------|-----|
| Football (soccer)    | 375       | 35.78% |
| Futsal               | 149       | 14.22% |
| Handball             | 164       | 15.65% |
| Basketball           | 116       | 11.07% |
| Hockey               | 11        | 1.05%  |
| Rugby                | 31        | 2.96%  |
| Judo                 | 22        | 2.09%  |
| Karate               | 59        | 5.63%  |
| Kenpo                | 14        | 1.34%  |
| Aikido               | 10        | 0.95%  |
| Volleyball           | 36        | 3.44%  |
| Mountain biking      | 17        | 1.62%  |
| Athletics            | 27        | 2.58%  |
| Swimming             | 17        | 1.62%  |
| **Total**            | **1048**  | **100%** |

### Table 2. Athletes knowledge about first-aid measures in a case of dental avulsion.

| What do you do in a case of dental avulsion? | Frequency | %   |
|---------------------------------------------|-----------|-----|
| I do not know how to act                    | 474       | 45.23% |
| Wash and disinfect very well the tooth and go to the dentist | 436 | 41.60% |
| Put the tooth back in its place and go to the dentist | 28 | 2.67% |
| Put the tooth inside the mouth and go to the dentist | 30 | 2.86% |
| Put the tooth inside a glass of milk and go to the dentist | 62 | 5.92% |
| Others                                       | 18        | 1.72%  |
Table 3. Athletes compliance about the use of mouthguards.

| Question                                      | Frequency | %    |
|-----------------------------------------------|-----------|------|
| Do you use a mouthguard during sports training or competition? | Yes       | 102  | 9.73% |
|                                               | No        | 946  | 90.27%|
| What type is your mouthguard?                 | Custom-made | 25   | 2.39% |
|                                               | Boil and bite | 64   | 6.11% |
|                                               | Stock mouthguard | 13   | 1.24% |
| Why do you not use a mouthguard?              | Esthetical reasons | 24   | 2.54% |
|                                               | I think that it is not necessary | 821  | 86.79%|
|                                               | Problems in communication with team mates | 26   | 2.75% |
|                                               | Breathing problems | 45   | 4.76% |
|                                               | Others     | 30   | 3.16% |
| Do you use another type of protection?        | Shoulders | 25   | 2.39% |
|                                               | Head       | 38   | 3.63% |
|                                               | Knees      | 181  | 17.27%|
|                                               | Shins      | 435  | 41.51%|

Table 4. Distribution of athletes according to sports modalities.

| Inferential statistics                                      | p-value | Cramer’s V |
|-------------------------------------------------------------|---------|------------|
| Frequency of training sessions per week versus Prevalence of dental injuries | 0.000   | 0.124      |
| Gender versus Ligament lesions                              | 0.010   | 0.114      |
| Gender versus Bone fractures                                | 0.032   | 0.095      |
| Gender versus Prevalence of dental injuries                  | 0.024   | 0.066      |
| Number of hours of training versus Prevalence of dental injuries | 0.001   | 0.118      |
| Those who observed a colleague sustaining a dental injury during sport versus Prevalence of dental injuries | 0.000   | 0.118      |
| The knowledge about the possible recovery of a tooth after an avulsion |         |            |
| Sports modalities versus Mouthguard awareness                | 0.000   | 0.390      |
| Use of mouthguards versus Prevalence of dental injuries      | 0.000   | 0.145      |

There was also a significant relationship between the prevalence of dental injuries and the use of mouthguards ($p=0.000$; Cramer’s $V=0.145$), meaning that those who have suffered a dental injury tend to use a mouthguard more frequently. For a better understanding, the inferential statistics are presented in Table 4.

**DISCUSSION.**

This study investigated the injury rate amongst athletes of several sporting modalities, with a particular focus on the occurrence of dental injury and the use of mouthguards. This report also analyses the oral health behaviors of athletes and the level of their awareness about tooth replantation. The response to and the interest in the survey were good, allowing the conclusion that the topic of the importance of good oral hygiene habits, mouthguards and prevention of dental injuries definitely interests the athletes.

The sample size may be considered a strength of our research as a high number of athletes were included. Also, this type of research, with a sample with these characteristics, has never been published about a Portuguese population before. As such our data is important for the population characterization in this area.
However, this research has some limitations, mainly focused on the questionnaire’ questions. For example, the questions applied focused on dental trauma, mainly dental avulsions and the use of mouthguards during the practice of physical exercise. No information was gathered on other types of dental trauma, besides dental avulsions, and if the athletes were using mouthguards during an event of dental trauma.

In this study, most of the athletes brushed their teeth at least twice a day. These results are in accordance with other studies amongst athletes.6,7 After meals, the percentage of athletes that brush their teeth was similar to the results founded in a study of Veiga et al.,35 among Portuguese young people, which reported that only 24.1% brush their teeth after dinner and only 10.1% brush after breakfast.

In our sample, the use of dental floss was not common. Also, Bryant et al.,7 reported a low prevalence of dental floss use (13%) in athletes.

With respect to dental appointments, the majority has last visited the dentist less than twelve months ago, similar to other studies.6 Nevertheless, there are some athletes who never visited the dentist or only visited when in pain, which suggest that it is necessary to provide more information and promotion of oral health in these groups.

An oral health problem had already affected sports training and sports competitions of only a few athletes. In contrast, higher values were founded in a study undertaken during the London 2012 Olympic Games,3 which suggested that 18% of athletes declared that their oral health had already had an impact in their trainings and physical performances.

The present work showed that a low number of the sample has already suffered a dental injury during sports activities. Crown fractures were the most common dental injuries experienced by athletes. The rate of dental injury demonstrated in this study is comparable to those reported in sports such as mountain biking (5.7%), squash (4.5%) and inline skating (9.2%).17,18,28

On the other hand, some authors reported higher rates of dental injuries in sports.3,6,16,22,28-30,36-40 For example, Needleman et al.,3 reported an incidence of orofacial injuries of 17.6% during the London 2012 Olympic Games, of which 45.8% were facial lesions and 54.2% were dental injuries. Also, Gay-Escoda et al.,6 determined a prevalence of 23.3% of dental injuries among FC Barcelona football (soccer) players.

Almost all players who suffered a tooth injury reported that the accident happened only once, which was similar to other studies.16,33

Two hundred and fifty-one players had observed another player sustaining a dental injury during a game, just like a study among squash players which reported similar values (20.4%).17 By contrast, the study of Perunski et al.,30 showed higher percentages (30.82%).

Less than half of all participants knew that an avulsed tooth can be replanted. This is a major issue, because athletes should be get help on dental injuries and mouthguards from their coaches, according to the literature.41 This highlights the fact that not all players and coaches are correctly informed.

Several studies referred that better knowledge about the first aid of dental traumas increases the success rate of the teeth involved.42,43 However, there are a higher number of athletes that declared not knowing how to act in a situation of a dental avulsion. Inclusively, most of them answered incorrectly about procedures for storage medium for avulsed teeth (e.g. wash and disinfect the tooth). Only, 11.45% (n=120) responded correctly in the recommended way reported in the literature (human saliva/buccal vestibule or milk).44

It is quite clear that mouthguard use presents a very low rate among athletes. The results of this study are in accordance with similar studies that reported the prevalence of mouthguard use varied between 0.15% to 8.93%,16-18,28-30

However, amongst rugby athletes this prevalence was higher.33 Boil and bite mouthguards were the most common used amongst athletes, while custom-made mouthguards had a very low percentage of usage.

In Portugal, custom-made mouthguards are only available through private dental services. The national health plans do not provide any government funding for dental services and dentists are not integrated in sports medical teams to make mouthguards. So, the fact that only 2.39% (n=25) of the athletes used custom-made mouthguards shows the need of promotion campaigns among Portuguese clubs.
The reasons for not wearing a mouthguard varied and are largely identical to the data reported in other studies, but the most frequent reason was not perceiving any necessity of wearing one. Points of criticism also included impaired communication with team colleagues, difficulties in breathing and disagreeable aesthetics.15

**CONCLUSION.**

Although the prevalence of dental trauma in our population was low, athletes are considered a high-risk group. We also conclude that a significant low number of athletes are using mouthguards and there is a lack of knowledge concerning dental trauma issues.

Prevention programs and promoting actions and specific strategies among this population are important and should be adopted in order to reduce the incidence of orofacial trauma and to increase knowledge about this public health issue.

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**Conflict of interests:** The authors declare no conflict of interest in relation to published results.

**Ethics approval:** All the participants agreed and authorized their participation in this study and signed an informed consent form. Informed consent was signed by the parents or tutors of those under 18 years old.

**Funding:** No funding.

**Authors’ contributions:** LA planned the study, distributed and collected questionnaires and wrote the draft of the publication and is overall responsible for the content as guarantor. DM co-developed the study and helps in the data collection. JF was responsible for the statistical analysis. NV and AC contributed in the design/methodology of this research, and in the edition and correction of this manuscript. PF helped in English language and provided sport dentistry expertise in the interpretation of the data and final manuscript.

**Acknowledgements:** The authors would like to thank the players for taking part in this research. They are also hugely grateful to the teams and especially the staff (coaches and presidents) for their support to conduct this study.
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