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

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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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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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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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