








Knowledge and Prevalence of Dental Trauma among Amateur Soccer Players in a Brazilian Subpopulation: A Cross-Sectional Study

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ABSTRACT

Objective: To investigate the knowledge and prevalence of dental trauma among amateur soccer players in a Brazilian subpopulation. **Material and Methods:** The players responded to a 20-item questionnaire on personal characteristics and the prevalence, education, and management of dental injuries between June and August 2023. Five questions with a five-point scoring system evaluated participant knowledge about managing coronal fractures and avulsion. The Mann-Whitney U-test and the Kruskal-Wallis test ($p < 0.05$) compared the subcategories of personal characteristics and education on dental trauma management. **Results:** Two hundred forty-four (244) amateur soccer players participated in the study, with 55 (22.55%) reporting experiences of traumatic dental injury during games and a higher frequency of coronal fractures. The median score for correctly managing coronal fractures and avulsion was 2.0 points. Athletes with health education/occupation showed a higher median value (3.0 points). Only 9.43% of participants use or have used a mouthguard during sports practice. The study identified a 22.55% prevalence of dental trauma among amateur soccer players. **Conclusion:** The knowledge of athletes about managing coronal fractures and avulsion is insufficient and requires improvement.

Keywords: Oral Health; Dentition, Permanent; Sports; Tooth Avulsion; Tooth Fractures.

■ Introduction

Dental trauma is the most frequent dentistry occurrence, with a global and Brazilian mean prevalence in permanent dentition estimated at 15% [1] and 21% [2], respectively, being highly relevant in public health. It affects the deciduous and permanent dentition of patients of different age groups, with higher occurrences in children. Dental trauma may be physical, chemical, or mechanical, affecting teeth and support tissues. Traumatic injuries compromise central and upper lateral incisors more frequently, causing esthetic and functional changes and social and psychological problems to patients, directly interfering with their quality of life [3].

The sports environment promotes several dental trauma cases, thus becoming the topic of numerous research. Agbor et al. [4] stated that sports injuries are the second most frequent accident type after domestic and work accidents. Injury extent will depend on various factors, from an enamel crack to more severe tooth avulsion cases. Protection equipment, such as mouthguards, significantly prevents dentoalveolar injuries by absorbing and dissipating the impact energy, but most sports do not fully promote and accept such equipment [5,6].

Soccer is among the more popular sports in the world and a contact sport with a high prevalence of dentofacial injuries (9.49%), only after rugby (37.36%), basketball (27.26%), handball (24.59%), and field hockey (19.07%). However, soccer presents higher rates of acute and potentially severe injuries [6,7]. The primary causes of dental trauma among soccer players include collisions with other players and/or the ball and falls during training and competitions [8,9]. Oliveira Werlich et al. [6] assessed the prevalence of dentofacial injuries in contact sports players older than 18 years, and dental injury was the most frequent (19.61%).

Although many studies have investigated the prevalence of orofacial injuries in professional soccer players, the literature offers little data on dental trauma prevalence and the level of knowledge about managing dental trauma among amateur soccer players [6]. In Brazil, to date, there are no studies that have evaluated the knowledge of amateur soccer players about dental trauma. A previous study carried out in Kuwait highlighted the need to improve amateur soccer players' knowledge and awareness of the possibility of dental trauma during sports practice [10]. Correctly handling an injury at the time of trauma and immediately after it may promote a better clinical outcome and prognosis. Therefore, the present study investigated the knowledge and prevalence of dental trauma among amateur soccer players in a Brazilian subpopulation.

■ Material and Methods

Study Design and Ethical Clearance

It was a cross-sectional study designed and reported according to the PROBE (Preferred Reporting items for Observational studies in Endodontics) guidelines for observational studies in endodontics [11]. The research project was submitted to a local ethics committee and approved (Opinion Number 6.066.567).

Sampling

The sample size was based on the estimate of amateur soccer players in João Alfredo, PB, Brazil, using the G*Power 3.1.9.6 statistical program. Sample calculation used a 20% effect size, 5% significance level, and 80% beta power, resulting in a minimum sample of 164. The inclusion criteria comprised respondents aged 18 years or older, residing in João Alfredo, and currently playing amateur soccer for at least one year. The study excluded professional athletes and participants unable to adequately respond to the research questionnaire (individuals with intellectual disabilities).

Data Collection

A printed or digital (Google Forms) questionnaire adapted from previous studies evaluated the knowledge about managing dental trauma and its prevalence among amateur soccer players in a rural city in Pernambuco, Brazil [12,13]. The questionnaires were applied between June and August 2023. A study investigator randomly recruited volunteer athletes in person on game days at the five main soccer fields of the city.

The questionnaire included 20 questions distributed into four sections: (1) personal characteristics of players; (2) dental trauma experienced during games; (3) management of coronal fractures and avulsion; (4) education on dental trauma management. The athletes were thoroughly instructed about the meaning of each question before filling out the questionnaire, and they signed an Informed Consent Form with information on study objectives, risks, and benefits. The participants provided the answers through a single restricted access with completely anonymous processing.

Five questions in section 3 evaluated participant knowledge about managing coronal fractures and avulsion, and a five-point scoring system compared the knowledge level among the subcategories of the remaining sections (personal characteristics and education on dental trauma management). A correct answer to each of the five questions scored one point, and an incorrect answer scored zero. Some questions had more than one right answer, but they scored one point regardless of the selected correct response (Table 1). Thus, the participants would receive a maximum of five points.

Table 1. Scoring system regarding the knowledge of amateur soccer players about managing coronal fractures and avulsion.

Question	Answers	Points
Would you look for a tooth fragment in the field if the tooth was partially broken?	Yes	1
	No	0
Do you think that a tooth fragment can be reinstated?	Yes	1
	No	0
Do you think an avulsed tooth can be reimplanted?	Yes	1
	No	0
What would you do if a tooth was permanently avulsed?	Discard/not look for the tooth	0
	Wash the tooth with water	0
	Wrap the tooth in a clean cloth/gauze	0
	Wash the tooth with water and wrap it in a clean cloth/gauze	0
	Preserve the tooth in milk	1
	Preserve the tooth in saline solution	1
	Preserve the tooth in disinfectant	0
	Maintain the tooth in the mouth/saliva	1
What is the most adequate storage for an avulsed tooth?	Water	0
	Milk	1
	Saliva	1
	Isotonic sports drink	0
	Saline solution	1
	Alcohol/disinfectant	0
	None; it is best to maintain the tooth dry	0

Data Analysis

The data were presented as frequencies, percentages, medians, or means \pm standard deviations. Statistical analyses were performed in Jamovi 2.3.28.0 software (<https://www.jamovi.org>) at a 5% significance level. The Shapiro-Wilk test showed a non-normal distribution of scores for the knowledge level about dental

trauma (dependent variable). Hence, The Mann-Whitney U-test and the Kruskal-Wallis test compared the subcategories regarding personal characteristics and education on dental trauma management (independent variables). The Dwass-Steel-Critchlow-Fligner test provided additional multiple comparisons.

■ Results

Two hundred and forty-four amateur soccer players were approached and agreed to participate in the research. All participants filled out the form completely and there was no sample loss. Table 2 presents the personal characteristics of participants. Most players were men (89.8%), showing a mean of 23 years \pm 6.0 (minimum age of 18 years and maximum age of 60 years of age) and played soccer for over ten years (61.5%). Only 36 respondents had health education/occupation, with a higher frequency of physical educators, first responders, and dentists (Figure 1).

Table 2. Personal characteristics of amateur soccer players.

Variables	N	%
Sex		
Male	219	89.8
Female	25	10.2
Age		
18-27 years	192	78.7
28-37 years	43	17.6
38-47 years	7	2.9
>48 years	2	0.8
Time of Soccer Practice		
<5 years	39	16.0
5-10 years	55	22.5
>10 years	150	61.5
Health Education/Occupation		
Yes	36	14.75
No	208	85.25

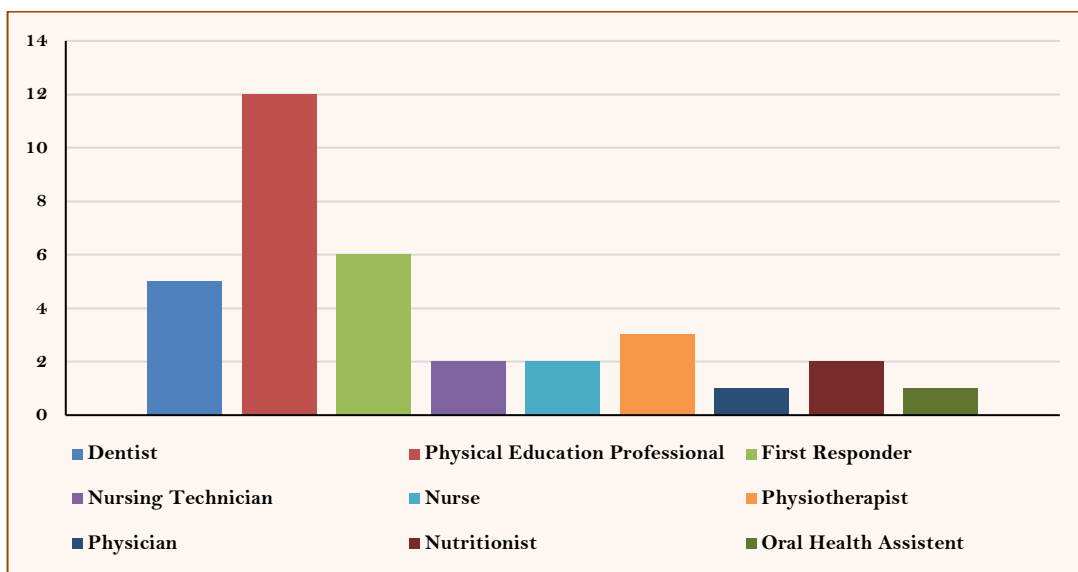


Figure 1. Distribution of the amateur soccer players with health education/occupation by profession.

Regarding the prevalence of dental trauma, 22.55% of players reported experiences of fracture, luxation, or avulsion during games, and 44.27% only witnessed the occurrence of injuries in other players. Fracture was the most frequent dental trauma (Table 3). Only five of the 55 participants who had experienced dental trauma reported using or having used a mouthguard.

Table 3. Prevalence of dental trauma during games.

Variables	N	%
Experienced Trauma		
Fracture	28	11.48
Luxation	22	9.02
Avulsion	5	2.05
Witnessed Trauma		
Fracture	67	27.46
Luxation	27	11.07
Avulsion	14	5.74

Figure 2 shows the percentage of right answers from amateur soccer players to each of the five questions evaluating their knowledge about managing coronal fractures and avulsion. The mean percentage of right answers was 38.85%, considering all questions. Lower rates of right answers referred to the storage of avulsed teeth (14.75% and 29.92%). One hundred forty-one participants (57.79%) believed an avulsed tooth could be reimplanted, and that was the only question with mostly right answers.

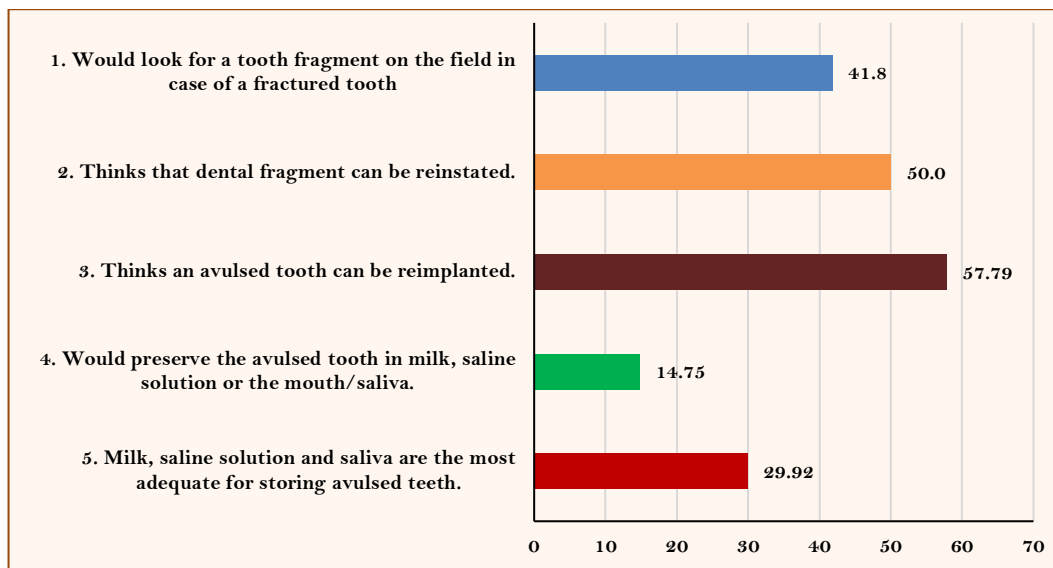


Figure 2. Percentage of right answers from amateur soccer players to the five questions about managing coronal fractures and avulsion.

The median score for correctly managing coronal fractures and avulsion was 2.0 (variation from 1.0 to 3.0) points. Table 4 shows the median scores of right answers distributed according to personal characteristics and education on dental trauma management. The median scores of amateur soccer players with health education/occupation were significantly higher than those without it. Players who were willing to receive training in dental trauma also scored higher than those who were not. Sex, time of soccer practice, and previous training in dental trauma management did not significantly affect the number of right answers.

Table 4. Median scores of amateur soccer players about managing coronal fractures and avulsion distributed according to personal characteristics and education on dental trauma management.

Variables	Score Medians (25%-75%)	p-value
Sex*		
Male	2.0 (1.0-3.0)	0.103
Female	1.0 (0.0-3.0)	
Time of Soccer Practice**		
<5 years	1.0 (1.0-3.0)	0.646
5-10 years	2.0 (1.0-3.0)	
>10 years	2.0 (1.0-3.0)	
Health Education/Occupation*		
Yes	3.0 (1.75-3.0)	0.028
No	2.0 (1.00-3.0)	
Previous Training in Dental Trauma Management*		
Yes	2.0 (1.0-3.0)	0.840
No	2.0 (1.0-3.0)	
Willingness to receive training in dental trauma*		
Yes	2.0 (1.0-3.0)	0.044#
No	2.0 (1.0-3.0)	

*Mann-Whitney test; **Kruskal-Wallis and Dwass-Steel-Critchlow-Fligner tests; #Players who were willing to receive training in dental trauma presented a higher mean \pm standard deviation score (2.08 ± 1.39) than those who were not (1.70 ± 1.26).

Around 90% of participants reported knowing about mouthguards, and 88% think they can effectively prevent dental trauma during soccer games (Table 5). Nonetheless, only 9.43% of players used or had used mouthguards during sports practice. It is worth noting that 13.52% of respondents had been trained in dental trauma management. Table 5 displays the reasons athletes do not use a mouthguard and data on the willingness of participants to receive training in dental trauma management.

Table 5. Answers from players regarding education on dental trauma management.

Questions	N	%
Have you been trained in dental trauma management?		
Yes	33	13.52
No	211	86.48
Do you know what a mouthguard is?		
Yes	220	90.16
No	24	9.84
Do you use or have used a mouthguard during a soccer game?		
Yes	23	9.43
No	221	90.57
In case you do not use a mouthguard, why not?		
Lack of knowledge	49	21.49
Unavailable	43	18.86
Uncomfortable	48	21.05
Unnecessary	46	20.18
Esthetic impairment	5	2.19
Breathing impairment	9	3.95
Communication impairment	9	3.95
High cost	19	8.33
Do you think a mouthguard can efficiently prevent dental trauma during a soccer game?		
Yes	215	88.11
No	29	11.89
Would you like to receive training in dental trauma management?		
Yes	155	63.52
No	89	36.48

■ Discussion

This study investigated the prevalence of traumatic dental injuries in amateur soccer players of a subpopulation in northeastern Brazil, assessing their knowledge level about managing these lesions. The present research showed a 22.55% prevalence of dental trauma among the participants, with around 44.27% only having witnessed accidents with other players, confirming the assumption that traumatic dentofacial injuries are highly prevalent among physical contact sports players. These findings are similar to other physical contact sports, such as CrossFit, rugby, basketball, handball, and field hockey, which show prevalence rates from 27.8% to 30% for dentofacial injuries [6]. However, Qudeimat et al. [10] found only an 11% prevalence of traumatic dental injuries among male amateur soccer players in Kuwait. This difference may be due to the characteristics of the studied population and research methods, mainly because the study included seven- to 18-year-old players enrolled in sports clubs, and injury prevalence was determined by two pediatric dentists who examined the participants looking for oral lesion signs [10]. On the other hand, the method used to assess the prevalence of dental injuries in the present study was based only on data self-reported by the amateur soccer players, and no clinical or radiographic examination was performed to confirm the lesion, which may have overestimated the prevalence rate. Coronal fractures were more frequent in players with previous trauma experience than in those who only witnessed the injuries, corroborating other studies [6,10]. Moreover, athletes with longer sports practice time experienced more traumatic dental injuries.

A critical review by Soares et al. [14] identified intrinsic risk factors for traumatic dental injuries in the Brazilian population, highlighting men as more susceptible to traumatic injuries in permanent dentition than women. The present study found a predominance (96.36% of cases) of male participants affected by dental trauma, confirming the data from the critical review [14]. That may occur because soccer is played mostly by men, as seen in our study, which showed an 89.9% prevalence of male players. Other risk factors mentioned in the review study but not investigated in the present research were occlusal aspects, such as overjet, inadequate lip sealing, anterior open bite, excessive alcohol consumption, and drug use [14]. Fronza et al. [15] highlight sports modality and philosophy, competition rules and levels, accessory equipment, environmental and field conditions, operating regime, and human resources as extrinsic factors associated with orofacial trauma in sports. However, knowing the extrinsic trauma determinant and understanding its relationship with other factors, such as educational and socioeconomic levels, is directly related to the behavior of traumatized patients and is required when formulating prevention strategies against dental trauma [15].

The participants presented a low knowledge level, considering the methodology by van Vliet et al. [13] and using a scoring system from 0.0 to 5.0 regarding the knowledge about managing coronal fractures and avulsion. The median score was 2.0, and the mean percentage of right answers was 38.85% considering all questions. These findings agree with Tewari et al. [16], whose systematic review demonstrated insufficient knowledge of athletes and coaches worldwide regarding the prevention and emergency management of traumatic injuries. Although more than half (57.79%) the participants knew that avulsed teeth could be reimplanted, the knowledge about storing avulsed teeth was very low, with a mean of 22.33% right answers. That is concerning because, even though tooth avulsion represents 0.5% to 16% of all dental injuries, it has the worst prognosis, and immediate reimplanting or adequately storing the teeth is crucial for their survival. Milk, saline solution, or saliva (e.g., after spitting in a cup) are the more correct and accessible types of storage to the population [17]. The low percentage of right answers about storing avulsed teeth may have occurred because 86.48% of participants were not previously trained for managing dental trauma, which is a more specific topic.

Amateur soccer players with health education or occupation and willing to receive training in dental trauma presented significantly higher scores, with medians of 3.0 and 2.0 points, respectively. However, previous training in dental trauma management did not significantly affect the number of right answers. That possibly indicates the low quality of former education, suggesting the need for improving training courses for dental trauma management. Van Vliet et al. [13] described similar findings when investigating the knowledge of field hockey coaches in the Netherlands about the emergency management of dental injuries. Hartmann et al. [18] analyzed 1,414 dentists in Rio Grande do Sul, Brazil, evidencing a deficient quality of previous training even among professionals qualified to handle dental trauma cases. Dentists in this Brazilian state obtained a moderate knowledge level, with an overall mean of 5.87 points from a possible maximum of 12. That emphasizes the relevance of adequate training provided by skilled and experienced professionals and the need for continuous education on the emergency management of dental trauma cases.








Azadini et al. [19] have recently affirmed that the most common dental injury mechanism in sports is the collision between athletes without adequate protection, concluding that mouthguards are highly relevant for prevention, significantly decreasing the likelihood of dental trauma. In this context, most participants in the present research reported knowing about mouthguards and believed they effectively prevent dental trauma during soccer games. Nonetheless, only 9.43% of players used or had used mouthguards during sports practice, reflecting the low use of this equipment among soccer players and the higher susceptibility of these athletes to trauma episodes. Galic et al. [12] found that higher traumatic dental injury rates among water polo, karate, taekwondo, and handball players occurred for athletes who did not use mouthguards. That agrees with our study because five of 55 participants with previous dental trauma stated they used or had used mouthguards during soccer practice. Similarly, de Souza et al. [20] reported that only five of 234 CrossFit practitioners used mouthguards during sports practice, and 27.8% of these athletes had experienced orofacial trauma.

Basic knowledge about prevention methods for sports injuries and immediate care after dental trauma is essential to ensure safe sports practice and favor a long-term treatment prognosis [21,22]. Our study showed that amateur soccer players did not present the required knowledge to handle an emergency dental trauma case. Also, mouthguard use as prevention for traumatic dental injuries showed low adherence from the investigated population. Most players justified not using a mouthguard because they did not know about it, found it uncomfortable, or did not have access to this device in their location. The literature established that mouthguards protect against dental injuries in physical contact sports without harming athlete performance [20,23,24]. That evidences the need for educational programs on dental trauma prevention and emergency conduct for amateur soccer players, promoting a higher quality of life for athletes and adequate first-aid care after trauma episodes. The ToothSOS app developed by the IADT may also represent an effective training tool for improving knowledge about dental trauma in athletes [25].

■ Conclusion

This study identified a 22.55% prevalence of dental trauma in amateur soccer players, with the highest frequency for coronal fractures, reinforcing the assumption that sports are a risk factor for these injuries. Player knowledge about managing coronal fractures and avulsion during sports practice was insufficient, especially regarding adequate storage of avulsed teeth. Athlete training in dental trauma management is required, considering that first-aid care is vital for injury prognosis. Moreover, mouthguard use must be promoted among soccer players to reduce the rates of sports-related accidents.

■ Authors' Contributions

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ALF		https://orcid.org/0000-0001-9084-0131	Conceptualization, Investigation, Writing - Original Draft and Writing - Review and Editing.
ABBGR		https://orcid.org/0000-0001-9069-2386	Conceptualization, Methodology, Formal Analysis and Writing - Review and Editing.
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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.			

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■ Conflict of Interest

The authors declare no conflicts of interest.

■ Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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