RNO

REVISTA NAVAL DE ODONTOLOGIA

NAVAL DENTAL JOURNAL

MARINHA DO BRASIL

ANO/YEAR 2025 | VOL 52 | N 2

ISSN PRINT 0102-7506 E-ISSN 1983-7550

RNO

NAVAL DENTAL JOURNAL

Year 2025 - Vol 52 N 2

ISSN (Print): 0102-7506
ISSN (Online): 1983-7550

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https://portaldeperiodicos.marinha.mil.br/index.php/odontoclinica
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SUMMARY

RNO
NAVAL DENTAL JOURNAL
Year 2025 - Vol 52 N 2

SUSTAINABILITY IN DENTISTRY: A NECESSARY PATH

Sustainability is no longer merely a global trend but a pressing necessity in all sectors, including dentistry. Since 2015, when the United Nations (UN) established the 17 Sustainable Development Goals (SDGs), healthcare professionals have been encouraged to rethink their practices, pursuing not only clinical excellence but also environmental and social responsibility.

In Dentistry, the pursuit of high-quality care is traditionally guided by Evidence-Based Dentistry (EBD), which values research, training and the active participation of patients in the treatment decision-making process. However, it is increasingly recognized that the efficiency and effectiveness of services can no longer be assessed without considering the environmental impact of our actions and the rational use of natural resources.

Every year, dental offices and clinics generate large amounts of waste, including gloves, masks, suction tips, sterilization packaging, needles, impression materials, as well as chemicals and heavy metals resulting from radiographic processing. Improper disposal of these materials poses risks to soil, water, and public health. In addition, is the high consumption of water and energy, driven by the operation of autoclaves, the need for air-conditioning systems, and high-technology equipment and the use of some high-tech equipment. These factors underscore the urgency of adopting a sustainable approach to Dentistry.

Fortunately, the debate surrounding sustainability in Dentistry has gained momentum. Digital technologies, such as electronic dental records and digital radiography, already contribute to reducing physical waste. Contemporary restorative protocols that prioritize composite resins over amalgam help prevent mercury contamination. Selective waste collection, proper segregation of infectious materials, the use of biodegradable products, and educational programs for professionals and patients are initiatives that should be further expanded and strengthened.

The experience of the Brazilian Navy, particularly that of the Central Navy Dental Clinic (Odontoclínica Central da Marinha, OCM), serves as an inspiring example. The institution has promoted cultural change and the implementation of sustainable practices, aligning dentists and patients with the principles of *Green Dentistry*. Actions such as selective waste collection, encouraging conscious energy use, and reducing disposable materials demonstrate that it is possible to transform dental routines while improving the quality of care provided.

As a Science and Technology Institution (STI), OCM develops research and innovation projects aimed at promoting oral health and preventing diseases among military personnel and other patients. These initiatives seek to improve self-care practices without losing sight of the importance of environmental responsibility. The projects also incorporate the perspective of economic sustainability, focusing on low-cost, reproducible, and accessible solutions that can be adopted on a large scale in public and military services.

The projects developed by the OCM are aligned with the targets established in the United Nations (UN) Sustainable Development Goals (SDGs) for 2030, which involve health, well-being, innovation and responsible consumption. Thus, the institution reaffirms its role in integrating innovative and sustainable practices into Dentistry. This integration contributes not only to the reduction of direct environmental impact, but also to the fostering an institutional culture committed to environmental preservation and efficiency in the use of public resources.

Among the results of these projects are products and devices aimed at oral hygiene and personal protection, designed with biodegradable materials and reuse potential. They are simplified and low-cost versions of devices already proven by use, expanding access and promoting conscious consumption, without compromising the effectiveness and safety of dental care. These actions reinforce the principle of the triple bottom line of sustainability (environmental, social, and economic), demonstrating that innovation and environmental responsibility can progress synergistically.

The OCM also develops AI-based projects focused on diagnostic support and oral health monitoring, with the objective of expanding access in remote areas and optimizing the use of resources. In addition to contributing to the reduction of the burden on the Navy Health System (SSM), the initiative enables the generation of georeferenced and real-time clinical data, facilitating health management more agile, accurate and evidence-based.

The challenge is clear: sustainability must be incorporated as an essential criterion in the evaluation of dental services. More than an ethical obligation, it is a commitment to the future of health and the planet. It is up to each professional, manager and patient to assume their role in this transformation. Only integrated actions—involving innovation, environmental education, responsible resource management and collective engagement—will ensure a truly sustainable Dentistry committed to the future generations.

CF(CD) Teresa Cristina Pereira de Oliveira
Editor in Chief

LETTER TO THE EDITOR

ORAL MANIFESTATIONS IN INFLAMMATORY BOWEL DISEASES: WHAT DENTISTS SHOULD KNOW

MANIFESTAÇÕES ORAIS NAS DOENÇAS INFLAMATÓRIAS INTESTINAIS: O QUE O CIRURGIÃO-DENTISTA DEVE SABER

Danielle Nobre Lopes[1], Noemia Pereira de Oliveira[1], Rafaela Elvira Rozza-de-Menezes[1]

DEAR EDITOR,

Inflammatory bowel diseases (IBDs) are chronic diseases that affect the gastrointestinal system from the mouth to the anal region, mainly consisting of Crohn's disease (CD) and ulcerative colitis (UC) (1). They show alternating periods of remission and activity; their common symptoms include diarrhea, abdominal pain, fever, nausea, vomiting, and weight loss (2).

UC predominantly manifests itself as bloody diarrhea in the colon (between the cecum and the rectum) (3). It causes higher morbidity and mortality than CD, which shows a more heterogeneous and systemic clinical picture, including malaise, anorexia, and fever, and can affect any segment of the digestive tract (4). CD causes transmural inflammation that spans from the mucosa to the serosa. It mainly occurs in the ileum and colon (5). Complications such as intestinal obstructions, perianal fistulas, and abscesses occur more often in CD than in UC, resulting in a greater need for surgical intervention (3,6).

The incidence of IBDs has increased in industrialized countries together with changes in eating habits and lifestyle (7). They occur more prevalently in Western countries, especially in northern Europe and North America (7). They show no predilection for sex, and the onset of their symptoms usually occurs from age 15 to 25 years in CD and from age 25 to 35 years in UC (8). The scarce epidemiological data in Brazil stems from the lack of compulsory notification (9). In a study carried out in São Paulo (2012-2015), Gasparini *et al*. (10) observed a 13.3/100,000 annual incidence (6.14 for CD and 7.16 for UC) and a 52.6/100,000 prevalence. Most patients were women (59.7%) with a mean age of onset of 42.7±16.2 years for CD and 47.9±16.6 years for UC.

The multifactorial etiopathogenesis of IBDs involves immune responses, genetic predisposition, environmental factors, and gut microbiota (11). A central hypothesis proposes an anomalous interaction between the microbiota and local immune responses that cause dysbiosis and activate dysfunctional immune cells, such as macrophages and autoreactive T lymphocytes (12).

In addition to intestinal involvement, IBDs, especially CD, show extraintestinal manifestations that may involve the musculoskeletal system, eyes, skin, oral cavity, and biliary tract, significantly contributing to morbidity and increasing mortality, which varies from 6 to 47% (13,14).

Oral manifestations of inflammatory bowel diseases

The first cases of oral manifestations of IBDs were described in 1969 in two individuals with CD (15). Since then, varying methodologies have found their heterogeneous prevalence (16). This variability also results from the difficulty in distinguishing whether the lesions result from the course of the disease, adverse effects of treatment drugs, or from nutritional deficiencies due to intestinal malabsorption (16).

Oral lesions occur more often in CD than in UC, although some studies have found no significant differences (16-18). They can emerge with intestinal manifestations or precede them in up to 60% of cases (16). In about 30% of them, they persist even during remission, especially in children (16,18). Their histological classification as specific and non-specific follows the presence of granulomas of epithelioid macrophages, lymphocytes,

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How to cite this article: Lopes DN, Oliveira NP, Rozza-de-Menezes. Oral manifestations in inflammatory bowel diseases: what dentists should know. Nav Dent J. 2025;52(2):5-8.

Received: 08/13/2025
Accepted: 09/10/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-C1

and multinucleated giant cells. These poorly defined granulomas have no central caseous necrosis and only occur in CD (17,19).

Specific lesions (less common than non-specific ones) include lip edema, deep linear ulcerations, tissue growth similar to fibrous hyperplasia, linear edema, granulomatous mucosa (cobblestoning), and granular and hyperplastic mucogingivitis with or without ulcerations (1,20). Cobblestoning mainly occurs in the posterior mucosa, showing multiple normochromic and corrugated papules that are grouped into plaques and interfering with speech and swallowing (16). Linear ulcerations show hyperplastic, firm, or firm-elastic borders, mainly occurring in the lower vestibule and the retromolar trigone (16). Lip edema occurs often in CD and may involve one or both lips. It usually causes no pain, firmly resists palpation, and may be associated with vertical fissures (21,22).

Among the non-specific manifestations observed in both diseases, the following stand out: recurrent aphthous stomatitis, angular cheilitis, lichenoid reactions, perioral dermatitis, vegetative pyostomatitis, and periodontal disease (23). Vegetating pyostomatitis, considered the oral counterpart of vegetating pyodermatitis, constitutes a marker of UC activity, which is more common than in CD (1,16,24). Clinically, it presents erythematous, elevated lesions with multiple pustules and superficial erosions, which, when ruptured, cause folds and fissures in a "snail's track" (16,24). The most affected sites refer to the vestibular gingiva, jugal and labial mucosa, hard and soft palates, and the body of the tongue (16).

Individuals with IBDs show an increased periodontal disease prevalence, a risk two-four times higher than in the general population (16). This finding may be related to changes in these patients' oral microbiota and exacerbated inflammatory response (25). In contrast, periodontal disease can influence gut microbiota and compromise epithelial barrier function, contributing to the pathogenesis of IBDs (25). The meta-analysis by Papageorgiou *et al.* (26) has shown a higher risk of severe periodontitis in patients with UC than in those with CD. Patients with UC also have worse oral health indicators, suggesting a unique response to plaque among subgroups (16).

Oral manifestations related to the use of drugs to treat inflammatory bowel diseases

The literature describes oral lesions in patients with IBDs associated with the use of several drugs (1,20). Aminosalicylates such as sulfasalazine and mesalazine may induce adverse reactions in the oral mucosa. Sulfasalazine is related to lichenoid lesions, whereas mesalazine can cause hematological alterations, such as leukopenia, thrombocytopenia, and aplastic anemia, which predispose patients to hemorrhages and oral infections (20,27). In case of lichenoid lesions and taste alterations attributed to these drugs, their replacement is recommended (20).

The prolonged use of corticosteroids (common in severe cases of IBDs) is associated with multiple orofacial adverse effects, resulting from supraphysiologic doses: acne, moon face, petechiae, and ecchymosis due to vascular fragility (28). They also favor opportunistic infections, such as pseudomembranous and atrophic candidiasis.

Thiopurines such as azathioprine also increase the risk of opportunistic infections (candidiasis and herpes simplex virus infections), taste disorders (ageusia, hypogeusia, dysgeusia) and malignant lesions, such as lymphomas, affecting the oral mucosa (20). Methotrexate, a stomatotoxic drug, can induce ulcers and mucositis, the risk of which is proportional to doses, duration of use, advanced age, and drug interactions (29). The absence of folic acid supplementation potentiates these effects by blocking its synthesis by methotrexate (30). As with other immunosuppressive drugs, it also increases patients' predisposition to oral infections (31).

Anti-TNF-α biologic therapies (infliximab, adalimumab) have revolutionized the management of IBDs. However, they have numerous adverse effects, including lichenoid lesions, erythema multiforme, and opportunistic infections (20,30). Erythema multiforme may be associated with herpes simplex virus infections or medication use. On the other hand, Stevens-Johnson syndrome (which is usually triggered by drugs) requires the immediate interruption of treatment and hospitalization, unlike erythema multiforme, which can be controlled on an outpatient basis with systemic and topical corticosteroids (32,33).

The management of oral manifestations depends on the clinical picture as it aims to control pain, heal lesions, and prevent secondary infections. Candidiasis requires topical or systemic antifungal therapy without the need to suspend the underlying medication (20). On the other hand, herpetic ulcers should be treated with acyclovir, and antiviral prophylaxis may be considered in recurrent cases. Pharmacological prescription may be undertaken by the dental surgeon; however, it is essencial that the medical team responsible for the management of IBD

be informed of the therapeutic regimen implemented for the associated oral manifestations (34).

CONCLUSION

Knowledge of the oral alterations of IBDs, which may precede gastrointestinal symptoms, gives dentists a fundamental role in early diagnosis. Moreover, knowledge of the drugs used to treat IBDs and their potential adverse effects on the oral mucosa is essential for appropriate therapeutic approaches. Thus, integrating dental surgeons and gastroenterologists is essential for the effective management of intestinal disease and its oral repercussions.

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

ANATOMICAL LOCALIZATION OF MENTUAL FORAMEN BY DIGITAL PANORAMIC RADIOGRAPHY OF THE FACE IN ADULTS

LOCALIZAÇÃO ANATÔMICA DO FORAME MENTUAL ATRAVÉS DE RADIOGRAFIA PANORÂMICA DIGITAL DE FACE EM ADULTOS

Danielle Cristiny Gonçalves Pereira[1], João Cesar Guimarães Henriques[2], Fabio Franceschini Mitri[3]

ABSTRACT

The mental foramen (MF) is a stable and constant anatomical landmark, located at the level of the root apices of the lower premolars (PMs), through which the mental nerve passes. Its clinical identification by palpation may be challenging; however, it is easily detected in imaging exams. The aim of this study was to identify, through digital panoramic radiographs (DPRs), the bilateral location of the MF in relation to the roots of the PMs. One hundred DPRs of adults were analyzed, and the MF position was bilaterally classified as follows: (I) anterior to the first PM, (II) at the first PM, (III) between the first and second PMs, (IV) at the second PM, and (V) posterior to the second PM. The results showed a higher prevalence in position III (49.5%), followed by positions IV (46.0%), II (2.5%), V (1.5%), and I (0.5%), with a predominance of bilateral symmetry (79.5%). Positions III and IV were also more frequent in mandibles with symmetry (25.3% and 22.8%, respectively) and in those with asymmetry of the foramina (42.9%). We conclude that the clinician's knowledge of the mandibular region between the PMs apices or at the level of the second PM ensures a safer clinical approach, increasing the effectiveness of anesthesia and reducing the risk of injury to the mental nerve. The side of the mandible is not a determining factor for the position of the MF.

Keywords: Mandible; Mental foramen; Location; Panoramic radiography.

RESUMO

O forame mentual (FM) é uma referência anatômica estável e constante, ao nível dos ápices radiculares de pré-molares (PM) inferiores, e nobre pela passagem do nervo mentual. A sua identificação clínica pode ser complexa através da palpação, mas facilmente identificada por meio de exames de imagem. O objetivo desta pesquisa foi identificar através de radiografias panorâmicas digitais (RPDs) a localização bilateral do FM em relação às raízes dos dentes PM. Foram observadas 100 RPDs de adultos e identificada a posição do FM bilateralmente, considerando as posições (I) anterior ao primeiro PM, (II) no primeiro PM, (III) entre primeiro e segundo PMs, (IV) no segundo PM e (V) posterior ao segundo PM. Os resultados revelaram uma maior prevalência na posição III (49,5%), seguida da IV (46,0%), II (2,5%), V (1,5%) e I (0,5%), com prevalência na simetria (79,5%). As posições III e IV também prevaleceram nas mandíbulas com simetria (respectivamente 25,3% e 22,8%) e com assimetria da localização dos forames (42,9%). Concluímos que o conhecimento do cirurgião-dentista sobre a região mandibular entre os ápices dos PMs ou ao nível do segundo PM torna a abordagem clínica segura, aumentando a efetividade de anestesia e diminuindo o risco de injúria ao nervo mentual. O lado da mandíbula não é um fator determinante para a posição do FM.

Palavras-chave: Mandíbula; Forame mentual; Localização; Radiografia panorâmica.

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How to cite this article: Pereira DCG, Henriques JCG, Mitri FF. Anatomical localization of mentual foramen by digital panoramic radiography of the face in adults. Nav Dent J. 2025;52(2):9-16.

Received: 03/31/2025
Accepted: 06/06/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-01

INTRODUCTION

Mental foramen (MF) is a stable anatomical landmark in the mandible for dental anesthesia techniques or invasive and surgical procedures (1,2). However, repeated failures observed in the mental anesthetic block suggest variation in the location of this structure. The MF is a funnel-shaped opening of the mandibular canal on the lateral aspect of the mandible body and, anatomically, it is an eminent reference located in the apical premolar (PM) region, through which a neurovascular bundle containing the mental nerve emerges (3,4).

The MF location is usually described at the level of the apex of the lower PM, but it has also been described between the PMs or variably in the canine or mandibular second molar (5-9). There is evidence that the MF position may vary according to the ethnic group observed, but this is not a consensus in the anatomical literature (10-12). Clinical identification and palpation of MF are difficult because there is no anatomical structure available as a reference to guide us to accurate location (12). Failure to identify MF may result in trauma to the artery, vein, or mental nerve resulting in hematoma or post-anesthetic paresthesia of the lower lip and gingiva.

In dentistry, panoramic radiography is frequently used to provide an excellent overview of the maxillomandibular complex, in addition to being economically feasible and easy to perform and interpret. The image is substantially improved with the use of digital panoramic radiography (DPR) (13-16).

Therefore, this study aimed to identify, using DPRs, the bilateral location of MF in relation to the roots of PM teeth in adults. To this end, this investigation will provide parameters for the localization of MF in individuals, linking clinical practice with scientific evidence, contributing to the didactic teaching in facial anatomy and other clinical disciplines and to professional training, and updating protocols for clinical and surgical procedures in the mental region, aspects that will result in greater comfort and safety for the patient.

MATERIALS AND METHODS

This investigation is a retrospective analysis of the bilateral MF position in 100 DPRs, a number that is also recommended in other investigations, regardless of age and gender (5,16-19). The DPRs of adult individuals (18 to 59 years) were obtained using the Orthopantomograph OP 200 D Instrumentarium Dental at the Dental Hospital of the Faculdade de Odontologia, Universidade Federal de Uberlândia (FOUFU). Thus, considering 100 mandibles in DPRs, 200 MFs were analyzed bilaterally. No vertical analyses were performed.

Five MF positions were considered in relation to the root apex of the mandibular teeth (Figure 1): (I) Anterior to the first lower PM (1PM); (II) At the level of the root apex of the first lower PM (1PM); (III) Between the two lower PMs (1PM and 2PM); (IV) At the level of the second lower PM (2PM); and (V) Posterior to the second lower PM (2PM).

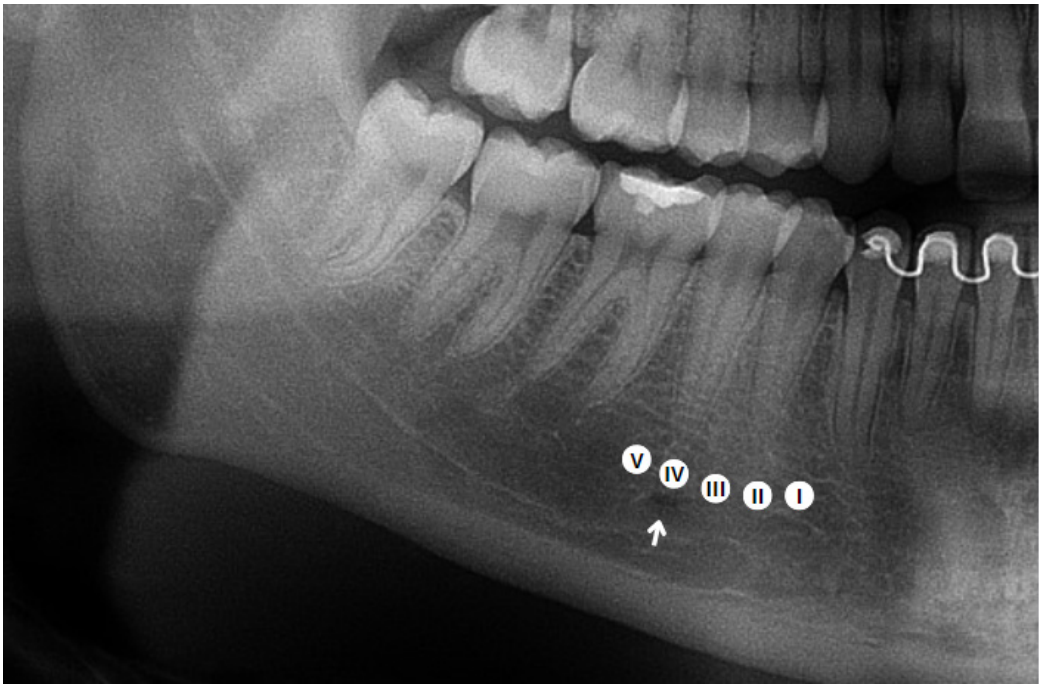

Figure 1 - Digital panoramic radiography showing the body of the mandible with the predetermined positions (I-V) for the location of the mental foramen (arrow).

The observations of the DPRs were conducted by a single observer, a dentist, on a computer screen, under good lighting conditions and in a controlled environment, free of external factors. Only DPRs from the same equipment were considered, as these are high-quality imaging exams, with no restriction on the date of performance. These were exams of dentate patients and, in partially edentulous patients, those with at least the PMs or residual roots present, as they are anatomical references for identifying the position of the MF.

The collected data were analyzed using percentage calculation Microsoft Excel, considering the positions and the side of the mandible. This study was approved by the Research Ethics Committee (REC) of the Federal University of Uberlândia, under registration number 5.544.523.

RESULTS

Table 1 shows the analysis of the total DPRs of the patients according to the distribution by sex and age.

Table 1 - Distribution of patients by age and sex regarding digital panoramic radiographs.

Age group of patients	Male	Female	Total by age group
18-20	1	4	5
21-29	19	32	51
30-39	8	13	21
40-49	3	8	11
50-59	10	2	12
Total of DPRs	**41**	**59**	**100**

DPRs (Digital Panoramic Radiographs).

Table 2 shows the results on MF location, which revealed one MF in position I (0.5%), five in position II (2.5%), 99 in position III (49.5%), 92 in position IV (46.0%), and three in position V (1.5%). All observed mandibles revealed the MFs vertically at the level of the apex of the respective teeth.

Table 3 shows that, considering the MFs on the right side in the total sample, there were two in position II (2.0%), 53 in position III (53.0%), 44 in position IV (44.0%), and one in position V (1.0%). For the MFs on the left side, one was observed in position I (1.0%), three in position II (3.0%), 46 in position III (46.0%), 48 in position IV (48.0%), and two in position V (2.0%).

Of the 100 mandibles radiographically observed, 79 (79.0%) revealed symmetry in the MF positions and 21 (21.0%) revealed asymmetry in the MF positions (Table 4).

Table 5 shows that, considering only the mandibles with symmetry in MF positions on the right and left sides, two were observed in position II (1.3%), 40 in position III (25.3%) (Figure 2), 36 in position IV (22.8%), and one in position V (0.6%) (Figure 3).

Table 2 - Percentage calculation of the position of the 200 mental foramina observed radiographically in 100 mandibles.

Rank	Mental foramen	Percentage
I	1	0.5%
II	5	2.5%
III	99	49.5%
IV	92	46.0%
V	3	1.5%

Table 3 - Position of the mental foramen in the right and left hemi-mandibles.

Rank	RS	LS
I	0 (0.0%)	1 (1.0%)
II	2 (2.0%)	3 (3.0%)
III	53 (53.0%)	46 (46.0%)
IV	44 (44.0%)	48 (48.0%)
V	1 (1.0%)	2 (2.0%)

RS (right side); LS (left side).

Table 4 - Distribution of mandibles with the mental foramina symmetrical and asymmetrical bilaterally.

Mental Foramina RS + LS	Number of Jaws	Percentage
Symmetrical	79	79.0%
Asymmetric	21	21.0%

RS (right side); LS (left side).

Table 5 - Jaws with symmetry in the bilateral position of the mental foramina.

Rank RS + LS	Jaws	Sample percentage (100 jaws)	Percentage in symmetry (79 jaws)
I	0	0.0%	0.0%
II	2	2.0%	1.3%
III	40	40.0%	25.3%
IV	36	36.0%	22.8%
V	1	1.0%	0.6%

RS (right side); LS (left side).

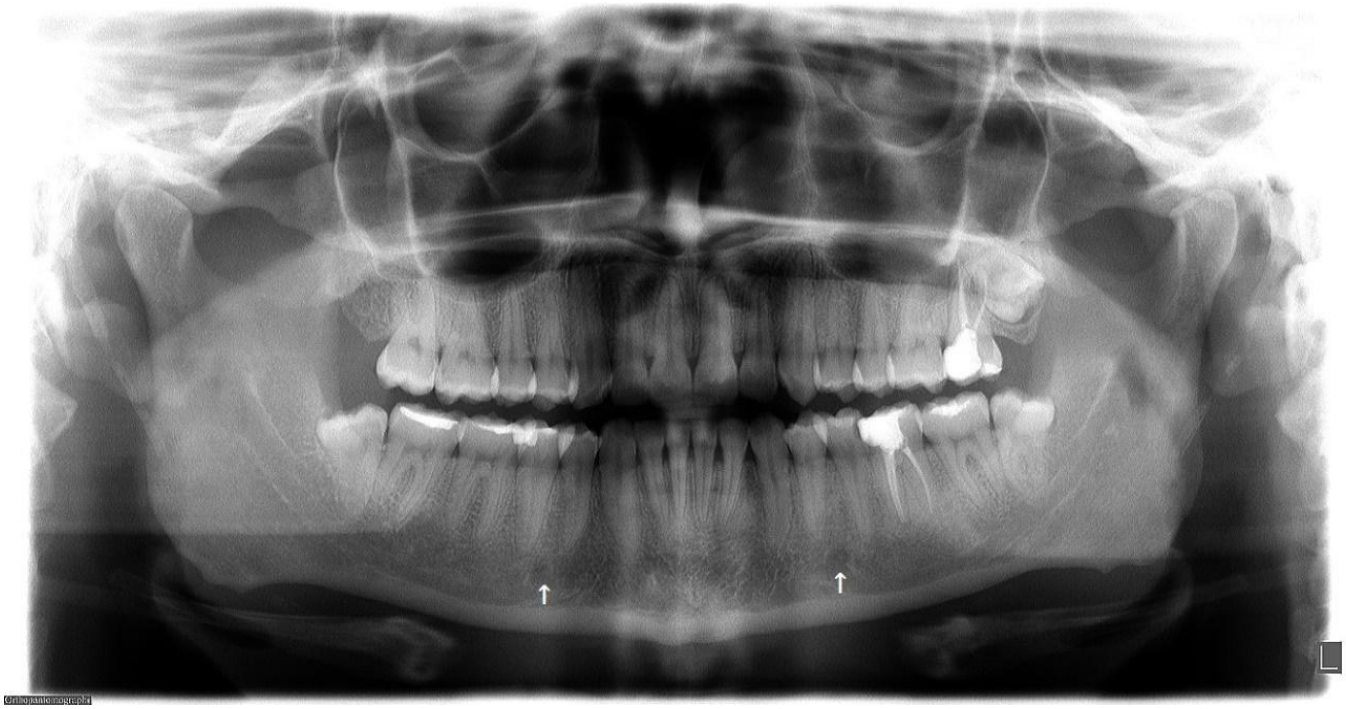

Figure 2 - Digital panoramic radiography showing the most prevalent symmetry of the mental foramen, in position III (arrows).

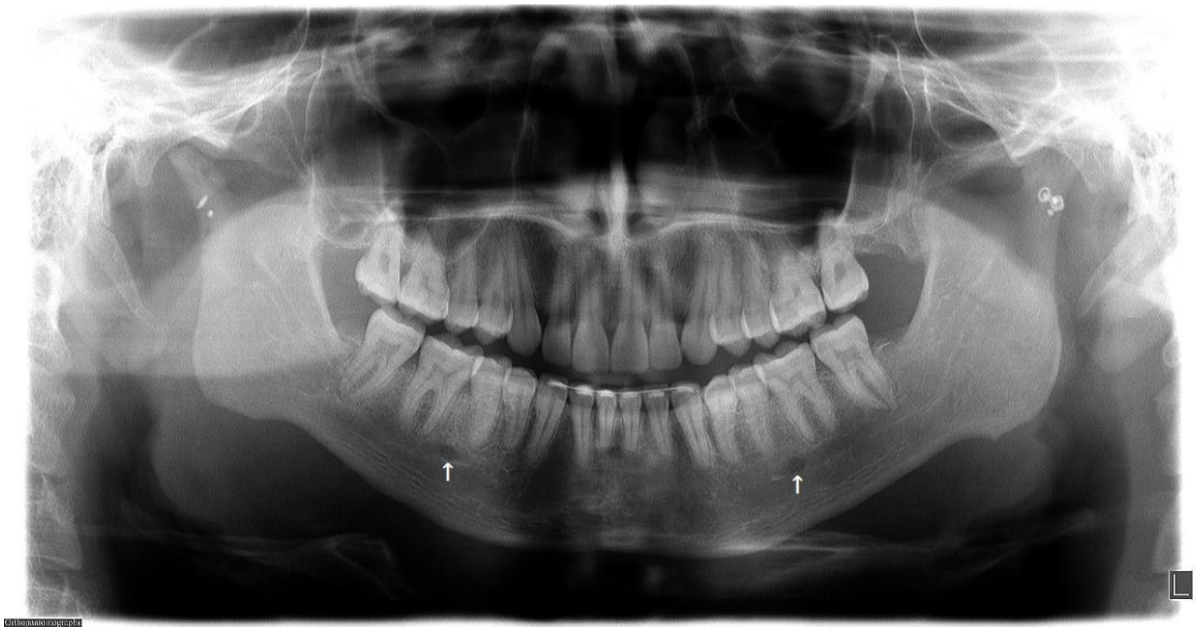

Figure 3 - Digital panoramic radiography showing the less prevalent symmetry of the mental foramen, in position V (arrows).

Table 6 shows that, considering the mandibles with asymmetry in MF positions on the right and left sides, one mandible had the foramina in positions I and IV (2.4%), one had foramina present in positions II and III (2.4%), 18 had foramina present in positions III and IV (42.9%) (Figure 4), and one mandible had foramina in positions IV and V (2.4%) (Figure 5).

Table 6 - Mandibles with asymmetry in the bilateral position of the mental foramina.

Position in the RS	Position in the LS	Jaws	Sample percentage (100 jaws)	Asymmetry percentage (21 jaws)
I	IV	1	1.0%	2.4%
II	III	1	1.0%	2.4%
III	IV	18	18.0%	42.9%
IV	V	1	1.0%	2.4%

RS (right side); LS (left side).

Figure 4 - Digital panoramic radiography showing the most prevalent asymmetry of the mental foramen, in positions III and IV (arrows).

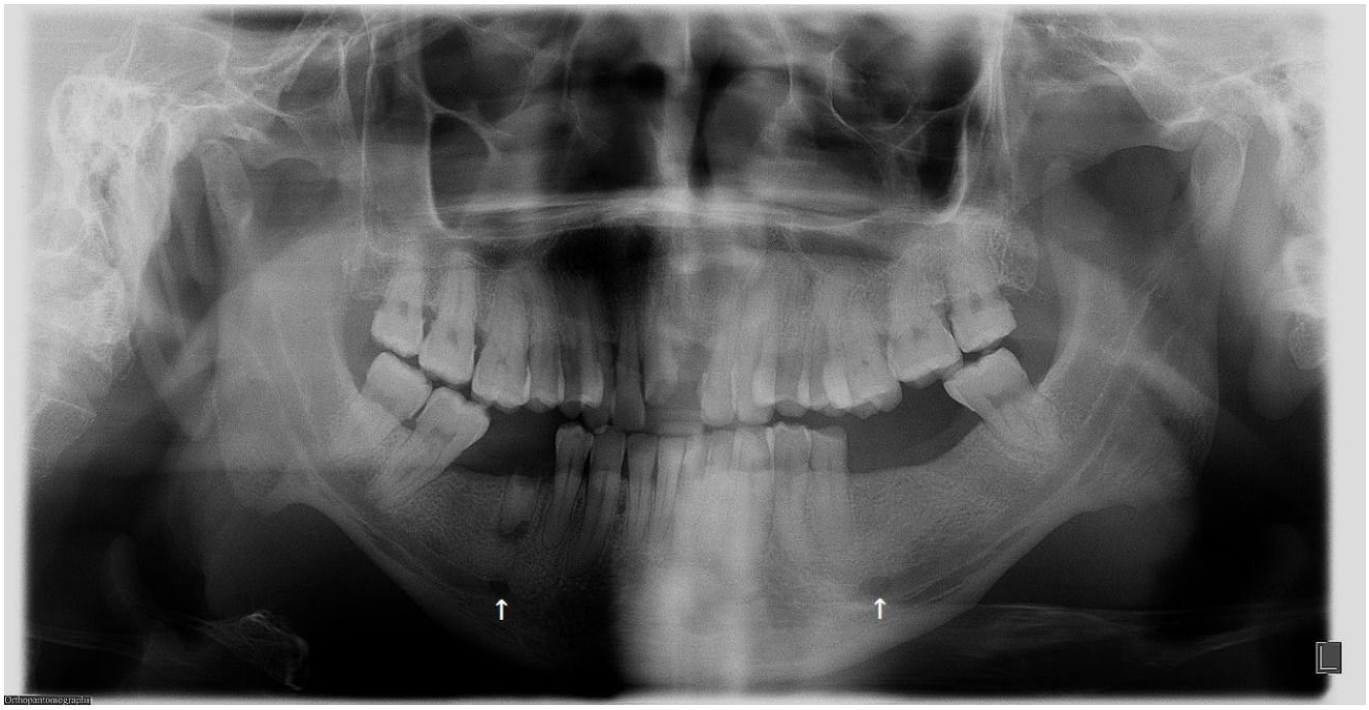

Figure 5 - Digital panoramic radiography showing the less prevalent asymmetry of the mental foramen, in positions IV and V (arrows).

DISCUSSION

DPR observation is a recommended technique for the analysis of MF morphology and position (14,19). The usual position of the MF is well established at the level of the root apices between the first and second PMs teeth; however, studies also affirm the prevalence of MF location at the level of the second lower PM, with a frequency below 50%, with no differences regarding age or sex (5,10,20-22).

The vertical position of the MF in relation to the alveolar crest and the mandibular base seems to vary between men and women (9,23). The MF is the passage site of the mental nerve, which provides sensory innervation of the mucosa and skin of the lower lip and buccal gingiva up to the lower central incisors. Thus, it is an important anatomical milestone for the approach to the nerve in clinical and surgical procedures (3,4). Not so rarely, we come across dental professionals and students with difficulty in locating MF, via palpation. Failures during mental nerve block reinforce these aspects. Thus, we can elucidate that the knowledge of the location pattern of this structure enhances operator's safety and patient comfort during clinical procedures, and its observation in imaging reproduces its anatomical-clinical location accurately.

In 2022, Nimigean *et al*. showed, by means of mandible computed tomography analysis, a high prevalence of about 79.45% of the cases for the MF location below the root apex, in a vertical direction, followed by 19.23% of the cases at the apex level and 1.31% above the root apex (24). The authors also reported a mean vertical diameter of 2.77 mm and a transverse diameter of 3.43 mm (mean diameter of approximately 3.1 mm), with bilateral symmetry, and a mean distance of 12.08 mm from the base of the mandible. Gupta reported this distance at 13 mm in 2008 (5) and Al-Tamimi *et al*., in 2022, reported statistical differences in these measurements between men and women in a population of Iraq (14). Vertical and horizontal measurements in mandible DPR, from MF, were statistically higher in men than in women, in Malays and Chinese, without difference on side or ethnicity (11). The differences in the measurements mentioned above could be explained by the larger overall body height in men. Phillips *et al*., in 1990, revealed a larger MF diameter on the left side of 75 adult mandibles, regardless of gender, age, or race (25). Therefore, MF is located near the root apices of mandibular teeth, with predominantly bilateral symmetry, as revealed by our results, and that age and sex do not determine the location of MF.

Our investigation indicated a higher frequency of MF localization among the PM (49.5%) and at the level of the root apex of the second PM (46.0%), representing almost half of the samples investigated (25). The high occurrence of bilateral symmetry in the MF location was also revealed in our results, with a prevalence of 79.0%, suggesting that the side does not interfere with the position of the

foramen. Other studies have reported similar results, with the prevalence of MF between the apices of the PMs (47.2%) and at the 2PM level (46.0%) with 85% symmetry in an Iranian population; prevalence among PM (43.0%) and at the level of 2PM (39.0%) in an Indian population, with 70.5% symmetry; prevalence of 63.0% among PMs and 20.67% at the 2PM level, with symmetry of 45.7%, in an Asian population; prevalence of MF location among PMs (57.7%), followed by 2PM (33.8%), with symmetry of 64.1% in the Belarusian population; prevalence of MF location among PMs (50.1%), followed by 2PM (45.1%) with symmetry of 83.3% (4,9,10,26,27). One investigation in 134 imaging studies reported a similar distribution of 48.15% of the MF position among the PMs and the 2PM level, corresponding to 96.3% of the sample investigated in the Romanian population, with no statistical difference in relation to age and side (2). An investigation in 100 mandibles revealed a higher prevalence of MF at the level of 2PM (49.4%) with remarkable symmetry; another investigation in 80 heads of cadavers revealed a higher prevalence of MF position at the level of 2PM, corresponding to 51% of the sample, followed by the position among PMs, with a higher prevalence of MF location among PMs in White individuals and after 2PM in Black individuals. Another study cited the highest prevalence of MF at the level of 2PM (67%) in 100 panoramic radiographs, followed by the location among PMs (24%), without symmetry analysis, in an Iranian population (16,17,28). Our research did not consider age, sex, and ethnicity, variables widely discussed in the literature (25), which do not imply the MF location, and the results corroborate most of the reports in literature worldwide, as mentioned above.

Based on our results and investigations, we can verify what most studies have indicated: the safe location of MF occurs primarily among PMs and secondarily at 2PM, with a high rate of symmetry in the mandible, without consideration for age, sex, or ethnicity.

The high symmetry indicates that this aspect is common and provides greater peace of mind for the dental surgeon. Nevertheless, the low asymmetry seems to be only an aspect of anatomical variation. Even in mandibles with asymmetry in the MF location, which represented 21.0% of our samples analyzed, the prevalent positions were III on the right side and IV on the left side, representing 18.0%, followed by positions I and IV, III and IV, IV and V, respectively on the right and left sides, each with 1.0% of occurrence. This situation reveals the low occurrence of MF localization in positions I and V, also observed in symmetrical samples.

This study was conducted with samples from a Brazilian population and it seems coherent to state that age, sex, ethnicity, and side are not factors that determine the MF location, with a higher frequency of MF location similar to those of our results (5,9,28,29,30), that is, between PM apices and at the apex of the second lower PM. Perhaps a broad comparative investigation between the various populations and ethnicities of all continents could clarify a probable hypothesis of interference of this variable in the MF position, which we believe to be very unlikely. No specific anatomical structure seems to determine the position of the MF, however, it is essential to know the most frequent location of the MF to avoid injury to the mental nerve and increase the efficiency of local anesthesia, making other invasive or surgical procedures safe. Our results become directly relevant to didactics and clinical practice.

CONCLUSIONS

The highest frequency of MF position in the mandible was observed between the apices of PM, followed by the apex of the second PM and, rarely, in a position before or after the PM teeth. There was a high prevalence of bilateral symmetry in the MF position, and, in cases of asymmetry, the most frequent localization also occurred between the PM teeth. The DPR proved to be a safe method for analyzing the location of MF, due to its high image quality. Knowledge about the location of MF is essential to prevent iatrogenic injury to the mental nerve and ensure the efficacy of local anesthesia, providing comfort and safety to the patient.

The authors declare no conflict of interest.

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ORIGINAL ARTICLE

ANALYSIS OF THE PREVALENCE AND KNOWLEDGE ABOUT PREVENTIVE MEASURES AND FIRST AID IN CASES OF DENTAL TRAUMA AMONG ATHLETES FROM SANTA MARIA – RS: A CROSS-SECTIONAL STUDY

ANÁLISE DA PREVALÊNCIA E DO CONHECIMENTO SOBRE MEDIDAS PREVENTIVAS E DE PRIMEIROS SOCORROS EM CASOS DE TRAUMATISMOS DENTÁRIOS ENTRE ATLETAS DE SANTA MARIA – RS: ESTUDO TRANSVERSAL

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ABSTRACT

Sports practice promotes well-being and quality of life, providing physical and psychological benefits. However, especially in contact sports, it is associated with the risk of orofacial trauma. This study investigated the prevalence of dental trauma in athletes and assessed their knowledge of preventive measures and first aid in such cases. The research was conducted through the administration of questionnaires to 58 athletes from different sports modalities. Results revealed that 47 athletes (81.03%) had already suffered some type of orofacial or dental trauma. Only 12 participants (20.68%) reported having knowledge about appropriate emergency management, and seven (12.06%) stated that they regularly used a mouthguard. The findings show a high prevalence of trauma and limited knowledge among athletes regarding prevention and emergency management, in addition to low adherence to mouthguard use—even among contact sports participants. In conclusion, educational actions and institutional strategies are needed to promote the use of mouthguards and to train athletes, coaches, and others in the prevention and proper management of dental trauma, thereby strengthening the integration between oral health and sports performance.

Keywords: Mouthguard; Athletes; Dental trauma; Sports; Dentistry.

RESUMO

A prática esportiva promove bem-estar e qualidade de vida, proporcionando benefícios físicos e psicológicos. No entanto, especialmente em esportes de contato, está associada ao risco de traumatismos orofaciais. Este estudo teve como objetivo investigar a prevalência de traumatismos dentários em esportistas e avaliar o conhecimento dos atletas sobre medidas preventivas e de primeiros socorros diante dessas ocorrências. A pesquisa foi realizada por meio da aplicação de questionários a 58 atletas de diferentes modalidades esportivas. Os resultados revelaram que 47 atletas (81,03%) já sofreram algum tipo de traumatismo orofacial ou dentário. Apenas 12 participantes (20,68%) afirmaram ter conhecimento sobre o manejo emergencial adequado, e sete (12,06%) relataram utilizar protetor bucal regularmente. Os achados demonstram uma alta prevalência de traumatismos e um conhecimento limitado por parte dos atletas sobre prevenção e condutas de emergência, além de baixa adesão ao uso de protetores bucais – mesmo entre praticantes de esportes de contato. Conclui-se que são necessárias ações educativas e estratégias institucionais que promovam o uso de protetores bucais e capacitem atletas, treinadores e demais envolvidos quanto à prevenção e ao manejo adequado dos traumatismos dentários, fortalecendo a integração entre saúde bucal e desempenho esportivo.

Palavras-chave: Protetor bucal; Atletas; Trauma dental; Esportes; Odontologia.

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How to cite this article: Warth WS, Guberovich JG, Quadros LA, Knorst JK, Tôrres LHN, Marquezan M. Analysis of the prevalence and knowledge about preventive measures and first aid in cases of dental trauma among athletes from Santa Maria – RS: a cross-sectional study. Nav Dent J. 2025;52(2):17-22.

Received: 06/17/2025
Accepted: 08/06/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-02

INTRODUCTION

Dental trauma, which involves the hard tissues, supporting structures, and soft tissues of the oral cavity, represents between 14% and 39% of the injuries sustained in sports activities (1). Most common traumatic injuries in dentistry vary depending on the dentition, patient age, and circumstances of trauma. In permanent teeth, fractures involving only enamel or enamel and dentin without pulp exposure are the most prevalent, especially in maxillary central incisors (2,3). In deciduous dentition, displacement injuries such as luxations, subluxations, and intrusions occur more frequently due to the lower bone density and greater flexibility of the alveolar bone (3,4). Although less common, tooth avulsion represents one of the most critical injuries and is more frequent in children between 7 and 9 years of age (5). Injuries such as root fractures and crown-root fractures occur less frequently, but require more complex clinical management and have a guarded prognosis (6). The maxillary central incisor is the most frequently affected tooth in practically all types of trauma (2,3).

Dental injuries are frequent in sports activities and can cause damage that directly affects athletes' physical performance (7). They are common in various sports, including boxing, judo, karate, jiu-jitsu, wrestling, sumo, basketball, volleyball, handball, hockey and rugby, due to physical contact, falls, collisions and use of sports equipment (8-10), being more prevalent in men than in women (11).

These injuries can be prevented with the proper use of mouthguards (MGs) (12). MGs are essential devices for protecting teeth and soft tissues of the mouth during sports, especially contact sports. Lack of prevention measures, however, may lead to temporary withdrawal of athletes for treatment, causing harm to both athletes and the club they represent (10). Another relevant aspect is the impact of dental trauma on the daily lives of individuals. Injuries to the central incisors are common in sports activities and can significantly affect the social life of adolescents (13) and worsen their oral health-related quality of life (14).

According to the American Academy of Sports Dentistry, MGs can reduce the risk of dental trauma by up to 80%, making them essential in contact sports practice (15). Some sports modalities with a higher prevalence of dental trauma show greater adherence of athletes to MG use, and their use is mandatory in several combat sports (16). However, according to Ferrari and Medeiros . (2002) (17), many athletes still do not adopt this measure, despite reporting that they understand its importance.

Thus, this study evaluated the prevalence of dental trauma in athletes from different sports who attended the Associated Laboratories Group of the Federal University of Santa Maria (GLASS/UFSM) located at the Center for Physical Education and Sports (RS, Brazil), between 2023 and 2024, as well as their knowledge about preventive and first aid measures in case of dental trauma.

MATERIAL AND METHODS

This is an exploratory cross-sectional study written following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. It used a convenience sample composed of athletes from different modalities, both contact sports (e.g., futsal and American football) and non-direct contact sports (e.g., archery, shot put, and padel) who attended GLASS/UFSM between 2023 and 2024. This study was approved by the Research Ethics Committee of the Federal University of Santa Maria (CAAE 61215622.0.0000.5346). Athletes from individual or team sports who had been practicing for at least six months, with a minimum frequency of once a week, and who sought GLASS for physical evaluation to improve their performance were included.

All athletes were properly informed of the study's objectives and signed the informed consent form (ICF). Subsequently, they answered a questionnaire with questions that investigated the prevalence of orofacial and dental trauma in their sports life, MG use and knowledge of first aid in case of trauma. Based on previous studies by Martins *et al.* (18) and Perunski *et al.* (19), we adapted the questionnaire to sports in general, removing some questions and adding others of interest to this research. Data underwent descriptive analysis (frequency calculation) on Stata 14.0.

After the interview, the athletes received an educational folder (Figure 1) produced by the Tutorial Education Program (PET) of Dentistry at UFSM to benefit them with knowledge after their kind collaboration by answering the survey. This educational material sought to inform athletes about preventive measures and first aid in case of trauma.

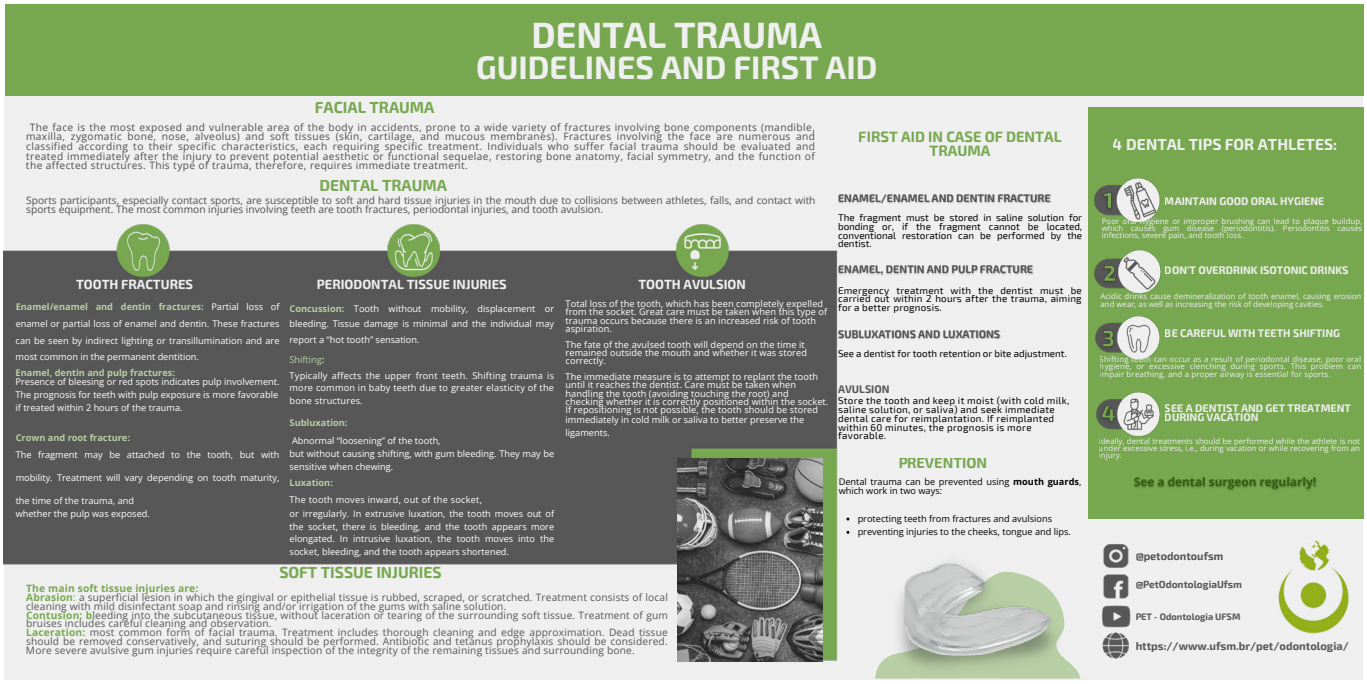

Figure 1 - Guidance and first aid folder for dental injuries in sports that was made available to research participants.

RESULTS

Most participating athletes were male (85%), with ages ranging from 18 to 48 years. They practiced football, padel, basketball, American football, futsal, archery, canoeing, athletics, handball and volleyball. Data were collected from a total of 58 athletes, who could practice more than one sport and therefore answered the questionnaire with more than one option.

Outcome analysis showed that over half of the sample had already suffered orofacial trauma, and approximately one quarter had already experienced dental trauma. Nonetheless, only 20% reported knowing about preventive measures and first aid for dental trauma, and around 12% use MG during sports practice. Table 1 details the results.

Table 1 - Prevalence of trauma, use of mouthguards and preventive knowledge in sports (result expressed in absolute numbers and percentages).

Sport	Number of athletes	Suffered orofacial trauma	Suffered dental trauma	Mouthguard use	Had prior knowledge
Total athletes	58	32 (55.17%)	15 (25.86%)	7 (12.06%)	12 (20.68%)
Football	17	4 (23.53%)	3 (17.64%)	0 (0.00%)	2 (11.76%)
American football	7	2 (28.57%)	0 (0.00%)	7 (100.00%)	3 (42.86%)
Futsal	9	5 (55.56%)	0 (0.00%)	0 (0.00%)	1 (11.11%)
Volleyball	10	3 (30.00%)	4 (40.00%)	0 (0.00%)	1 (10.00%)
Padel	10	2 (20.00%)	4 (40.00%)	0 (0.00%)	0 (0.00%)
Basketball	21	10 (47.62%)	1 (4.76%)	0 (0.00%)	4 (19.05%)
Athletics	13	4 (30.77%)	3 (23.07%)	0 (0.00%)	1 (7.69%)
Other	5	2 (40.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

Others = footvolley, archery, canoeing, flag football, handball, shot put, javelin and discus throw.

DISCUSSION

Results revealed a high prevalence of orofacial and dental trauma among the athletes studied, especially in contact modalities like futsal (55.56%) and basketball (47.62%). According to Levin *et al*. (2003) (20), contact sports presented a higher risk of orofacial injuries due to the frequency of collisions between players.

However, no American football athlete reported dental trauma, a fact that is related to the universal use of MGs among its players. This finding reinforced that MG use is a more determining factor for preventing dental trauma than the type of sport itself. Knapik *et al*. (2007) (21) noted that regular MG use significantly reduced the incidence of orofacial injuries. When analyzing the XV Pan American Games, Andrade *et al*. (2010) (22) observed that sports without mandatory MG use had a higher occurrence of dental trauma, which reinforced the importance of educational and normative strategies for its use.

In our sample, except for American football athletes, no other players used MGs, even in high-risk sports like football, futsal and basketball. This finding revealed a scenario of misinformation and negligence regarding the adoption of preventive measures. Lack of proper guidance could compromise the oral integrity of athletes and result in permanent damage.

Insufficient knowledge by the athletes regarding dental trauma management was also evident. Most participants reported not knowing how to act in emergencies, especially the padel athletes among whom none showed prior knowledge. In American football, where everyone uses MGs, many athletes reported lack of knowledge, which indicated that adherence was due more to imposition than to preventive awareness. These findings suggested gaps in both athletes' training and the support provided by sports organizations, which have the power to establish norms and guide preventive conduct.

Educational campaigns and institutional actions are evidently necessary. Such strategies could help improve knowledge, promote MG use, and prepare those involved on the appropriate conduct in case of trauma. Health education remained a crucial tool in this context. According to Semencio *et al*. (2017) (23), Santinoni *et al*. (2024) (24) and Bergmann *et al*. (2017) (25), athletes' knowledge of dental trauma was still limited but could be significantly expanded with appropriate educational actions. These authors point out that correct guidance could increase the chances of saving avulsed teeth, as long as time and care with storage were respected.

In this regard, Andreasen *et al*. (2003) (26) highlight that dental replantation performed in up to 60 minutes offered a good prognosis, whereas delayed or inadequate tooth storage drastically reduced the chances of success, which could lead to permanent loss. Educational campaigns could therefore raise awareness and improve emergency response during training and competitions.

Another relevant point concerns the direct influence of health professionals in encouraging preventive measures. Eminoğlu *et al*. (27) showed that, although dentists and coaches played a fundamental role in encouraging MG use, many athletes still did not receive adequate guidance. This gap compromised both injury prevention and response.

Sports dentistry played an essential role in preventing, diagnosing, and treating orofacial injuries, especially among children and adolescents. Ramagoni *et al*. (2014) (28) emphasized that this action requires technical and interdisciplinary knowledge, involving coaches, parents, and other health professionals. Additionally, Padilla and Balikov (1993) (29) highlighted that dentists should participate in activities such as pre-season evaluations, preparation of individualized MGs, and emergency care. According to Taimela *et al*. (1990) (30), dental care should consider not only physical injuries but also aesthetic and emotional impacts for athletes.

Karande *et al*. (2012) (31) showed that interventions conducted by dentists could significantly improve emergency response, as seen in actions with school teachers. However, sports dentistry is still not widespread, requiring expansion of its recognition among athletes and health professionals. Lima *et al*. (2019) (32) reinforced the importance of disseminating the specialty, the use of personalized MGs, and the dentist's role in sports teams, contributing directly to athletes' health and performance.

Praes *et al*. (2023) (33) emphasize that continuing education was essential to prepare parents, students, and teachers for preventing and managing dental trauma. Having a dentist in competitions also improved clinical outcomes, optimizing care in emergency situations. Common injuries in impact sports such as dental fractures, soft tissue cuts, and temporomandibular disorders, could be avoided with MG use. However, Ary Neto *et al*. (2024) (34) pointed out that factors like aesthetics, cost, and misinformation make using these devices difficult, reinforcing the importance of professional guidance and the making of personalized models.

Knowledge about emergency management was still limited in many sports contexts, as observed by Tewari *et al*. (2020) (35). Ferrari *et al.* (2024) (17) added

that the dentist needed to know the athlete's profile and their specific demands, acting in an integrated manner to enhance performance and preserve the oral health of both amateur and professional athletes.

This study has as strengths the relevance of the theme and its educational component, as the participating athletes received informative material. As a limitation, the use of convenience sampling stood out, which could restrict the generalization of the results.

Future investigations should use larger and more representative samples and analyze risk factors associated with orofacial trauma, such as time of sports practice, type of training, use of protective equipment, and institutional support offered by sports entities.

CONCLUSION

In conclusion, the sample studied showed a high prevalence of orofacial trauma and a significant number of dental traumas, both associated with low adherence to MG use during sports practice and insufficient knowledge of athletes about dental trauma and first aid measures.

The authors declare no conflict of interest.

ACKNOWLEDGMENTS

The authors thank the National Fund for Education Development (FNDE), of the Brazilian Federal Government, for the financial support through scholarships and funding provided to the PET Dentistry UFSM to conduct this research. They also thank the PET individuals who collaborated in designing the research, writing and recording the project, and collecting data. Finally, they thank the GLASS/UFSM professors and the participating athletes, without whom the research would not be possible.

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LITERATURE REVIEW

ORAL ALTERATIONS IN MILITARY PERSONNEL: A NARRATIVE REVIEW ON MAIN FINDINGS AND IMPLICATIONS FOR ORAL HEALTH AND OPERATIONAL READINESS

ALTERAÇÕES ORAIS EM MILITARES: UMA REVISÃO NARRATIVA SOBRE OS PRINCIPAIS ACHADOS E IMPLICAÇÕES PARA A SAÚDE ORAL E EFICIÊNCIA OPERACIONAL

Letícia Côgo Marques[1], Raquel Machado Andrade-Losso[1], Teresa Cristina Pereira de Oliveira[1], Humberto Jácome-Santos[1]

ABSTRACT

Oral health is fundamental to the well-being and performance of military personnel. Factors inherent to military work activities can affect the integrity of personnel's stomatognathic system. This narrative review examined the literature on the oral alterations in military personnel (especially the Armed Forces) to understand the impacts of these conditions on health and operational performance. An integrative review was conducted through a search in PubMed, SciELO and Google Scholar. Case studies, literature reviews, cross-sectional studies, and clinical trials were selected. The most prevalent oral conditions in military personnel include periodontal diseases, caries, bone and dental trauma, temporomandibular disorders, actinic cheilitis, and oral cancers. These problems directly impact the oral health of military personnel and their readiness for functional performance. Factors such as adverse working conditions, high stress levels, limited access to dental care, excessive sun exposure, irregular eating habits, and lack of time for self-care contribute to the increased prevalence of these conditions. Oral conditions can directly compromise the overall health and operational efficiency of military personnel; therefore, it is essential to implement prevention programs, oral health education, and expanding access to dental care. Results highlight the relevance of investing in technological innovations to meet the needs of military personnel regarding prevention, monitoring, and diagnosis in oral health.

Keywords: Oral health; Oral manifestations; Military health; Military personnel; Prevention.

RESUMO

A saúde oral é fundamental para o bem-estar e o desempenho dos militares. Fatores inerentes às atividades laborais militares podem impactar a higidez do sistema estomatognático. Este estudo propõe uma revisão narrativa da literatura acerca das alterações orais entre os militares, com enfoque nas Forças Armadas, para compreender os impactos dessas condições na saúde e no desempenho operacional. Realizou-se uma revisão integrativa por meio de uma busca nas bases de dados PubMed, SciELO e Google Acadêmico. Foram selecionados estudos de caso, revisões da literatura, estudos transversais e ensaios clínicos. As condições orais mais prevalentes entre os militares foram doenças periodontais, cáries, traumas ósseos e dentários, desordens temporomandibulares, queilite actínica e cânceres orais. Esses problemas impactam diretamente a saúde oral dos militares e sua prontidão para o desempenho funcional. Fatores como condições de trabalho adversas, elevado nível de estresse, acesso limitado a cuidados odontológicos, exposição solar excessiva, alimentação irregular e falta de tempo para autocuidado contribuíram para o aumento da prevalência dessas condições. As condições orais podem comprometer diretamente a saúde geral e a eficiência operacional dos militares. Portanto, a implementação de programas de prevenção, educação em saúde bucal e o aumento do acesso a cuidados odontológicos são fundamentais para aprimorar a prontidão. Com base nos resultados deste estudo, destaca-se ainda a relevância de investir em inovações tecnológicas para atender às necessidades específicas dos militares, no que diz respeito à prevenção, ao monitoramento e ao diagnóstico em saúde bucal.

Palavras-chave: Saúde oral; Manifestações orais; Saúde militar; Militares; Prevenção.

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How to cite this article: Marques LC, Andrade-Losso RM, Oliveira TCP, Jácome-Santos H. Oral alterations in military personal: A narrative review on the prevalence and implications for oral health and operational readiness. Nav Dent J. 2025;52(2):23-36.

Received: 07/02/2025
Accepted: 08/18/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-R1

INTRODUCTION

Oral health is a fundamental aspect of the overall well-being of an individual, directly influencing their quality of life (1). Among military personnel, who are subjected to challenging working conditions, oral health care takes on even greater importance, given the adverse characteristics of the environments in which they operate and the need for good oral health to maintain overall health and better operational performance (2). The stomatognathic system is susceptible to several conditions, which can result in discomfort, pain, and functional limitations. Oral hygiene emerges as one of the main ways to preserve oral health. However, during military operations, this practice becomes a complex task, due to the scarcity of resources and adverse environmental conditions (3,4). The limited access to appropriate health care further aggravates the situation, contributing to dental emergencies being one of the main causes of mission interruptions (5). In addition to individual implications, there are substantial financial and logistical concerns associated with managing dental emergencies during military operations, directly compromising operational efficiency (6). In this regard, the implementation of effective preventive measures becomes crucial not only for the health of military personnel but also for ensuring the sustainability of the military health system.

In this context, the present study proposes a narrative review of the literature on the oral alterations in the military, focusing on the Armed Forces. By examining the prevalence of these conditions and understanding their impacts, it will be possible to identify more effective prevention and management strategies, aiming at the quality of life of service members, the preservation of the operational capability of the military healthcare system, and operational readiness.

MATERIAL AND METHODS

This study is an integrative literature review. The guiding research question of this review was: "Which oral findings are observed in military personnel, and what are their possible impacts on performance, particularly in operational environments?"

An electronic bibliographic search was conducted for scientific articles indexed in the PubMed, SciELO, and Google Scholar databases, using the following descriptors "*oral diseases,*" "*mouth diseases,*" "*oral health,*" *"Temporomandibular Joint Disorders,*" and "*military personnel.*"

No time restrictions were applied in order to obtain the largest possible number of publications, if they met the inclusion criteria. Case studies, literature reviews, cross-sectional studies, and clinical trials were considered eligible. References were exported to the Zotero® bibliographic reference manager (Version 6.0.19), so they could be selected by reading the titles and abstracts according to their relevance to the study theme.

Duplicate publications and those without full-text availability were excluded. The articles found were previously screened by a researcher, by their title and abstract, according to the theme of interest of the study. Three researchers read, discussed, and collected articles, and, after reading the studies in full, the following data were extracted: author, year of publication, country of research, Force (Armed and Auxiliary), type of study, aim, result, and discussion. To broaden the scope of this review and support the discussion, articles on oral findings in the general population were also included, as well as timely information on diseases.

RESULTS AND DISCUSSION

A total of 2,326 articles were identified using the descriptors. After the screening, 34 articles that dealt specifically with the theme remained (Table 1). The most relevant findings identified among the military personnel were: periodontal diseases, caries, bone and dental trauma, Temporomandibular Disorders (TMDs), actinic cheilitis (AC), and oral cancers.

Table 1 - Data on oral disorders in military personnel

Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Ahuja and Darekar (7)	2003	India	Army	Cross-sectional observational study	Assess oral health status and treatment needs.	The study evaluated 1,200 military personnel, with 453 decayed teeth, 183 missing, and 258 filled. The mean of decayed, missing, and filled teeth index was 0.74; The absence of TMDs was found in 1,188, with temporomandibular joint (TMJ) clicking in seven military personnel and reduced mandible mobility in one. Healthy oral mucosa was observed in 1,196 military personnel. Periodontal health varied among the cantonments: A (416 military personnel: 48.8% healthy, 0.96% bleeding on probing, 42.1% calculus, 5.3% shallow pockets and 2.9% deep); B (400 military personnel: 74% healthy, 2% bleeding on probing, 23% calculus, 1% shallow and none deep); C (384 military personnel: 58.9% healthy, 0.8% bleeding on probing, 31% calculus, 7.3% shallow pockets and 2.1% deep). No periodontal treatment was required in 48.8% of cantonment A, 74% of B, and 58.8% of C. Complex periodontal treatment was required in 24% of cantonment A and 38.3% of B. The statistically significant difference reflects that there is a close association between the site and the need for periodontal treatment. Prostheses were required for 10.4% of the participants. Three cases of malocclusion were seen in cantonment A, two in B, and two in C.
Andrade-Losso *et al*. (8)	2024	Brazil	Navy	Retrospective observational study	To evaluate the relationship between QA and Squamous Cell Carcinoma in the Lip (SCCL) with military occupational factor.	The sample consisted of 89 cases of AC and eight cases of SCCL, from 80 military personnel and 17 civilians. Among the military personnel, 83.1% of the cases of AC and 75% of the SCCL were found, and no statistically significant association was observed between occupational exposure and the presence and severity of the disease.
Bornstein *et al*. (9)	2009	Switzerland	Army	Cross-sectional observational study	To assess the prevalence of halitosis via a questionnaire and clinical examination.	A total of 626 recruits aged between 18 and 25 years were evaluated (mean: 20.3 years). The questionnaire revealed that only 17% had halitosis. The organoleptic evaluation identified eight people with grade 3, 148 people with grades 2 and 424 people with grade 1 or 0. Tongue coating was the only influencing factor found that contributed to higher organoleptic scores and higher volatile sulfur compound measurement values.
Cigic *et al*. (10)	2023	Croatia	NE	Cross-sectional observational study	To assess the frequency, symptoms, and types of oral changes.	The study evaluated 102 disabled war personnel, of whom 24.5% reported subjective oral symptoms. Oral mucosal alterations were found in 25 participants, ten of which were potentially malignant oral disorders, two moderate epithelial dysplasias, one carcinoma *in situ,* and one invasive carcinoma.
Covington *et al*. (11)	2003	United States of America	NE	Cross-sectional observational study	To estimate the periodontal health status of a representative military population and compare the results with other studies of varied populations.	A total of 500 military personnel (413 men and 87 women), aged between 18 and 54 years, were evaluated. Men and women had a similar Simplified Periodontal Registry (RPS) prevalence, Blacks and Latinos had a similar prevalence of RPS, and both groups were twice as likely to have early disease as Caucasians. The central sextant of the maxilla was more disease-free; The central mandibular sextant was more frequently calculus; Mucogingival defects were most frequently observed in the maxilla; Posterior sextants and the right maxillary sextant showed greater destruction by periodontal disease.

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Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Deutsch *et al*. (5)	2008	United States of America	Navy	Cross-sectional observational study	To assess dental events in isolated periods of submarine missions.	During patrols, there were 109 initial emergency dental consultations and 45 visits, 48.6% of which were related to endodontic problems or caries. The incidence of all dental problems was 5 per 100,000 people-day at sea. Smoking has been associated with periodontal and general emergencies. The rate of dental emergencies per 100,000 person-days has declined over time. Between 1991 and 1999, dental problems accounted for 6.9-9.3% of all medical submarine evacuations. A survey revealed that, for 101 days submerged, 13.1% reported dental problems, 9.8% canker sores, and 4.1% gum problems.
Diefenderfer *et al*. (12)	2007	United States of America	Navy	Cohort	To analyze the prevalence and severity of periodontal disease and associate it with demographic data.	Dental records of 1,107 military personnel were evaluated. More than 98% of the recruits had periodontal disease, in which most had gingivitis (76%). Over 3.4 years, 91% received at least one oral prophylaxis and more than 60% received two to four. Severe periodontal cases made up to 22 consultations. From baseline to finish, periodontal status improved to 29.2% of individuals, worsened to 31.3%, and remained stable to 39.5%. Maintaining periodontal health requires preventive and periodic therapies from the entrance, adjusted to individual needs.
García *et al*. (13)	2022	Spain	Army	Cross-sectional observational study	To estimate the prevalence and severity of periodontal disease.	A total of 221 military personnel were evaluated. The mean probing depth, recession, and clinical attachment level were 2.17, 0.19, and 2.36 mm. The rates of plaque and gingival bleeding were 71% and 40.3%, with bleeding in all teeth of all individuals after the survey. Only 3.6% of the individuals did not have periodontal pockets, 58.8% had mild pockets, and 37.1% had severe pockets. All patients had some loss of periodontal attachment, 52% mild and 47.5% severe. Regarding the teeth, 86.5% had bleeding and 13.1% did not have; 28% had periodontal pockets and 40.4% had attachment loss. The means of the sextants with periodontal pockets and attachment loss were 2.79 and 3.56.
Wang *et al*. (14)	2020	China	Navy	Cross-sectional observational study	To assess the clinical manifestations and salivary secretion of patients with xerostomia in submariners who participated in a three-month mission.	In a study of 136 submariners, 42 experienced xerostomia after the mission. Among them, 71.4% had a reduction in unstimulated salivary flow, correlated with cheilosis and angular cheilitis. Xerostomia was associated with the working conditions and psychological pressure of submariners.
Hancock e Wirthlin (15)	1977	United States of America	Navy	Cross-sectional observational study	To compare the plaque index.	A total of 98 military personnel were evaluated. The prevalence of periodontal disease was 98%. The relationship between the Navy Periodontal Disease Index (NPDI) and the total scores of the Navy Plate Index (NPI) was determined to be 0.55 ($p<0.01$). The ratio between the NPDI gingival score and the NPI was 0.75 ($p<0.01$). NPI has a better relationship with a reversible index of inflammatory periodontal disease. The use of total NPDI is recommended to guide treatment recommendations.
Joss *et al*. (16)	1992	Switzerland	Army	Cross-sectional observational study	To evaluate oral hygiene and periodontal conditions.	Of the 757 military personnel evaluated, 20.3% had missing teeth, mainly because of orthodontic therapy. The mean Plaque Index (PII) and Groove Bleeding Index (SBI) of the 756 recruits was 0.6, while the mean retention index (RI) was 0.1. The mean Probing Depth (PD) was 2.3 mm, and the mean attachment loss was 0.9 mm. PD and attachment loss on probing were slightly higher in the proximal aspects than in the oral aspects. Only 0.4% of the recruits had a 5≥ mm probing and only 1% had attachment loss ≥4 mm on any surface.

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Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Katz *et al*. (17)	2,000	Israel	All	Cross-sectional observational study	Determine periodontal treatment needs using the Periodontal Treatment Needs Index (CPITN).	A total of 1,300 military personnel aged between 25 and 44 years (mean age 33.8 +/− 5.4) were evaluated. Only 1.19% of the individuals had periodontal health. Deep pouches were more frequent with increasing age and almost three times more common in men (18.7%) than in women (6.2%). Individuals with higher schooling (>12 years) had fewer deep bags and bleeding (p<0.05).
Khalilazar & Khoshdel (18)	2016	Iran	All	Cross-sectional observational study	To assess the oral health profile of Iranian military personnel.	A total of 420 male military personnel were evaluated, with a mean age of 34.7 (± 8.16) years. CPOD: index of permanent teeth that were decayed, missing and filled. Only 3.3% were caries-free, and 21.9% had root caries. The mean number of existing teeth was 25.4 (± 3.26). Of the 11,760 teeth examined, 9.7% had caries. The mean healthy sextant per person was 2.6%, while 45.5% of the sextants were calculated, with periodontal index 3 in 49.6% of the individuals. The Navy had greater oral health problems compared to other forces (91.7% had calculus in at least one sextant and periodontal pockets in more than 40.4%). There was an association between cardiovascular diseases and Decayed, Missing, and Filled Teeth (DMFT) (p=0.014).
Kelbauskiene *et al*. (19)	2006	Lithuania	NE	Cross-sectional observational study	To assess the state of the oral cavity of military personnel, the level of dental care, and predict possible oral problems during the mission period.	A total of 50 soldiers were evaluated on a military mission, with an average age of 24.5 (6.5) years. Procedures with single crowns and bridges were performed in 18%, and endodontic treatment in 56%. Radiological examinations revealed 67.3% of the root canals incompletely filled, with apical alterations in 80.6% of these cases, compared to 19.4% in the filled teeth (p<0.001). Dental problems have also been associated with incorrect position of third molars and complications in the eruption of these teeth.
Laband e Bumsted (20)	1955	United States of America	Army	Cross-sectional observational study	To assess Potentially Malignant Oral Disorders (PMOD).	A total of 996 military personnel who were returning from the Korean War and 1,170 from other assignments were evaluated. Hyperkeratotic lip lesions were found in ten men. All ten men had fair skin and blond or red hair, returned from the Korean War, and worked outdoors. Five of these lesions were potentially malignant oral disorders (PMOD) and five had focal keratosis. Dentists should be alert to the possibility of malignant lesions and PMOD on the lips in young men (20 to 30 years), especially leukoderma.
Lew *et al*. (21)	2010	United States of America	All	Retrospective observational study	To characterize and describe the Craniomaxillofacial (CMF) injuries suffered on the battlefield.	Common midface fractures (CMF) injuries were found in 2,014 of the 7,770 military personnel (mean of 2.4 per soldier), with an incidence of 72% in the Army, 26% in the Navy, and 1% in the Air Force. Penetrating soft tissue injuries accounted for 58% and fractures 27%, 76% of which were exposed. The most frequent facial fractures occurred in the mandible (36%), followed by the maxilla/zygoma (19%), the nasal bone (14%) and the orbit (11%), in addition to the unspecified ones (20%). The main mechanism of injury involved explosive devices (84%). Over six years, 26% suffered injuries in the CMF region.
Marker *et al*. (22)	1997	Denmark	Army	Cross-sectional observational study	To assess oral diseases and the need for treatment.	The sample consisted of 223 men (63% enlisted men, 28% non-commissioned officers and 9% officers), 80% of whom were under 28 years. Among those over 27 years of age, 29% have not seen a dentist in the last three years. Subjective symptoms affected 19% of the participants, with a mean of 29.5 teeth per person and absence of removable prosthesis. Only five people had healthy teeth. Officers had almost twice as many untreated cavities compared to enlisted men. Of the total, 48% needed treatment, two of which were extensive and 105 periodontal care, with an estimated time of 185 hours for care.

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Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Melo *et al*. (23)	2016	Brazil	Air force	Cross-sectional observational study	To verify the association between dental condition and the presence of TMD.	A total of 38 military instrumentalist musicians were evaluated. Most of them had TMDs (86.8%). Tooth absence was present in 78.9% of the cases, tooth wear in 23.7%, caries in 21.1%, and crowding in 13.2%. Despite the high percentage of dental alterations, it was not possible to identify the existence of a relationship between dental condition and the presence of TMDs.
Morgan *et al*. (24)	1992	Australia	Navy	Cross-sectional observational study	To assess tooth decay.	A total of 1,100 recruits were evaluated. The mean DMFT index was 4.3 for individuals aged 15 to 19 years; 6.9 from 20 to 24 years; and 8.9 from 25 to 29 years. Comparison with previous military studies indicated decreased experience of tooth decay and tooth restorations rather than extraction.
Norozy *et al*. (25)	2020	Iran	NE	Retrospective cross-sectional study	To assess the prevalence, pattern, treatment, and complications of lesions in the soft and hard tissues of the face.	Data from 591 patients were analyzed. Among maxillofacial fractures, fractures of the middle third of the face were the most prevalent (49%), followed by fractures of the lower third (43%) and upper third (24%). The most common cause of injuries was explosives (58%). The most frequent fracture site in the mandible was the angle region, followed by the mandibular body and the condyle. Nasal fractures were observed in 44% of the fractures of the middle third of the face. The most used technique for treatment was open reduction with internal fixation, which was used in 89% of the patients.
Prokhvatilov *et al*. (26)	2006	Russia	All	Cross-sectional observational study	To assess the incidence of oral diseases.	A total of 1,030 reserve officers were evaluated. The high incidence of diseases was evidenced by the high rates, with 100% of dental caries (intensity 14.15 +/− 0.22), 92.8% of periodontal diseases (17.6% gingivitis, 12.9% mild and moderate periodontitis, and 62.3% severe), 0.5% of oral mucosal lesions, 32.1% of non-carious dental lesions. The need for prostheses was identified in 40.2% of the retirees and oral prophylaxis in 55.7%.
Sandoval e Puy (27)	2008	Spain	Army	Cross-sectional observational study	Assess periodontal disease, treatment needs, and length of care.	A total of 387 military personnel (302 men and 85 women) were evaluated, with a mean age of 39 years (7.3). Periodontal health was present in 7.2% of the sample. Calculations predominated among young people. Periodontal pockets were exclusive to individuals over 25 years, with 7.8% of 4-5 mm and 2.3% of 6 mm or more. Women under 25 years had better periodontal health than men. The mean number of healthy sextants was 2.4, with no differences by classification. Soldiers had more sextants with bleeding, while officers and non-commissioned officers had more sextants with bags. Almost all required oral hygiene and scaling guidance, and 2.3% more complex treatments, all over 25 years. The estimated annual treatment time was one hour per person.
Schlagenhauf *et al*. (28)	2020	Germany	Navy	Cross-sectional observational study	To assess whether regular consumption of probiotics can improve periodontal health during missions at sea.	Overall, 72 military personnel were evaluated. There were no significant differences between the groups at the beginning of the study. On days 14 and 42, the scores of the test group of all parameters assessed improved significantly ($p<0.001$) compared with basal value and the control group, which, nonetheless, showed a significant deterioration ($p<0.001$) of all parameters at the end of the study. The consumption of probiotic lozenges can be an alternative to improve and maintain periodontal health in situations with decreased effectiveness of oral hygiene.

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Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Senna *et al*. (29)	2005	Italy	NE	Cross-sectional observational study	To assess the DMFT and CPITN and relate them to socioeconomic data.	The sample was composed of two groups from different Italian academies: A total of 1,184 male soldiers aged between 19 and 25 years; and 2,477 cadets aged between 19 and 25 years. The mean DMFT value was 3.7 +/− 3.31. The military personnel had a higher DMFT index, and the D value was higher in the less educated individuals. Bleeding during the survey did not vary among soldiers and cadets drafted or among socioeconomic subgroups.
Singh *et al*. (30)	2015	India	Military police	Cross-sectional observational study	To assess the frequency of vicious habits (alcohol and tobacco) and their association with the frequency of oral mucosal lesions and periodontal diseases.	A total of 781 individuals with a mean age of 40.6 ± 9.9 years were evaluated. Tobacco use was found in 55% and only 1.3% of the individuals consumed alcohol. The prevalence of oral mucosal lesions and periodontal diseases was significantly higher among tobacco users.
Škec *et al*. (31)	2006	Croatia	Army	Cross-sectional observational study	To check the oral health condition and whether it reduces the number of dental emergencies and absences from training and the battlefield, in addition to improving the safety of the entire training.	Among the 912 soldiers evaluated (650 recruits and 262 soldiers) oral health was considered poor. Caries was the most prevalent, with a mean of 5.9 decayed teeth per recruit and 2.7 per soldier. Only 1.5% had completely healthy teeth. One third did not show bleeding on the sounding. Acute odontogenic pain was present in 23.5% of the examinees. The absence of oral health compromises the readiness of soldiers, making most of them unfit for six-month peacekeeping missions, due to the reduction of their combat capacity.
Sonoda *et al*. (32)	2022	Japan	Navy	Cross-sectional observational study	To verify the contribution of each oral disease to the perception of dental problems.	Of the 22,441 individuals analyzed, 22.7% reported dental problems in the last 12 months. Multiple logistic regression showed that those who had decayed teeth were more likely to have dental problems than those who did not have dental caries. People whose periodontal disease was found to be more severe on a dental exam had a higher score for perceiving dental problems (33).
Stoetzer *et al*. (33)	2014	Germany	NE	Case report	To report a case of toothache on mission.	A 20-year-old soldier with a toothache. Computed tomography revealed the presence of hyperdontia and tooth retention. Despite the variability among dentists in the attribution of dental fitness, future options and needs for treatments of unerupted and retained teeth should be considered.
Suman *et al*. (4)	2008	Croatia	Army	Cross-sectional observational study	To check whether war conditions and the length of time spent on the battlefields, stress, altered diet, and oral hygiene habits, as well as the battlefield environment had an impact on oral health.	The study was conducted with 640 soldiers between the ages of 19 and 49. Military personnel in the war group had worse oral health compared to control cases, with a higher DMFT rate: 14.4 war group and 13.1 control; $p<0.001$, more periodontal pockets and compromised sextants and fewer healthy sextants.(1.3 war group and 2.1 control; $p<0.001$). Significant differences were observed in the frequency of visits to the dentist, daily brushing, and diet. Oral health deteriorated with increasing time on battlefields, indicating that wartime conditions aggravate the prevalence and severity of oral diseases in soldiers.
Wennström *et al*. (34)	1981	Sweden	Air force	Cross-sectional observational study	To clinically and radiographically evaluate periodontal conditions in flight crew.	A total of 70 women, aged from 20 to 54, were evaluated. The periodontal conditions of both groups of study participants were better than those of the average Swedish population but did not reveal major differences between flight crew and control cases.

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Author	Year	Country	Forces	Type of study	Aim	Results and conclusions
Zadik and Levin (35)	2009	Israel	All	Cross-sectional observational study	To evaluate the incidence and etiology of orofacial lesions.	A total of 311 male skydivers were evaluated, with a mean age of 21.1 years. Orofacial lesions were found in 28% of cases, with an incidence rate of 129.6 cases per 1,000 years of combat. Extraoral lacerations (lip, chin, cheek/facial muscles) were the most common injuries. Dental injuries were reported by 48 of the participants, among whom 44 suffered dental fractures and four subluxation/dislocation. A total of 37 participants (42.5%) reported post-event disturbances and 10 (11.5%) reported loss of operational activities because of the event (mean 8.6 +/− four days of loss).
Zajc *et al*. (36)	2011	Croatia	Army	Cross-sectional observational study	To assess use of tobacco as a risk factor in the development of periodontal diseases such as dental urgency and readiness.	A total of 884 military personnel (650 recruits and 234 veterans) were evaluated. Smoking was reported by 62.7% of the soldiers, being more prevalent among recruits (63.8%) than among veterans (59.4%), although veterans had higher consumption and duration of the habit. Smokers demonstrated poorer dental readiness and a higher occurrence of supragingival calculus/subgingival calculus, gingivitis. In both groups, smokers had more periodontal problems and less readiness to combat it, highlighting the need for oral health prevention and smoking cessation programs.
Zhao *et al*. (37)	2015	NE	Navy	Cross-sectional observational study	To investigate the prevalence of periodontal diseases during prolonged travel.	In a study with 186 military personnel, it was found that the prevalence of periodontal diseases increased from 59.7% to 83.3% after navigation, with a significant worsening in the degree of the disease ($p<0.01$). Factors such as prolonged navigation, dietary restrictions, and poor oral hygiene negatively influence periodontal health. Oral hygiene education, proper brushing, a balanced diet, and periodontal treatment are essential during extended travel.

NE: Not specified.

Periodontal diseases

The analysis of studies in military personnel indicates that periodontal diseases are the most prevalent oral conditions in this population (4,7,12,13,15-17,27-29,34,36,37) and represent a significant concern, accounting for approximately 10% of oral emergencies during military deployments and maneuvers (27). Reported prevalence rates range from 51.2% to 100% across different study populations (7,12,13,15,17,27,29). This variation may be related to differences in socioeconomic contexts, lifestyle habits, oral hygiene, and combat environment. However, this prevalence rate is, in some cases, higher compared to the general world population (9.3% in adults, 9.7% in elderly adults, and 21.2% in adolescents) (38), which reinforces the need for preventive measures, oral hygiene instructions, and basic periodontal treatment in this population.

The most evident periodontal conditions were as follows: presence of plaque, gingival bleeding, presence of calculus, periodontal pockets, and loss of periodontal attachment (7,13,27,29).

Moreover, studies have identified the influence of biological, socioeconomic, occupational, and behavioral factors on periodontal health (5,12,17,27,29). Women and White individuals had better periodontal conditions (11,17,27). This result may be related to the higher frequency with which women seek oral health services when compared to men (39). Nevertheless, Black individuals face greater socioeconomic barriers and access to dental services, which contributes to disparities in oral health (40).

Senna (29) observed statistically significant differences in the presence of calculus and periodontal pockets between different socioeconomic groups (recruit soldiers 12.6%; cadets 25.3%; $p<0.001$), suggesting that financial status may play a role in the prevalence of periodontal disease among military personnel. Katz *et al*. (17) found that people with higher education had fewer deep pockets and gingival bleeding than individuals with less than 12 years of schooling.

Also, the higher the age of entry into the military, the greater the risk of developing more severe periodontal disease (12). Regarding behavioral risks, Zajc *et al*. (36) and Singh *et al*. (30) observed that smoking soldiers had higher rates of periodontal problems and lower combat readiness compared with

non-smokers. Deutche *et al*. (5) found that smoking was statistically associated with the occurrence of periodontal-related emergencies and with the occurrence of any dental emergency. This indicates the need for oral health prevention programs and smoking cessation programs.

The study of Wennstrom *et al*. (34) specifically investigated military subgroups, such as aircraft crews, and compared them with groups of military personnel not exposed to the same occupational conditions. While they did not find significant differences in periodontal conditions between groups, they underscore the importance of examining different subsectors within the military to better understand oral health patterns.

Some studies discuss the impact of the military environment, including operating conditions and associated stress (4,7,37). These studies observed an increase in the prevalence and severity of periodontal diseases during periods of active duty, especially in combat situations. This highlights the need for specific interventions to maintain the oral health of service members during operational maneuvers.

Zhao *et al*. (37) investigated the prevalence of periodontal diseases in Navy personnel during long voyages and found that the periodontal index after navigation (83.3%) was higher than before navigation (59.7%). The prolonged navigation environment, dietary restriction, and poor oral hygiene can compromise periodontal health. Rapidly implementing oral health promotion and developing devices to facilitate brushing during missions, and performing basic periodontal treatment pre- and post-embarkation is essential for the periodontal health of naval personnel during extended voyages.

Finally, potential interventions, such as the use of probiotics to improve periodontal health, are explored in studies such as Schlagenhauf *et al*. (28). However, more research needs to be conducted to prove the effectiveness of this therapeutic approach.

Dental caries, endodontic problems, and tooth loss

Tooth decay, endodontic infections, and tooth loss pose significant challenges for military personnel, due to their impacts on overall military health and operational readiness (4,5,7,18,19,22,24,26,29,31, 41-45). Studies have reported high prevalence rates of these conditions, requiring restorative, prosthetic, and endodontic treatments (19,29). The quality of dental care and regular access to preventive and therapeutic services are essential to mitigate these problems (42,44).

Dental emergencies due to caries and endodontic infections represent approximately 48.6% of clinical occurrences in military personnel and are responsible for 6.9% to 9.3% of evacuations for health reasons (5). The mean index of Decayed, Missing, and Filled Teeth (DMFT) index of military personnel varies widely between 0.74 and 14.4, depending on the population evaluated (4,7,18,24,29). Higher values are consistently observed in individuals with lower educational levels and with advancing age (24,29). Comparatively, military personnel engaged in war zones have worse oral health indicators than the control group (4). These findings suggest that the operating environment may aggravate oral conditions due to factors such as stress, poor diet, poor oral hygiene, and lack of access to regular dental care.

Regarding endodontic infections, Kelbauskiene *et al*. (19) observed that 67.3% of the service members on mission had incompletely treated root canals, with apical alterations in 80.6% of the cases, increasing the risk of future complications.

In a multiple logistic regression analysis, Sonoda *et al*. (32) identified an association between the presence of caries and an increased risk of other dental complications, emphasizing the importance of early management strategies.

In this context, certain specific activities, such as those conducted by submariners, divers, and aircrew, require special attention due to the risk of barotrauma and barodontalgias, which are conditions related to changes in atmospheric pressure. In a literature review, Zadik *et al.* (45) described a prevalence of barodontalgia in 11% of the military personnel during the flight, highlighting the following as the main pain factors: dental caries without pulp involvement (29.2%), necrotic pulp/periapical inflammation (27.8%), vital pulpitis (13.9%), and disease resulting from recent dental treatment (11.1%).

These data reinforce the importance of establishing adequate and preventive dental care and screening protocols for oral diseases, especially in military combatants and in isolation contexts where access to dental care may be limited.

Orofacial lesions and bone or dental trauma, temporomandibular disorders, and third molar eruption disorders

Penetrating injuries and craniomaxillofacial trauma (CMF) are more common in military personnel than in civilians, due to exposure to high-risk situations, such as combat scenarios, use of explosives, firearms, intensive training, and physical contact activities (21). In a conflict scenario,

Lew *et al*. (21) reported that, over a six-year period, 26% of military personnel suffered CMF injuries, with explosive devices being the main mechanism of trauma (84%). The Army was the most affected armed force by CMF fractures (72%), followed by the Navy (26%), and the Air Force (1%) (21).

The prevalence of bone trauma in military personnel varies according to sex. Norozy *et al*. (25) identified a higher occurrence in men, with a mean age of 31.4 years, possibly due to the predominance of men in the Armed Forces and the cultural restrictions that still limit the entry of women in some countries. In contrast, Wentz *et al*. (46) observed, in a systematic review, a higher incidence of stress bone trauma in female military personnel (9.2%) compared with men (3%), whereas in civilian athletes the rates were 6.5% and 9.7%, respectively. Thus, the study argues that these findings indicate that physical condition and bone health are more determinant factors in the occurrence of fractures than gender.

Although the head and neck region represents only 12% of the body surface, Rustemeyer *et al*. (47) reported a prevalence of CMF fractures in 40% of the military personnel. Among them, Norozy *et al*. (25) indicate that midface fractures are the most prevalent (49%), usually accompanied by nasal fractures, which occur in 44% of midface injuries (25). The second most prevalent type is fractures of the lower face (43%). On the lower face, specifically in the mandible region, the angle is the most affected region, followed by the mandibular body and the condyle (25). The upper face is, therefore, the third most affected region (24%). In contrast, Lew *et al*. (21) report that the most frequent facial fractures occur in the mandible (36%), followed by the maxilla/zygoma (19%), nasal bone (14%), and orbit (11%), with 20% of the lesions unspecified (21).

Dental trauma is also frequent in military personnel and can occur alone or in association with CMF fractures. The interaction of physical and psychological etiological factors, such as stress and pressure, which may be present in the military routine, predispose the individual to the development of bruxism and tooth clenching, resulting in wear, cracks, and increased risk of dental fractures (48).

Zadik & Levin (35) reported that the frequency of orofacial injuries during military service was found in 87 (28.0%) of the participants, with an incidence rate of 129.6 cases per 1,000 years of combat. Extraoral lacerations (lips, chin, cheek/facial muscles) were the most common injuries. Dental injuries were reported by 48 participants, of whom 44 (50.6%) suffered dental fractures and four (4.6%) subluxation/dislocation. Most orofacial injuries occurred in an isolated training or operational field. A total of 37 participants (42.5%) reported post-event disturbances and ten (11.5%) reported loss of operational activities because of the event (mean 8.6 +/− four days of loss).

Neglected oral health is another risk factor for tooth fractures, since cavities and other conditions that weaken teeth can increase susceptibility to fractures in cases of trauma. The treatment of fractures depends on the severity of the injuries and the resources available in military units, which directly influences the recovery and quality of life of those affected. Care with oral hygiene and the use of protective devices in specific contexts becomes essential as an effective preventive measure (49,50).

TMDs are multifactorial conditions that can arise both because of trauma and CMF fractures and independently. Psychological factors may also predispose to the development of these disorders (51). Moreover, poor lifestyle habits, such as sleep deprivation during prolonged military missions, can aggravate musculoskeletal conditions, including TMDs. The combination of stress, trauma, and insufficient care can favor the development and progression of these conditions.

In the study of Melo *et al.* (23), there was a prevalence of TMDs (86.8%) in military instrumentalist musicians. Moreover, Morais and Antunes (52), via systematics, found that advanced age and time in the profession increase susceptibility to TMDs, especially in musicians who play wind instruments.

However, despite the risk factors associated with the military environment, Mello *et al*. (53) did not find statistically significant differences in the prevalence of TMDs between military and civilian personnel. However, when present, TMDs in military personnel were more severe (53). Similarly, Ahuja and Darekar (7) reported a low prevalence of TMDs (1%) in their study, emphasizing the variability of the findings.

Considering that TMDs can impact the functional performance and quality of life of military personnel (54), it is essential to implement prevention and awareness programs. Such initiatives should address stress management, offer psychological support, promote oral health, and encourage early diagnosis. Continuous monitoring and investigation of risk factors are essential to improve the general and oral health of military personnel, ensuring adequate support in the face of career demands.

Another relevant aspect involves disorders related to the eruption of third molars, which in some cases may be impacted, included, or semi-included (33). These conditions can be niche for infections, causing

pain, and, in more severe cases, necessitate tooth extraction, which can have a significant impact on military performance, especially in scenarios in which there is a shortage or impossibility of access to dental care, during periods of intense training or prolonged missions (33). This can result in discomfort and functional difficulties. The effective management of these conditions requires the implementation of regular dental screening protocols, aiming at their early detection, prevention, and minimization of the consequences of these disorders, especially in military missions (33).

Soft tissue lesions, potentially malignant oral disorders, and oral cancer

Available publications on the presence of soft tissue lesions in military personnel are scarce. In the study by Cigic *et al*. (55), 34.3% of the 102 military veterans had oral injuries. Regarding normal variations, they found seven cases of hairy tongue, five of leukoedema, four of traumatic lesions (such as fibromas and morsicatio), two of fissured tongue, one of benign migratory glossitis, and one of papilloma (55). Another important finding was xerostomia, reported in 35.3% of the cases (55). Among the potentially malignant oral disorders (PMOD), these authors (55) observed four cases of leukoplakia, two cases of erythroplakia with moderate to severe epithelial dysplasia, four cases of oral lichen planus, and two cases of actinic cheilitis (AC) . Moreover, one case of squamous cell carcinoma of the lip and one in situ carcinoma, without specifying the location (55). Notably, most participants were unaware of the increased risk of oral cancer, despite having a high prevalence of risk factors such as daily alcohol consumption (62.7%), smoking (45.1%), and occupational stress (55).

Regarding xerostomia, Wang *et al*. (14) reported its presence in 30.8% of the post-mission submariners, and 71.4% had a reduction in unstimulated salivary flow, associated with clinical symptoms such as cheilosis and angular cheilitis. These findings underscore the impact of psychological and environmental conditions, suggesting the need for more in-depth studies on risk factors and preventive strategies for xerostomia in military personnel.

Bornstein *et al*. (9), in an epidemiological study, conducted using questionnaires and clinical examination, reported that only 17% of all recruits had never experienced halitosis. These authors (9) found that tongue coating was the only factor associated with organoleptic scores and in the measurements of higher volatile sulfur compounds. It is believed that halitosis can be relatively common in military personnel when exposed to stressful conditions, irregular diet, hyposalivation, periodontal diseases, caries, and compromised oral hygiene habits, negatively affecting social and professional life, impairing self-esteem, and interpersonal relationships (9).

A relevant concern related to military function is with AC, a PMOD with a considerable rate of malignancy (10-30%) and strongly associated with chronic sun exposure, which is characteristic of the outdoor activities of these professionals (56,57). Studies (20,58) indicate that AC and lip cancer are often observed earlier in military compared to the general population, which reinforces the need for preventive measures aimed at this population.

Andrade-Losso *et al*. (8) demonstrated that military personnel of the Brazilian Navy had a higher prevalence of AC and squamous cell carcinoma of the lip compared to civilians. Similar findings were reported in the Italian Navy, in a study conducted by Vimercati *et al*. (59), reinforcing the hypothesis that occupational exposure contributes to the development of these injuries. Nevertheless, a study conducted by Araújo *et al*. (60) among Brazilian military police officers observed a lower prevalence of AC (0.5%), attributed to the low incidence of smoking and the effectiveness of preventive programs for sun exposure implemented in the corporation (60). However, the study did not consider the impact of the different functions performed by police officers, such as the variation between administrative positions and those of ostensive policing, the latter experiencing high levels of chronic sun exposure.

Expanding knowledge about oral and maxillofacial alterations in military personnel is crucial to identify the main needs of this population. This enables the development of effective oral health strategies, focused on prevention, early diagnosis, and proper management of the conditions encountered.

Limitation of the study

This study is a narrative review of the literature, without the application of systematic methods of search, selection, or statistical analysis, which limits the possibility of quantitative data synthesis. The small number of studies available, associated with the methodological heterogeneity among them, restricts the comparability of the findings and the breadth of the inferences. These limitations reinforce the need for new investigations with a standardized study design and focus on the particularities of military activities, to support more effective preventive and clinical care strategies.

CONCLUSION

Oral conditions in military personnel can directly affect general health and operational readiness, compromising well-being and combat capability. The literature highlights that military activities, especially operational ones, increase the risk of problems such as periodontal diseases, caries, dental fractures, temporomandibular disorders, actinic cheilitis, and oral cancer. To mitigate these risks, it is essential to implement prevention programs with adapted oral hygiene kits for use in adverse conditions, appropriate personal protective equipment, and effective sunscreens. Preventive policies should consider occupational and behavioral factors, in addition to promoting regular dental care follow-up and the development of technologies for monitoring and early detection and diagnosis, improving the oral health and efficiency of military personnel.

The authors declare no conflict of interest.

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LITERATURE REVIEW

THE ROLE OF DENTISTS IN THE DIAGNOSIS OF ARTERIAL HYPERTENSION ASSOCIATED WITH PERIODONTAL DISEASE: INTEGRATIVE LITERATURE REVIEW

O PAPEL DO CIRURGIÃO-DENTISTA NO DIAGNÓSTICO DA HIPERTENSÃO ARTERIAL ASSOCIADA À DOENÇA PERIODONTAL: REVISÃO INTEGRATIVA DA LITERATURA

Lívia Paes Borges[1], Luiz Eduardo Monteiro Dias da Rocha[1], Ricardo Guimarães Fischer[1], Guaracilei Maciel Vidigal Junior[1]

ABSTRACT

This study aimed to conduct an integrative literature review on the relationship between periodontal disease and arterial hypertension. A search was performed on PubMed using the Boolean operator AND with the following MeSH descriptors: "periodontal disease" and "arterial hypertension". The following filters were applied: randomized controlled trials (RCTs) published in the last ten years. The inclusion criterion involved RCTs that simultaneously evaluated periodontal disease and arterial hypertension. The exclusion criteria referred to studies that evaluated other diseases and articles written in languages other than English. After reading, selecting, and organizing the studies, the final sample for result extraction comprised three articles out of the nine retrieved titles. These RCTs included a total of 308 patients. Although few RCTs have investigated the relationship between periodontal disease and cardiovascular disease, all analyzed studies indicated a beneficial effect of periodontal treatment on the reduction or improvement of arterial hypertension control. Further research is needed to clarify this relationship.

Keywords: Periodontal Disease; Arterial Hypertension; Cardiovascular Diseases; Randomized Controlled Trial.

RESUMO

O objetivo deste artigo é realizar uma revisão integrativa da literatura acerca da relação entre doença periodontal e hipertensão arterial. Foi realizada uma pesquisa no banco de dados eletrônicos PubMed por meio do operador booleano AND, usando os seguintes descritores MeSH: "*periodontal disease*" e "*arterial hypertension*". Também foram usados os seguintes filtros: títulos publicados até dez anos e estudo clínico controlado randomizado (ECCR). O critério de inclusão foi ECCR, que avaliou simultaneamente doença periodontal e hipertensão arterial. Os critérios de exclusão aplicados para a seleção do artigo foram estudos que avaliaram outras doenças e artigos escritos em outras línguas diferentes do inglês. Após a leitura, seleção e organização dos estudos, a amostra final para extração dos resultados foi composta por três artigos dos nove títulos encontrados. Todos eram ECCR, com um total de 308 pacientes avaliados. Embora existam poucos ECCR que investiguem a relação entre a doença periodontal e as doenças cardiovasculares, todos os estudos analisados indicaram um efeito benéfico do tratamento periodontal na redução ou melhoria do controle da hipertensão arterial. Pesquisas adicionais são necessárias para obter maior clareza sobre essa relação.

Palavras-chave: Doença periodontal; Hipertensão arterial; Doenças cardiovasculares; Ensaio clínico controlado randomizado.

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How to cite this article: Borges LP, Rocha LEMD, Fischer RG, Junior Vidigal GM. The role of dentists in the diagnosis of arterial hypertension associated with periodontal disease: integrative literature review. Nav Dent J. 2025;52(2):37-42.

Received: 03/19/2025
Accepted: 04/30/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-R2

INTRODUCTION

Among healthcare professionals, the dentist examines and diagnoses various diseases (1). Although the diseases that most affect the oral cavity are dental caries and periodontal disease (PD), the dentist is also involved in the diagnosis of systemic diseases, such as arterial hypertension. The involvement of the dentist in this area is justified by the fact that this professional spends more time with patients than other healthcare professionals. In addition, the early diagnosis of systemic diseases also brings benefits such as an improvement in the patient's overall health status and a more effective response to PD treatment (2,3).

Arterial hypertension is a chronic non-communicable disease, similar to PD, and has a direct impact on individual health (4,5). It is widely recognized as a major risk factor for cardiovascular events (6). Moreover, growing evidence points to a bidirectional relationship between this systemic condition and PD (7–11).

PD is a multifactorial, chronic inflammatory disease associated with dysbiotic biofilm and characterized by the progressive destruction of tooth-supporting structures (12,13). It is highly prevalent and linked to elevated circulating levels of inflammatory biomarkers (14). An increasing body of evidence indicates that the periodontal microbiota contributes to multiple systemic diseases associated with higher mortality rates, including arterial hypertension, cardiovascular disease, and diabetes mellitus (15–18). In addition, PD and many systemic conditions share environmental, lifestyle, and genetic risk factors, as well as immunopathological mechanisms (19). In this context, Kapellas et al. demonstrated that PD treatment exerted a positive effect on the progression of carotid artery intima–media thickness (IMT), a noninvasive method for diagnosing atherosclerosis (20).

Moreover, beyond early diagnosis, the dentist should refer these patients to a medical specialist. Thus, the exchange of information regarding these diseases benefits patients' health, aiming for the control of blood pressure. Therefore, the objective of this research is to conduct an integrative literature review on the relationship between PD and arterial hypertension (21, 22).

MATERIAL AND METHODS

A search was conducted in the PubMed electronic database. The searches were performed using the keywords "periodontal disease" and "arterial hypertension", combined with the Boolean operator AND. The following inclusion and exclusion criteria were also used:

- Inclusion criterion: randomized controlled trials (RCTs) that simultaneously evaluated PD and arterial hypertension, published within the last ten years.
- Exclusion criteria: studies that evaluated other diseases and articles published in languages other than English.

The selected RCTs were evaluated using the Cochrane risk-of-bias tool for RCTs (23). The primary outcome evaluated was the relationship between PD and arterial hypertension.

RESULTS

The flowchart (Figure 1) shows the result of the study selection process.

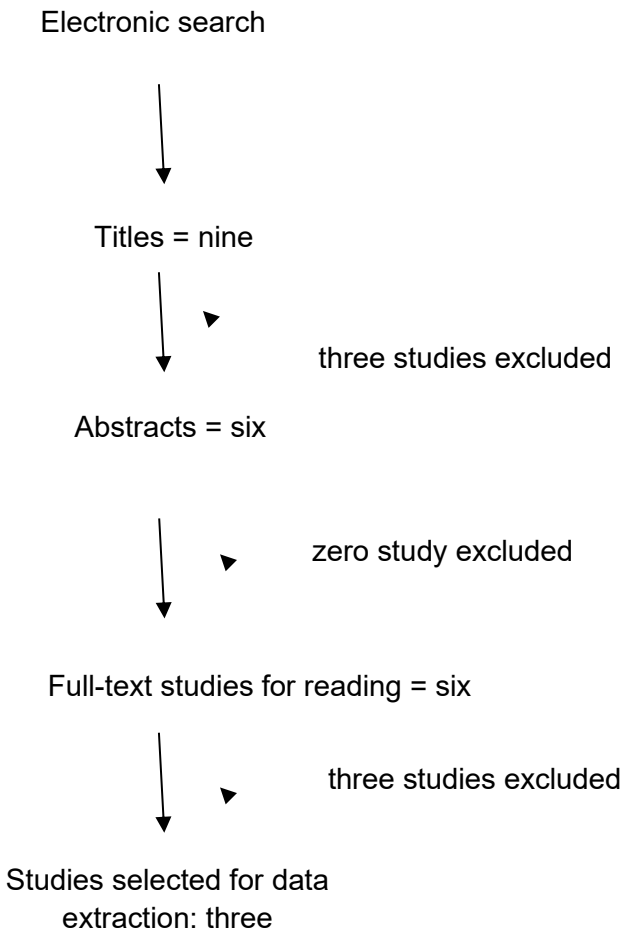

Figure 1 - Flowchart of the study selection process.

The same inclusion and exclusion criteria were applied, and from the six abstracts, all were selected for full-text reading. Of the six selected studies, three were included for data extraction.

Reasons for exclusions

One study investigated chronic obstructive pulmonary disease (24); another assessed the effect

of theaflavin on oral bacteria in Japanese individuals (25); and the last investigated the use of antiseptic mouthwash during pregnancy (26).

Excluded during the full-text reading phase

One study was a retrospective cohort study (27); another measured blood pressure but did not correlate it with PD (20). The last study assessed arterial hypertension only at baseline (present or absent), without correlating it with PD (28).

Table 1 presents a descriptive analysis of the studies selected for data extraction, focusing on the relationship between PD and arterial hypertension. Table 2 shows the risk of bias assessment of the selected studies.

Table 1 - Description of the selected studies comparing the relationship between periodontal disease and arterial hypertension

Author/year	Design of the study	Results	Comments
Zhou *et al*. (2017) (29)	RCT	Periodontal parameters improved significantly (P<0.05) six months after intensive periodontal treatment. The primary outcomes (systolic and diastolic blood pressure and endothelial microparticles) were drastically reduced in the intensive treatment group compared with the control group. The reduction in blood pressure and endothelial microparticle levels was associated with improvements in probing depth (r=0.358, r=0.363, and r=0.676, respectively, according to Pearson's product-moment correlation coefficient; P=0.009, P=0.008, and P<0.001, respectively).	The authors concluded that intensive periodontal intervention, without any antihypertensive drug therapy, may be an effective means of reducing blood pressure levels and endothelial microparticles in patients with prehypertension and PD.
Czesnikiewicz-Guzik *et al*. (2019) (30)	RCT	Mendelian randomization analysis showed a significant relationship between single nucleotide polymorphisms associated with PD and blood pressure phenotypes. There was a substantial reduction in mean systolic blood pressure in the intensive periodontal treatment group compared with the control group (mean difference −11.1 mmHg; 95% CI: 6.5–15.8; P<0.001).	The authors observed a causal relationship between PD and blood pressure. Furthermore, they note that although the mechanisms underlying this relationship require further investigation, there is genetic and experimental evidence linking PD to hypertension. They suggest that these preliminary findings need to be confirmed in a large cohort of hypertensive patients, as they may represent a new non-pharmacological approach to hypertension management.
Pejcic *et al*. (2023) (31)	RCT	Periodontal status was worse in patients in the cardiovascular disease group compared with the control group. A significant association between levels of tooth loss and cardiovascular disease was also observed. In the cardiovascular disease group, tooth loss exceeded 50%. In the control group, tooth loss was about 20% of the total number of teeth.	Considering that hypertension is a cardiovascular risk factor, this article was selected. The authors found a significant association between levels of tooth loss due to PD and the prevalence of cardiovascular disease.

Table 2 - Cochrane Risk of Bias Scale used for randomized clinical trials (RCTs)

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective outcome reporting	Other sources of bias
Zhou et al. (2017) (29)	Low	Low	Low	Low	Low	Low	Low
Czesnikiewicz-Guzik et al. (2019) (30)	Low	Low	Low	Low	Low	Low	Low
Pejcic et al. (2023) (31)	Unclear	Unclear	Unclear	Unclear	Low	Low	Unclear

Low: low risk of bias; Unclear: insufficient information.

DISCUSSION

Since the 1980s, the interrelationship between PD and other systemic diseases has gained relevance (32), leading the field to adopt a new focus known as Periodontal Medicine (33). Arterial hypertension and PD are two highly prevalent

conditions worldwide, with a significant impact on cardiovascular disease complications (11).

The potential mechanism by which PD influences hypertension involves the translocation of periodontal pathogens into the bloodstream, causing direct damage to endothelial cells, potentially leading to atherosclerosis and hypertension. Furthermore, bacterial endotoxins enter the circulation and trigger the release of pro-inflammatory cytokines such as interleukin-1 (IL-1), IL-6, IL-17, C-reactive protein (CRP), tumor necrosis factor alpha (TNF-α), prostaglandin E-2 (PGE-2), and interferon-gamma (IFN-γ). These mediators activate the immune-inflammatory response involving the liver, kidneys, cardiovascular system, and sympathetic nervous system, thereby inducing hypertension. Moreover, periodontal treatment can significantly reduce the number of bacteria entering the bloodstream, either directly decreasing atherosclerosis formation or indirectly reducing the immune-inflammatory reaction, thus reducing or improving blood pressure levels and improving its regulation across multiple organ systems (34).

In the search strategy, a filter was applied to select RCTs. However, upon full-text reading, it was verified that the article by Chou et al. was a cohort study and was therefore not included in the data extraction phase (27). Although Cullinan et al. conducted an RCT involving patients with cardiovascular disease and PD, the authors evaluated only the effect of a triclosan-containing toothpaste on cardiovascular risk biomarkers obtained through annual blood tests over five years. For this reason, the study was also excluded, as no periodontal treatment was performed (28).

Kapellas et al. reported a reduction in carotid intima–media thickness (IMT) with periodontal treatment, but no direct association with hypertension was observed (20). The study concluded that periodontal therapy was effective in reducing IMT, suggesting a significant association between PD and atherosclerosis. After the selection of studies for data extraction, the Cochrane Risk of Bias tool was applied (Table 2). Of the three studies selected in this integrative literature review, two showed a low risk of bias (29, 30).

Pejcic et al. assessed periodontal status and the number of teeth lost due to periodontal disease in patients with cardiovascular disease, investigating the relationship between the severity of PD and the occurrence of cardiovascular disease. They observed a positive association between the number of missing teeth and cardiovascular disease, although this study presented an unclear risk of bias in several domains. In the domains of random sequence generation and allocation concealment, the authors did not provide information on how the randomization sequence was generated, and no data were reported regarding blinding of participants or personnel (31).

Zhou et al. evaluated the association between intensive PD treatment and the reduction of blood pressure and endothelial microparticles (EMPs). Such microparticles play an important role in the initiation and progression of arterial hypertension. In this study, patients received intervention for four consecutive weeks and were followed up for six months. Blood pressure and EMP levels were assessed at baseline, and after one, three, and six months after the intervention. The study concluded that intensive PD intervention, without any antihypertensive medication, is an effective means to reduce blood pressure levels in patients with prehypertension and PD (29).

Another study investigated the causal association between PD and arterial hypertension through a RCT of non-surgical periodontal therapy in hypertensive patients, with 24-hour ambulatory blood pressure monitoring as the primary outcome. The findings demonstrated a significant reduction in systolic blood pressure in the periodontal treatment group compared with the control group. In addition, the study provided genetic evidence that PD is linked to arterial hypertension through a pleiotropic gene (30).

CONCLUSION

Despite the limited number of RCTs evaluating the relationship between PD and cardiovascular disease, the findings are consistent. All selected studies indicated a positive effect of periodontal treatment on the reduction and improvement of arterial hypertension control.

The authors declare no conflict of interest.

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LITERATURE REVIEW

THE RELATIONSHIP BETWEEN POSTERIOR TOOTH LOSS AND FUNCTIONAL ORAL REHABILITATION

A RELAÇÃO ENTRE A PERDA DE DENTES POSTERIORES E A REABILITAÇÃO ORAL FUNCIONAL

Vanessa Barbosa Dias[1], Vilmara Procópio Castro[1], Patricia de Hollanda Cavalcanti Aragão Costa[1]

ABSTRACT

The loss of posterior teeth significantly impairs masticatory function, occlusion, and patients' quality of life, potentially leading to bone resorption and nutritional difficulties. Oral rehabilitation is essential to restore these functions. Various techniques have been employed, such as fixed, removable, and implant-supported prostheses. The choice of approach depends on factors such as the extent of tooth loss, bone condition, and patient needs. This study aimed to analyze the clinical implications of posterior tooth loss and the main available oral rehabilitation techniques. A descriptive and qualitative literature review was conducted based on the analysis of recent scientific articles on the subject. Results showed that the absence of posterior teeth overloads the remaining teeth, causes progressive bone resorption, and impairs aesthetics and function. Among rehabilitation techniques, dental implants demonstrated superior efficacy in bone preservation and functional stability, whereas removable prostheses remain widely used due to their accessibility and applicability in patients with bone or financial restrictions. The choice of rehabilitation technique should be individualized considering clinical and socioeconomic factors. Advances in materials and dental technologies have enabled more efficient rehabilitations, contributing to the improvement of patients' quality of life.

Keywords: Tooth loss; Dental prosthesis; Dental implant; Chewing; Chewing function; Oral health.

RESUMO

A perda de dentes posteriores compromete significativamente a função mastigatória, a oclusão e a qualidade de vida dos pacientes, podendo levar a reabsorção óssea e dificuldades nutricionais. A reabilitação oral é essencial para restaurar essas funções, e diferentes técnicas têm sido aplicadas, como próteses fixas, removíveis e implantossuportadas. A escolha da abordagem depende de fatores como a extensão da perda dentária, a condição óssea e as necessidades do paciente. Este estudo teve como objetivo avaliar as implicações clínicas da ausência de dentes posteriores e identificar as principais técnicas de reabilitação oral utilizadas para restabelecer a função mastigatória e o bem-estar do paciente. Para isso, foi realizada uma revisão bibliográfica descritiva e qualitativa, baseada na análise de artigos científicos recentes sobre o tema. Os resultados demonstraram que a ausência de dentes posteriores acarreta sobrecarga nos dentes remanescentes, reabsorção óssea progressiva e comprometimento estético e funcional. Entre as técnicas de reabilitação, os implantes dentários apresentaram maior eficácia em termos de preservação óssea e estabilidade funcional, enquanto as próteses removíveis continuam sendo amplamente utilizadas por sua acessibilidade e aplicabilidade em pacientes com restrições ósseas ou financeiras. Concluiu-se que a escolha da técnica reabilitadora deve ser individualizada, considerando fatores clínicos e socioeconômicos. A evolução dos materiais e das tecnologias odontológicas tem possibilitado reabilitações mais eficientes, contribuindo para a melhoria da qualidade de vida dos pacientes.

Palavras-chave: Perda dentária; Prótese dentária; Implante dentário; Mastigação; Função mastigatória; Saúde bucal.

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How to cite this article: Dias VB, Castro VP, Costa PHCA. The relationship between posterior tooth loss and functional oral rehabilitation. Nav Dent J. 2025;52(2):43-48.

Received: 04/30/2025
Accepted: 08/13/2025

DOI: https://doi.org/10.22491/1983-7550-52-2-R3

INTRODUCTION

Tooth loss is a common condition that can significantly compromise patients' functional capacity and quality of life (1), especially when involving posterior teeth (2). These structures are essential for efficient chewing, occlusal stability, and alveolar bone preservation (3). Oral rehabilitation using fixed or removable prostheses or implant-supported prostheses is a fundamental strategy to restore masticatory function and prevent complications associated with posterior tooth loss (2,4). The loss of posterior teeth can overload the remaining teeth, leading to wear, unwanted movements, and even temporomandibular joint disorders (5,6). In addition, it may affect smile aesthetics, directly impacting self-esteem and the ability to eat well (1,5,7).

Tooth loss, particularly of posterior teeth, has significant effects on general health and individuals' quality of life (8). Research indicates that edentulous individuals have a higher prevalence of nutritional deficits, as inadequate chewing not only impairs food breakdown but also negatively affects digestion and nutrient absorption (7). The influence of posterior tooth loss on the functioning of the stomatognathic system is also widely recognized in literature. The absence of these structures alters the distribution of masticatory forces, which may contribute to the development of temporomandibular disorders, overload on remaining teeth, and even postural changes (2,4).

Moreover, studies show that the loss of posterior teeth can directly interfere with speech and phonetics, hindering speech articulation and affecting communication, thereby impacting self-confidence and quality of life (9). The absence of these teeth may cause chewing difficulties, occlusal changes, and bone loss, requiring careful consideration of the best treatment options (10). To prevent such consequences, the use of prostheses—removable or fixed, supported by teeth or implants—has proven to be an effective solution for restoring masticatory function and facial harmony (11,12). Early rehabilitation also helps prevent bone loss and maintain the dental arch structure (3,13).

The choice of the most appropriate treatment in oral rehabilitation must consider a series of clinical and individual factors, such as gingival condition, remaining bone volume, and each patient's functional and aesthetic needs (13). More than simply replacing missing teeth, oral rehabilitation represents a fundamental strategy for maintaining oral health throughout life, promoting functional balance, comfort, and quality of life (6). The rehabilitation of partially or fully edentulous patients has received increasing attention in scientific literature, especially due to the impact of posterior tooth loss on occlusal dynamics, arch stability, and possible systemic repercussions associated with compromised masticatory function (9,10,11,14).

In this context, geriatric dentistry highlights the importance of oral rehabilitation as an essential component of older adults' oral health care, contributing to the maintenance of self-esteem, communication, and social integration (2,15). Thus, well-conducted rehabilitative interventions play a decisive role in preventing functional imbalances, restoring masticatory efficiency, and promoting greater occlusal stability and patient comfort. The psychological impact of oral rehabilitation should also be emphasized, as tooth loss can impact patients' self-esteem and social interaction (5,12). Studies indicate that partially edentulous individuals using ill-fitting or inadequate prostheses may develop insecurity when speaking and eating in public, directly reflecting on their quality of life (12).

Adapting to a new prosthetic device can be challenging, but well-planned rehabilitation can restore not only masticatory function but also patients' confidence and psychological well-being (10). This study stems from the importance of functional oral rehabilitation in preserving the oral and general health of patients who have lost posterior teeth. Thus, the research seeks to contribute to clinical practice, reinforcing the importance of individualized planning in restorative and prosthetic dentistry.

MATERIALS AND METHODS

This study is characterized as a descriptive literature review with a qualitative approach, aimed at gathering and critically analyzing the scientific literature on functional oral rehabilitation and the effects of posterior tooth loss on quality of life, chewing, and oral health. The publications were selected from the scientific databases PubMed and the Biblioteca Virtual em Saúde (BVS), both internationally recognized for their breadth of health-related articles. The following descriptors and their corresponding English and Brazilian Portuguese versions were used, combined with Boolean operators ("AND" and "OR"): Perda dentária / Tooth loss, Prótese dentária / Dental prosthesis, Implante dentário / Dental implant, Mastigação / Chewing, Função mastigatória / Masticatory function, Saúde bucal / Oral health.

The initial search yielded 578 articles. Titles and abstracts were screened according to the inclusion criteria: articles with full-text access; publications from the last 10 years (with occasional exceptions of theoretical relevance); clinical studies, systematic reviews, qualitative studies, and case reports; and works addressing aspects related to tooth loss, masticatory function, or rehabilitation with dental prostheses (fixed or removable) or implants. Exclusion criteria included duplicate articles across databases; works not directly relevant to the subject; publications unavailable in full text; and studies with insufficiently described methodology or limited practical relevance.

Data collection involved full-text reading of the selected studies, prioritizing information on the functional effects of posterior tooth loss, masticatory performance, types of prosthetic rehabilitation (conventional or implant-supported), and impact on patients' oral health and quality of life. The analysis was qualitative and interpretative, seeking to identify patterns, clinical evidence, knowledge gaps, and relevant contributions to dental practice. The selected literature was critically interpreted to support a well-founded and updated discussion, promoting reflections on more effective, patient-centered clinical approaches. This methodology ensures the consistency and scientific relevance of the material used, integrating different levels of evidence and broadening the understanding of challenges and opportunities in contemporary functional oral rehabilitation.

DISCUSSION

Impacts of posterior tooth loss on masticatory function, aesthetics, and quality of life

Posterior tooth loss is a significant concern in dentistry, as it compromises not only masticatory function but also occlusal stability, aesthetics, and patient quality of life (2,5). Masticatory efficiency is one of the main aspects impacted by tooth loss, considering that posterior teeth, including premolars and molars, play an essential role in food breakdown, ensuring proper digestion and efficient nutrient absorption. Therefore, the absence of these elements has a negative impact on patients' nutrition (4,5) and can lead to a series of undesirable adaptations in the stomatognathic system, resulting in overload of the remaining teeth and changes in the temporomandibular joint (4,6,7).

The lack of posterior support in occlusion may favor the collapse of the occlusal relationship, contributing to tooth migration and imbalance in the distribution of masticatory forces (6,13). This imbalance can cause overload on anterior teeth, increasing the risk of fractures and pathological wear (2,6). The relationship between posterior tooth loss and temporomandibular disorders (TMD) has been widely studied. The lack of posterior support can lead to compensatory mandibular movements, predisposing patients to pain and discomfort in the temporomandibular joint (TMJ) region. The most common symptoms include headaches, joint clicking, and limited mouth opening, directly impacting patient quality of life (6,10).

Bone atrophy associated with tooth loss is another important factor. The lack of adequate masticatory stimulation due to the absence of posterior teeth results in progressive resorption of the alveolar bone, making future prosthetic or implant-supported rehabilitations more difficult. This phenomenon is particularly concerning in elderly patients, where bone loss is more accelerated due to physiological and systemic factors. The impact of bone resorption can be seen in the stability of removable prostheses and in the success of dental implants, making the choice of rehabilitation therapy a clinical challenge (13,16,17). Beyond functional aspects, posterior tooth loss significantly impacts aesthetics and facial harmony. Progressive bone resorption compromises adjacent soft tissues, potentially leading to changes in facial contour and a more aged appearance over time (3).

Such changes may result in dissatisfaction with one's appearance, affecting self-esteem and psychological well-being. Partially edentulous patients often report discomfort while speaking and smiling, potentially leading to progressive social isolation (9). Another relevant aspect is the influence of posterior tooth loss on quality of life. Research indicates that partially edentulous patients have a poorer perception of their oral health and report greater difficulty in eating properly. The discomfort caused by the absence of teeth may lead to inadequate eating habits, with excessive consumption of processed and easily chewed foods, which in turn may contribute to systemic diseases such as diabetes and obesity (5).

The impacts of tooth loss can also be observed in speech and phonetics. The absence of posterior teeth may compromise phoneme articulation, resulting in difficulties in oral communication. This issue can be particularly significant for professionals who rely on speech, such as teaching or lecturing, further increasing the need for adequate oral rehabilitation (9). Therefore,

posterior tooth loss represents a multifactorial issue that impacts not only chewing ability but also bone health, occlusal stability, phonetics, and patients' emotional well-being (1,5-7). Proper planning of oral rehabilitation for these individuals is essential to restore lost function and minimize the adverse effects of posterior tooth loss. Thus, early and well-planned dental interventions are crucial to ensure better quality of life and preserve patients' oral and systemic health (10).

Main oral rehabilitation techniques to restore posterior tooth function and the effectiveness of fixed, removable, and implant-supported prostheses

Oral rehabilitation is essential to restore masticatory function and prevent complications arising from posterior tooth loss. The choice of the most appropriate technique depends on factors such as the extent of tooth loss, the patient's bone condition, occlusal stability, and individual functional and aesthetic needs (8,11,12). The main treatment options include fixed and removable prostheses, conventional or implant-supported, each with its specific indications and clinical benefits. Fixed prostheses are widely used in the rehabilitation of single or multiple tooth losses, supported by remaining teeth or implants. These prostheses offer greater stability and patient comfort, providing satisfactory functional and aesthetic outcomes (18). However, for a fixed prosthesis to be feasible, the adjacent teeth must have good support structure, which may limit its indication in cases of multiple tooth losses without adequate abutments (13).

Removable prostheses, on the other hand, represent a viable alternative for patients who are not candidates for implants or who present extensive tooth loss. These prostheses may be partial or complete and are indicated mainly for older adult patients and those requiring a more affordable rehabilitative solution (5,7,8). Despite their popularity, removable prostheses present challenges such as patient adaptation and the need for frequent maintenance to prevent complications like bone resorption and denture stomatitis (19). Dental implants represent the most advanced and effective solution for posterior tooth rehabilitation, as they provide superior stability, bone preservation, and greater patient comfort, being a primary therapeutic choice due to their high success rates. Implant placement can prevent bone resorption, ensuring balanced distribution of masticatory forces (3,8). This technique enables the replacement of lost teeth without the need to prepare adjacent teeth for support, offering a stable and functional solution (3,13). However, implant success depends on several factors, including the quality of the recipient bone, the surgical technique used, and patients' postoperative care (20).

The choice among these techniques must consider patients' individual conditions, financial feasibility, and expectations regarding oral rehabilitation (10). Patients with good bone density seeking a definitive solution generally opt for dental implants, while those with bone or financial limitations may resort to removable prostheses (13). Studies show that the longevity of rehabilitations is directly related to the quality of the materials used and patients' adherence to maintenance protocols. Fixed prostheses made of all-ceramic or zirconia provide greater durability and aesthetics compared to metal-ceramic ones and are widely recommended in complex rehabilitations (21-24).

In addition to the choice of rehabilitation technique, it is essential to consider long-term follow-up to ensure treatment success. Patients rehabilitated with fixed, removable, or implant-supported prostheses should undergo regular dental visits for adjustments and evaluations, as well as maintain strict oral hygiene to prevent complications such as peri-implantitis (13,19,25). Given the wide range of available options, oral rehabilitation should be planned individually, considering patients' anatomical, functional, and psychological factors (5,10,12,13). Advances in dental materials and surgical techniques have enabled increasingly effective treatments, ensuring better quality of life and greater predictability of rehabilitation outcomes (8,11,18).

The main rehabilitation options include fixed, removable, and implant-supported prostheses, each with benefits and limitations that must be considered to achieve a functional and long-lasting outcome. Choosing the best rehabilitative approach often involves challenges related to patients' bone condition and adaptation to new prosthetic structures (3,13). Fixed prostheses, for example, are widely recommended for patients who still have healthy remaining teeth, as they provide greater stability and comfort compared to removable prostheses (8). However, their installation may require preparation of adjacent teeth for support, which can compromise dental structure over time (26). On the other hand, removable prostheses, while being a more affordable alternative, require an adaptation period and may present limitations regarding stability and retention (8,10).

One of the most significant advances in oral rehabilitation has been the development and refinement of dental implants, which enabled more predictable and long-lasting rehabilitation (24). Implants promote alveolar bone preservation, preventing the resorption that frequently occurs in edentulous patients (3). In addition, they provide greater patient comfort and eliminate the need to prepare healthy teeth for prosthetic support (6,25). However, implant success is directly linked to bone availability and the need for an appropriate surgical protocol, which may be challenging in patients with severe bone resorption (10,13,26). The advancement of dental materials also plays a key role in improving the durability and aesthetics of prosthetic rehabilitations (21,24). Currently, ceramic and zirconia-based materials offer superior strength and better aesthetic adaptation, and they are widely used in fixed and implant-supported rehabilitations.

The digitalization of dental processes, via CAD/CAM technology, has enabled the fabrication of prostheses with greater precision and predictability, reducing treatment time and optimizing clinical outcomes (21,27,14,28). Beyond technological advances, patient adaptation to oral rehabilitation must also be considered. Studies show that individuals rehabilitated with removable prostheses experience greater functional and psychological adaptation difficulties, reporting discomfort when speaking and chewing during the first months of use (5,7,8). In contrast, patients treated with dental implants demonstrate greater satisfaction with treatment stability and functionality, although the time required for healing and osseointegration still poses challenges in some clinical cases (6,8,13,18,14).

Another relevant point concerns the maintenance and longevity of rehabilitations. Regardless of the technique used, treatment longevity depends on strict oral hygiene and regular dental visits for adjustments and evaluations (28). Patients rehabilitated with implant-supported prostheses, for instance, must be monitored periodically to prevent complications such as peri-implantitis, which can compromise implant stability in the long term (13,20,25,29).

CONCLUSION

The rehabilitation of posterior teeth goes beyond merely replacing lost structures, playing a fundamental role in restoring patients' masticatory function, aesthetics, and quality of life. Achieving satisfactory clinical outcomes requires individualized planning, careful selection of the rehabilitative technique, and continuous follow-up. Advances in materials, clinical techniques, and digital technologies have contributed to increasingly personalized, predictable, and accessible treatments, aligning dental care with individuals' functional, aesthetic, and psychosocial needs. In this way, oral rehabilitation has become an indispensable component of contemporary dentistry, with a significant impact on oral health, well-being, and patients' social reintegration.

The authors declare no conflicts of interest.

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