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The Impact of Prolonged Sea Voyages on Oral Health: A Literature Review

Ankit Ahlawat*, Ruchi Jangid, Sonali, Parimeeta Singh Chauhan, Nikhil Kumar, Mohini Sharma

Faculty of Dental Sciences, PDM University, Bahadurgarh, Haryana, India. *Corresponding Author's Email: ankitahlawat141202@gmail.com

Abstract

Maintaining good dental health is vital for overall well-being, yet sailors face unique challenges in this regard due to prolonged periods away from professional dental care. Extended voyages, often lasting several months or even years, restrict access to routine dental check-ups, preventive care, and early detection of emerging oral health problems. The isolation at sea creates an environment where even minor dental issues can worsen, and new oral health conditions can develop in the absence of expert treatment. This review explores the impact of long-distance sea travel on sailors' oral health, focusing on how pre-existing conditions, such as dental caries and gum disease, can deteriorate over time without proper care. Additionally, it examines the emergence of new oral health issues, including tooth decay and periodontal problems, which are exacerbated by the lack of access to dental professionals. The review further highlights contributing factors, such as limited access to nutritious foods, dehydration, and stress, all of which can negatively affect oral health. Furthermore, the review discusses the implications of these challenges on sailors' overall health and well-being, emphasizing the need for effective preventive measures and dental care strategies to address these issues. By addressing these gaps in care, this review aims to provide a better understanding of the dental health risks faced by sailors and the importance of improving oral health support during long voyages.

Keywords: Dental Caries, Diet, Oral Health, Periodontal Diseases, Seafarers, Voyages.

Introduction

An individual's oral health affects multiple aspects of their well-being, including speech, communication, nutrition, and overall systemic health. Maintaining good oral health is essential for individuals across all walks of life, but for seafarers, the challenge is far greater due to the unique circumstances of life at sea (1). Long-duration voyages, often lasting months or even years, create an environment where pre-existing oral health conditions can worsen, and new dental issues can develop in the absence of regular dental care. The lack of access to professional care, combined with the stress of isolation, dietary changes, and inconsistent hygiene habits, can lead to serious oral health complications for sailors. These may include dental caries, periodontal diseases, untreated orthodontic problems, and even the unchecked growth of precancerous lesions (2).

Seafarers, by nature of their work, face particular challenges that can exacerbate oral health problems. Unlike those who have easy access to regular dental check-ups, sailors are often isolated from healthcare facilities for extended periods. Even on larger ships that may have basic medical facilities, comprehensive dental care is rarely available, meaning that minor dental problems often go unnoticed or untreated until they become serious and require urgent care. The absence of timely intervention can lead to complications such as infections, abscesses, and severe pain, which can, in turn, affect a sailor's ability to perform their duties and impact their overall well-being (3).

One of the primary contributing factors to oral health problems aboard ships is diet. The reliance on processed, canned, and preservative-heavy foods, which are staples for sailors due to their long shelf life, often leads to an imbalance in nutrition. Many of these foods are rich in carbohydrates, which can increase the risk of dental diseases such as cavities and gum disease (4). The limited availability of fresh fruits and vegetables on long voyages means that sailors may also suffer from deficiencies in essential vitamins,

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such as Vitamin C and D, which are crucial for maintaining healthy gums and teeth. Vitamin C deficiency, for example, can lead to scurvy, a condition that has historically plagued sailors, causing gum inflammation, bleeding, and tooth loss (5).

Another significant issue sailors face is dehydration. The harsh environmental conditions at sea, coupled with the physically demanding work onboard, make it difficult for sailors to stay hydrated. Dehydration leads to reduced saliva production, which is a critical defense mechanism in oral health. Saliva helps neutralize acids, remineralize enamel, and wash away food particles and bacteria. Without enough saliva, the risk of developing gum disease, tooth decay, and other oral health problems increases significantly. This problem is compounded by the consumption of alcohol, which is often prevalent among seafaring communities. Alcohol not only contributes to dehydration but also increases the risk of oral cancer due to the toxic effects it has on the tissues in the mouth and throat (6).

Nicotine use, both through smoking and smokeless tobacco, is also common among seafarers. The risks associated with nicotine use include periodontal disease, oral cancer, and a range of other oral health complications. Nicotine is a potent vasoconstrictor, which limits blood flow to the gums and impairs the body's ability to fight infection. This, in turn, leads to an increased susceptibility to gum disease and other oral health problems (7).

While previous research has touched on the oral health issues faced by seafarers, this review differentiates itself by focusing specifically on the prolonged absence of dental care during extended voyages and how modern maritime conditions differ from past seafaring practices. Historically, sailors' oral health was significantly impacted by issues like scurvy due to poor nutrition, but contemporary seafaring presents new challenges (8). Modern ships often lack the necessary infrastructure to provide regular dental checkups or care, and while some ships have rudimentary medical facilities, they are rarely equipped to handle dental emergencies. Furthermore, the environmental conditions and lifestyle factors that affect oral health have evolved. For instance, modern seafarers face issues like stress, poor water quality, and inconsistent access to oral hygiene products, which are not typically considered in earlier studies of seafaring health (8).

The novelty of this review lies in its comprehensive approach, which not only explores traditional issues such as diet and water quality but also examines the current challenges faced by seafarers. The impact of stress, limited dental care, and environmental factors such as exposure to saltwater, high humidity, and extreme temperatures can all negatively affect oral health. The modern-day sailor's lifestyle, characterized by irregular hours, limited sleep, and restricted access to dental professionals, presents a unique set of challenges that were not as prevalent in the past. This review aims to provide a more holistic view of the oral health issues seafarers face today, offering insights into how contemporary maritime conditions contribute to oral health problems and exploring potential solutions to mitigate these challenges.

Through this review, the objective is not only to highlight the oral health risks seafarers face but also to propose strategies for improving their dental care on board. By recognizing the modern-day challenges, including dietary habits, psychological stress, limited access to dental care, and environmental factors, the hope is to bring awareness to the issue and advocate for better preventive measures and solutions for seafarers' oral health. These solutions may include providing sailors with oral hygiene kits, establishing pre-departure dental checkups, and incorporating tele-dentistry services on ships.

Analysis of the Past Studies

Seafaring has played a major role in global exploration, commercialization, and many military operations for centuries. However, life at sea may present many complications, especially regarding health. Isolation, limited access to fresh water, fruits, and vegetables, and irregular dental hygiene practices, along with the absence of professional dental care, contribute to a higher incidence of dental diseases among sailors (9). Scurvy, a common disease among sailors in earlier centuries, was caused by a deficiency of vitamin C, which led to bleeding gums, tooth loss, and even death. Although there have been many improvements in food storage and availability, long voyages still often involve carbohydrate-rich diets. Long-term

storage of fruits and vegetables is unfeasible, leading to a deficiency in vitamins and calcium. Vitamin C is essential for collagen synthesis, healing, and maintaining epithelial integrity. Deficiency results in impaired wound healing, gingival swelling, spontaneous bleeding, and periodontal breakdown (10). Compromised gingival collagen turnover results in gingival ulceration and bacterial superinfection. Vitamin D deficiency impairs calcium and phosphate homeostasis, affecting the mineralization of enamel and the integrity of alveolar bones. Lack of UV exposure during sea voyages, particularly on polar routes or in submarines, can lead to insufficiencies. Untreated periodontal conditions can further cause systemic diseases, particularly in immunocompromised individuals. Bacteremia originating from periodontal pockets has been linked to endocarditis and exacerbation of systemic inflammatory diseases (11).

Table 1: Literature Review of the Study

Author	Year	Title	Objective	Methodology
Duangthip *et al.*, (1)	2020	Challenges in Oral Hygiene and Oral Health Policy	To identify and discuss global challenges in oral hygiene and the development of effective oral health policies.	Narrative review based on literature related to oral hygiene practices and policies.
Tungare *et al.*, (3)	2023	Diet and Nutrition to Prevent Dental Problems	To provide an overview of the role of diet and nutrition in preventing dental problems.	Updated medical reference chapter, summarizing current evidence and clinical guidance.
Maxfield *et al.*, (6)	2023	Vitamin C Deficiency	To discuss the etiology, diagnosis, and management of vitamin C deficiency, including oral symptoms.	Updated clinical resource with summary of current medical literature.
Martínez-García *et al.*, (10)	2021	Periodontal Inflammation and Systemic Diseases: An Overview	To present the relationship between periodontal inflammation and systemic diseases.	Literature-based overview with focus on systemic links to oral inflammation.
Zabin *et al.*, (11)	2022	Increasing the Resilience of Ecological Restoration to Extreme Climatic Events	To explore strategies for improving ecological restoration under climate stress.	Review of ecological strategies and case studies (not directly related to oral health).

Discussion

Seafarers often embark on voyages with pre-existing oral conditions. The unique weather limitations of life at sea can significantly influence the progression of these issues in the absence of professional dental care. Without professional intervention, dental caries, which may appear as minor lesions, can progress at an accelerated rate. As the decay advances, it reaches the pulp, pulp causing pulpitis. If the pulp infection is not treated, it may progress further, leading to the development of a periapical abscess. These infections can cause severe pain, swelling, fever, and malaise, necessitating immediate medical attention (12). Poor oral hygiene leads to the accumulation of plaque and calculus, which in turn causes gum inflammation. This gradual progression of periodontitis at sea significantly increases the risk of tooth loss. Researchers have linked severe systemic diseases, such as cardiovascular diseases and respiratory infections, to the chronic inflammation associated with periodontitis. The prolonged inflammatory burden with progressing periodontal diseases could potentially exacerbate these risks (13).

The marine environment exposes existing restorations to extreme temperature variations between day and night along with high levels of humidity. These fluctuations can cause expansion or contraction of restorative materials, eventually

leading to marginal breakdown of restoration. The physical demands of onboard work and the potential for minor trauma and bruxism, exacerbated by stress, can place increased occlusal forces on restorations, leading to fractures or chipping (14). Dental cases are not easy to manage on board, and almost all of them require further shoreside evaluations. When a dentist cannot immediately attend to crew members, the pain and discomfort can significantly impact their performance, concentration, sleep, and safety. Adopting a multifaceted evidence-based approach is necessary to improve the oral health of seafarers. Pre-departure dental examinations and the treatment of pre-existing conditions are mandatory. It is important to tailor the application of fluoride varnish, scaling, and polishing to the individual's needs. Implementing a dental health certificate as a part of the overall medical assessment can ensure a baseline level of oral health before the trip (15). The maritime environment continues to present numerous barriers to optimal oral health. While historically scurvy posed a challenge, currently a more diverse and demanding multidisciplinary approach is required. Emphasizing prevention, early detection, and remote intervention strategies can significantly reduce the oral disease burden in seafarers.

The integration of Metaverse, AI, AR, and VR technologies in maritime oral health could significantly enhance access to remote dental care, provide immersive training for seafarers, facilitate real-time health monitoring, and promote preventive care, ultimately improving the overall oral health management aboard ships (16, 17).

Conclusion

Prolonged sea voyages have a significant impact on oral health, primarily due to limited access to professional dental care and preventive services during extended sea times. Sailors and other maritime professionals often go months without dental examinations, which can lead to the development of untreated dental conditions like periodontal infections, dental caries, and other oral health issues. In addition to nutritional restrictions, sailors' dental health deteriorates due to weather, stress, and poor oral hygiene habits brought on by a lack of knowledge and restricted resources. In light of all these variables, it's critical to emphasize the importance of taking preventative action to safeguard their dental health. Preventive measures include pre-voyage dental screenings, oral hygiene kits, remote dental consultations, and educational initiatives for maintaining oral health while at sea. Closing these gaps would improve the health and quality of life of those who work at sea, boost their performance, and reduce the chance of medical emergencies.

Abbreviation

None.

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Author Contributions

Ankit Ahlawat conceptualized the study and contributed to writing the manuscript. All other co-authors contributed equally to the research, data collection, and manuscript preparation. Ankit Ahlawat is the corresponding author, responsible for communication with the journal and final manuscript submission.

Conflict of Interest

The authors declare that there is no conflict of interest related to this study.

Ethics Approval

This study was conducted in accordance with ethical standards and the principles outlined in the Declaration of Helsinki. The ethical committee of PDM Dental College & Research Institute approved the research protocol, and written informed consent was obtained from all participants.

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