

How can the athlete's dental situation influence their sports life? A systematic review

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Abstract

Athletes need excellent health and well-being for successfully participating in sports activities, training and competitions. Due to their lifestyle, athletes are considered high-risk patients for developing dental problems. Sportsmen unsatisfactory oral health has been related to the fall in performance in their training, competitions and to the delay in recovering from muscular injuries. The aim of the present study is define and discuss the articles published about the oral health conditions of athletes and to see how these issues can affect the performance of athletes. A Systematic review was carried out and comprehensive search was performed in the Systematic Electronic Databases: Pubmed, Scopus, Web of Science and Cochrane Library. Were considered dental alterations everything that may interfere with the quality of the athlete's oral health, or that may represent some disturbance in the oral cavity, orofacial and oral lesions. In this systematic review, although the initial search provided over 300 papers, 05 papers eventually corresponded to the thorough analysis of this systematic review. Few are the researches studying specific diseases such as caries, periodontal diseases or erosion in athletes. The impact of oral health on the performance of athletes should be

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always investigated. Poor quality oral health will have an impact negative effect on the athlete's performance.

Keywords: Athletes; Health; Oral cavity; Performance; Sports

INTRODUCTION

Athletes need excellent health and well-being for successfully participating in sports activities, training and competitions (Macdougall et al., 2016; Bryant et al., 2011). Due to their lifestyle, athletes are considered high-risk patients for developing dental problems (Kragt et al., 2019).

Sportsmen unsatisfactory oral health has been related to the fall in performance in their training, competitions and to the delay in recovering from muscular injuries (García González et al., 2015). The findings in the athlete's oral health are related to the high frequency of sugar ingestion. Others include transient breathing in the oral cavity, reduction in the salivary flow due to physical activity and to the smaller saliva buffer capacity (Andrian, Stoleriu, 2019).

Dentists treating high-performance athletes should conduct regular caries risk assessments, identifying their individual risks. It is worth understanding the role of oral health in general health and recognizing oral disease as a hindrance to satisfactory performance (da Silva Teles et al., 2020). An unexpected toothache in healthy elite athletes may lead to their withdrawal from a competition, or compromised performance, independently of the physical conditioning (Sharma et al., 2012). Furthermore, the professional can detect, for example, poor dental occlusion, a characteristic that may hinder the sportsman performance, interfering with chewing and digesting food (Gallagher et al., 2018). As a consequence, there is also loss of the muscle balance, headaches, problems with the temporomandibular joint, discomfort and stress (Souza et al., 2011).

Elite athletes' oral health is unsatisfactory. This is a surprising fact, once oral diseases are preventable in nature, and there is also their potential impact on the sportsmen's health, well-being and performance (Needleman et al., 2013; Needleman et al., 2016; Gay-Escoda et al., 2011). Observing the need to expand and to disseminate knowledge in the area of Sports Dentistry, the aim of this systematic review is to define and discuss the articles published about the oral health conditions of athletes and to see how these issues can affect the performance of athletes.

MATERIALS AND METHODS

The protocol for this systematic review was developed following the PRISMA (www.prismastatement.org) standards and also based on criteria adopted as from recommendations published about the evaluation of the quality of the studies and risk of bias (Higgins et al., 2011). This systematic review was registered in the PROSPERO database (PROSPERO registry number: CRD42017058097)

The present systematic review was conducted so as to respond to the following specific question: How oral health impact athletes lives? The criteria for inclusion for our review were the selection of controlled and randomized studies having oral health and orofacial protection as the major themes of study, dating from 1990 to 2017. The study was limited to reviewing papers about professional athletes, considering high performance and university athletes.

Inclusion criteria outlines according to the population, interventions, comparisons, and outcomes (PICOS)

Population (P): Amateur/elite/professional athletes.

Interventions (I): athletes' oral health.

Comparison (C): high oral health / poor oral health.

Outcome (O): effects of oral health in athletes.

Study design (S): randomized-controlled trials, cross-over clinical trial and controlled clinical trials.

The criteria for exclusion were laboratory studies, reports on cases, review papers, book chapters, theses and letters to readers.

A structured search into the literature was conducted in the electronic databases Pubmed, Scopus, Web of Science and Cochrane Library (Table 1). It comprehended the period between 1990 and 2017. The key words used for the bibliographic research were: 'ORAL HEALTH, ATHLETES, EPIDEMIOLOGY IN SPORTS DENTISTRY'. Were considered dental alterations everything that may interfere with the quality of the athlete's oral health, or that may represent some disturbance in the oral cavity, orofacial and oral lesions. Among the approach terminologies, the following stand out: smoking, alcohol, caries, bleeding gums, pain, poor occlusion, brushing frequency, flossing and visits to the dentists.

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Table 1. Electronic database used and search strategy.

Database	Search strategy
PubMed	Search: (oral health athletes, epidemiology in sports dentistry) Filter article type: (Clinical Study, Clinical Trial, Controlled Clinical Trial and Randomized Controlled Trial)
Scopus	Search: (oral health athletes, epidemiology in sports dentistry) Filter article type: (Clinical Study, Clinical Trial, Controlled Clinical Trial and Randomized Controlled Trial)
Web of Science	Search: (oral health athletes, epidemiology in sports dentistry) Filter article type: (Clinical Study, Clinical Trial, Controlled Clinical Trial and Randomized Controlled Trial)
Cochrane Library	Search: (oral health athletes, epidemiology in sports dentistry) Filter article type: (Clinical Study, Clinical Trial, Controlled Clinical Trial and Randomized Controlled Trial)

The term chosen and the filter used were those yielding the best search results in the pre-test stage. The term was selected by using the MeSH (Medical Subject Headings) (www.nlm.nih.gov/mesh/meshhome.htm~number=plural), which is considered a comprehensive controlled vocabulary for indexing papers from periodicals. The researches were complemented by sorting the references of the papers selected to find any study that had not shown in the database search.

Initially, four of the authors selected the studies by titles and abstracts, in accordance with the search strategy previously described. To evaluate the agreement among the authors, 10% of the publications were randomly selected, were classified by comparison, and next a 0.97 Kappa statistics was determined. Only papers fitting in the criteria for inclusion were accepted. The papers appearing in more than one database were considered once only. In the cases in which the abstract and the title were not clear, the entire paper was read so as to minimize the possibility to disconsider important papers. Later, the full texts of all the studies potentially eligible were accessed and the criteria for inclusion and exclusion were applied again. Any disagreement was discussed and resolved by consensus or by discussing with third parties and with the four authors.

In the cases of oral health of athletes, the documents were assessed according to the type of study design, to whether the aims of the study were clear, if they had been evaluated by at least one item identified as oral health factor, and if the oral health had been evaluated by clinical examination or by a questionnaire filled in by the athlete him/herself. Owing to the anticipated heterogeneity of the studies, the meta-analysis of the data will not be performed.

For the part of the study regarding orofacial protection, the Cochrane Collaboration Tool was employed to evaluate the risk of bias of clinical trials (Higgins et al., 2011). The following domains were evaluated: random

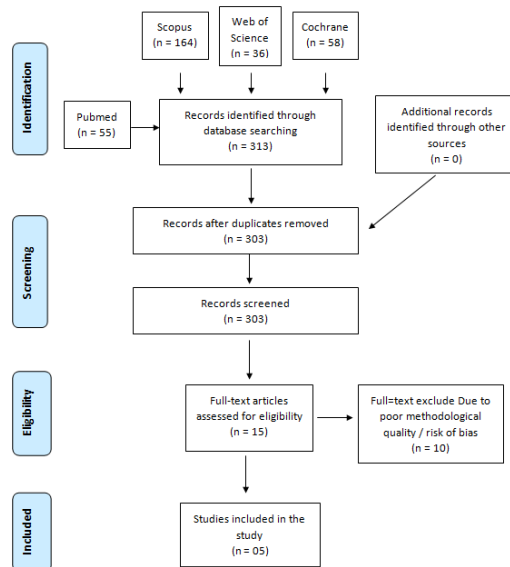
sequence generation, hiding allocation, blinding of participants and professionals, blinding of outcome evaluators, incomplete outcomes, selective outcome reports and other sources of biases. The authors also included as a possible risk of bias studies without the description of criteria for inclusion and exclusion. For the part of the study concerning athlete's health, for their being transversal studies, all the papers with risk of bias were withdrawn. As risk of bias, the following were considered: inadequate methodology, small sample, lack of researchers' calibration, lack of comparison group (control group).

The data extraction was conducted under two viewpoints considered oral health.

RESULTS

313 articles were found, 55 in PubMed, 164 in Scopus, 36 in Web of Science and 58 in Cochrane. 10 duplicate articles were excluded. Then, another 288 articles were excluded due to the initial reading of the titles, because they are reviews and they are not related to the topic. 15 full texts articles were assessed for eligibility. 10 full texts were excluded due to poor methodological quality or risk of bias. At the end, 5 articles were read in full and included in the study (Flowchart 1).

Flowchart 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: Prisma 2009 Flow Diagram. (From: Moher et al., 2009. For more information, visit www.prisma-statement.org).



The data of the studies included under the oral health viewpoint were compiled and organized according to: 1 - Paper First Author, year of Publication; 2 – Study Design; 3 - Participants (total and group); 4 – Age Evaluated; 5 – Diseases / Situations Analyzed; 6 – Result/Prevalence; referred to in Table 2.

Table 2. Summary characteristics of included studies.

Author (year)	Study type	samples (n)	Mean age (SD)	Oral diseases/ considered conditions	Results/Prevalence
Bryant et al., 2011	cross-sectional, self-administered questionnaire	31	24	Do not use dental floss	29%
				Two brushings per day	74%
				Go to the dentist twice a year	61%
				Two brushings per day	74%
	clinical examinations	11	19 - 28	High risk of developing cavities	36,66%
Souza et al., 2011	cross-sectional, clinical examination	84	13 - 20	Malocclusion	
				Class I	89%
				Class II	8%
				Class III	3%
				Anterior open bite	11%
				Crossbite	18%
Gay-Escoda et al., 2011	cross-sectional questionnaire and clinical examinations	30	21	Two or more brushings per day	60%
				Use dental floss or mouthwash	13,4%
				Gingival bleeding	60%
				Angle Class I	60%
				Angle Class II	20%
				Angle Class III	20%
				Malocclusion	30%
				There were dental discomforts during training and / or competition	16,7%
Needleman et al., 2013	cross-sectional questionnaire and clinical examinations	278	16 – 47	Caries	55,1%
				Gingivitis	76%
				Periodontitis	15%
				Pericoronaritis	9,9%
				Consumo Cigarro	5%
				Erosion	44,6%
Needleman et al., 2016	cross-sectional questionnaire and clinical examinations	187	18-39	Toothache	10,2%
				Caries	36,9%
				Irreversible Periodontitis	5%
				Pericoronitis	3,2%
				Erosion	53,1%
				Sensitivity	27,4%

DISCUSSION

The data in this review suggest that athletes do not present good oral health. This is impressive, considering that the most prevalent conditions, that is, dental caries, erosion and periodontal diseases, are preventable (Ashley et al., 2015).

Oral health may affect performance considering the well acknowledged effects of oral health on the quality of life of health. The mechanisms may include pain, effects on feeding, psychological impacts (Júnior, Schlösser, 2019) and inflammatory load on the organism. The effect of poor oral health in athletes along their lives is also unknown, yet it may have considerable impacts, including high need of treatment, loss of teeth, reduction in oral function and psychological effects (Macías, 2018). Interleukin-6 (IL-6) is produced locally in working skeletal muscle and can account for the increase in plasma IL-6 during exercise. The production of IL-6 during exercise is related to the intensity and duration of the exercise, and low muscle glycogen content stimulates the production. Muscle-derived IL-6 is released into the circulation during exercise in high amounts and is likely to work in a hormone-like fashion, exerting an effect on the liver and adipose tissue, thereby contributing to the maintenance of glucose homeostasis during exercise and mediating exercise-induced lipolysis. Muscle-derived IL-6 may also work to inhibit the effects of pro-inflammatory cytokines such as tumour necrosis factor α . The latter cytokine is produced by adipose tissue and inflammatory cells and appears to play a pathogenetic role in insulin resistance and atherogenesis (Pedersen et al., 2001).

In the study by Gay-Escoda et al., 2011, the number of decayed (D), missing (M) and filled (F) teeth (DMFT rate) of professional soccer players was analyzed; they are athletes with thorough health self-care, as compared to dentistry and medical students of the University of Barcelona, a control group, all living in the same geographical area, the same age and aware of the importance of health self-care. They found that the athletes presented more active caries than the control group. Almost two-thirds of the players had some type of poor occlusion, being class III the most frequent, and they could be more exposed to dental trauma, corroborating Lam, 2016. In the study by Souza et al., 2011, 11% of the athletes presented poor occlusion, 29% of the cases being open bite, bilateral or unilateral crossbite – equally on the right and on the left side. These may interfere with breathing, swallowing and with digestion, besides contributing to the occurrence of dental traumas (Moimaz et al., 2020).

One of the first reports regarding Olympic Games was a pilot study conducted with British athletes before the 1968 Games in Mexico City (Hemmersbach, 2008). Cases in which the use of toothpaste was not common,

an average of 3.5 decayed teeth for each British athlete was verified. Later data of elite athletes not related to the Olympic Games also reported poor oral health in elite triathletes and in soccer players (Gay-Escoda et al., 2011). There were high levels of oral disease in elite athletes present in the dental clinic in the 2012 London Games, including dental caries (55% of the athletes), dental erosion (45 % of the athletes) and periodontal diseases (gingivitis: 76% of the athletes; periodontitis: 15 % of the athletes). 18% of the athletes reported to have had their performance affected (Needleman et al., 2013).

The latest study published demonstrates high levels of poor oral health with impacts associated to professional soccer players. About 4 out of 10 players had untreated dental caries. The experience with caries or restorations increased with age: ≥ 1 : 77.9% of young people aged 16-24 and 92% of young people aged 25-34. Dental erosion was present in more than half of the athletes. 7 % reported an impact on their training or performance, being statistically significantly associated to dental caries, toothache, history of swollen third molars/infections and dentin sensitivity (Needleman et al., 2016).

Presenting accurate results with the literature currently available is quite a challenge. In this study, although the initial search provided over 300 papers, 05 papers eventually corresponded to the thorough analysis of this systematic review. Few are the research studying specific diseases such as caries, periodontal diseases or erosion in athletes, for example. Moreover, their numbers are not large enough to be truly representative of athletes, and present questionable methodological quality.

Dental problems play a significant role in sports, albeit underestimated (Ozgur, 2016). Poor oral health has been related to poor performance in training and in competitions (Engebretsen et al., 2013; Ashley et al., 2014; Anton et al., 2020).

The most widely analyzed disease found in the literature is dental erosion. They were found in different clinical, transversal and laboratory studies (Berard et al., 2021). In the other approaches, few studies are observed to exist, and they still approach different aspects at the same time, rather than investigating a specific disease and its related factors; they present a small sample or they lack groups of comparison as regards categories, age or sports modality. An example is studying the prevalence of periodontal diseases in groups of amateur and professional soccer athletes, or both; studying the prevalence of caries in handball athletes aged up to 18, up to 25, or older than 30. The lack of data for comparison groups in studies is another common problem. Without understanding a control group, it is more difficult to verify the parcel in risk of disease.

So as to determine the true extension and gravity of oral diseases in athletes in a wide range of sports and their impact on performance, epidemiologic studies with representative samples are necessary, employing trained examiners and measures with validated results (Timpka et al., 2014).

CONCLUSION

The impact of oral health on the performance of athletes should be always investigated. Poor quality oral health will have an impact negative effect on the athlete's performance.

Potential conflict of interest

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

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