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ORIGINAL ARTICLE

Dental and periodontal findings in seafarers: A single-center retrospective study in Bangkok, Thailand

Sirada Chaichanachuchird[1], Narissara Temvanich[2], Atipong Sujiratana[3], Hansa Premmaneesakul[3]

[1]Maritime Medicine Residency Training Institute, Naval Medical Department, Bangkok, Thailand
[2]Dental Center, Naval Medical Department, Bangkok, Thailand
[3]Maritime Medicine Division, Somdech Phra Pinklao Hospital, Naval Medical Department, Bangkok, Thailand

ABSTRACT

Background. Dental problems are common among seafarers due to unique environmental, occupational, and lifestyle factors that may impact their dental health. This study aims to assess the prevalence of dental and periodontal problems among Thai seafarers.

Material and methods. A cross-sectional study was conducted among 602 Thai seafarers who received oral health assessments and were subsequently categorized based on dental readiness classification (DRC) from dentists at Somdech Phra Pinklao Hospital from November 2021 to October 2023.

Results. The prevalence of dental caries among seafarers was 43.5% with significant differences in the number of dental caries between officers and non-officers (p < 0.0001). The mean (SD) of decayed, missing, and filled teeth were 1.2 (± 2.0), 2.9 (± 3.3), and 1.6 ± (2.8), respectively. About fifty percent of the seafarers were categorized as DRC 1, 44.9% as DRC 2, and 5.3% as DRC 3. Dental findings of non-officers were significantly more likely to be not dentally fit compared to officers (AOR = 2.179, 95% CI: 1.396-3.402). Dental scaling was the most required treatment, needed by 53.7% of the study population.

Conclusions. High rates of dental caries and periodontal disease are found among seafarers. Incorporating comprehensive dental assessments into pre-boarding fitness evaluations for seafarers can help reduce the likelihood of dental emergencies while at sea.

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Keywords: oral health; periodontal diseases; seafarer; dental caries; occupational health

INTRODUCTION

Seafarers' health and well-being are essential for the global marine sector to operate successfully and safely. Working in the maritime industry exposes employees to specific environmental, occupational, and lifestyle factors that may influence their overall health, including their dental health [1, 2]. The demands and pressures of the job sometimes cause seafarers to lose sight of the need to maintain good dental health, due to extended travels and limited access to regular healthcare services [3].

Dental issues at sea often necessitate using telemedicine medical assistance services (TMAS) both domestically and internationally [4–6]. They can significantly impact onboard safety protocols and an individual's quality of life [7]. The symptoms can range from minor discomfort to excruciating pain, resulting in impaired attention, decreased job productivity, and an increased risk of accidents [8]. Furthermore, periodontal disease has been linked to several medical conditions such as diabetes mellitus, atherosclerotic cardiovascular disease, certain malignancies, and other systemic diseases [9–12].

Table 1. Description of dental readiness classification

Class	Description
1	Patients with no dental treatment required
2	Patients with dental conditions which are unlikely to result in dental emergencies within 12 months if not treated
3	Patients with dental conditions which require urgent or emergent dental treatment and expected to have dental emergencies within 12 months if not treated
4	Patients with unknown dental conditions

According to research by Lefkowitz et al., which included a telemedicine database of 3,921 seafarers, dental conditions (22.8%) were the most prevalent illness for which assistance was needed, followed by dermatologic (19.9%) and gastrointestinal (16.6%) problems [4]. In addition, a survey of 5,090 calls to Turkish TMAS found that digestive illnesses were the most prevalent causes of contact among seafarers, with dental concerns accounting for 40% of them [5]. A recent study conducted on German-flagged container ships, focusing on medical consultations through the review of medical logbooks, found that respiratory system issues were the most common problem (19.6%), followed by musculoskeletal (13.3%), skin (12.4%), and dental (9.1%) problems [6].

Dental issues are common among seafarers [1–3]. Recent cross-sectional research in India discovered that 59% of seafarers had dental caries [13]. Dental problems such as dentalgia, cracked teeth, and loose teeth are also evident in a study on American seafarers [14]. In a questionnaire study on dental hygiene habits by Mahdi SS et al., it's noteworthy that only 834 out of 2060 participating seafarers brushed their teeth twice a day [15]. Similarly, cross-sectional research in India indicated that over half of the seafarers surveyed brushed their teeth only once daily [16].

Since merchant ships typically lack regular professional dental services onboard, effective management often necessitates a transfer to a land-based dentist [17, 18]. This usually involves ship-to-ship transfers, evacuations by helicopter, or rerouting the ship to the closest port [19, 20]. Repatriating an ill seafarer is a costly operation especially if the vessel is in remote areas [21]. A helicopter evacuation at sea was estimated to cost 25,000 euros for each rescue [22]. In Thailand, an emergency helicopter could cost between 50,000–800,000 Thai baht (1,300–20,700 euros) per flight [19]. Additionally, there are other indirect costs that need to be considered. Therefore, it is essential for seafarers to maintain good oral health and have dental check-ups regularly before embarkation.

Seafarers are susceptible to several dental problems due to poor oral hygiene, excessive sugary food consumption, cigarette and liquor usage, and lack of oral hygiene knowledge and awareness [15, 16, 23, 24]. While there have been substantial studies on the physical and mental health of seafarers, there has been less done on their dental health. This study intends to evaluate the prevalence of dental and periodontal health problems in this seafaring population.

MATERIALS AND METHODS
STUDY SETTING AND PARTICIPANTS

A descriptive cross-sectional study was conducted among 602 Thai seafarers who visited the seafarer outpatient department (OPD) at Somdech Phra Pinklao Hospital for medical certifications before working on board. In our hospital setting, all seafarers' oral examinations were routinely conducted by dentists. We implemented the Dental Readiness Classification (DRC), commonly used for assessing the readiness of military personnel for deployment, to identify the oral health needs of the participants [25]. The DRC system consists of four classes as shown in Table 1. Class 1 is dentally fit, Class 2 needs dental treatment but is unlikely to have dental emergencies within the next 12 months if not treated, and Class 3 is expected to have a dental emergency within 12 months. Individuals with unknown dental conditions are classified in Class 4 [26].

Eligible participants were Thai seafarers aged over 18 years who visited Somdech Phra Pinklao Hospital for medical certificates from November 1, 2021, to October 31, 2023. The exclusion criteria for this study were seafarers who lack oral health data in their medical records, as well as records that are incomplete or unreadable. Additionally, duplicate records were excluded; if a seafarer had more than one visit within six months, only the first recorded dental examination for each seafarer will be included in the study.

SAMPLE SIZE

The target sample size was estimated to be 371, calculated using the Daniel formula: $N = Z^2 \times P (1-P)/d^2$ ($\alpha = 0.05$, $Z = 1.96$, and $d = 0.05$) [27]. The prevalence used in this formula was 59% based on a study conducted in India [13]. Our study covered a total of 602 seafarers using a convenience sampling method.

DATA COLLECTION

The data collection process consists of 5 parts: Part 1 includes demographic data including age, BMI, position on board, smoking and alcohol history, and underlying diseases. Part 2 records dental findings such as decayed, missing, and filled teeth. Part 3 covers periodontal findings including calculus, gingivitis, and periodontitis. Part 4 outlines the dental treatment plan. Lastly, Part 5 focuses on classifying dental readiness among seafarers.

STATISTICAL ANALYSIS

Data analysis was done by STATA/BE 18.0 Software. Continuous variables are presented as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. A chi-square test was performed to check for the association between study variables among the participants. Multivariate logistic regression adjusting for age, department, smoking, alcohol drinking, and BMI was used to explore the association between demographic variables and dental readiness classification. Odds ratios (OR), 95% confidence intervals (CI), and p-values were calculated to determine the strength of these associations. For analysis purposes, dental fitness classification was dichotomized into dentally fit patients (Class 1) and those who require dental treatment or re-evaluation (Class 2 and 3). For all the tests, a p-value less than 0.05 was statistically significant (p < 0.05).

RESULTS

A total of 602 seafarers were included in the study. Baseline characteristics of the population are presented in Table 2. Males made up most of the study sample. The mean age of the participants was 35.3 ± 9.78. Regarding BMI, 40.4% were defined as obese, according to WHO Asia-Pacific region criteria [28]. About thirty-four percent were current smokers and 62.3% reported alcohol drinking. Most of the population were non-officers (64.6%) compared to officers (35.4%). Seafarers classified under other departments were mainly those who carried out support work for officers in both the deck and engine departments, with a smaller portion working in the catering department. In terms of underlying diseases, the prevalence of dyslipidemia, hypertension, impaired fasting glucose, and diabetes mellitus were 25.8%, 6.3%, 9.6%, and 1.7%, respectively.

Dental caries were observed in 43.5% of seafarers as shown in Table 3. The mean (SD) of decayed, missing, and filled teeth were 1.2 (± 2.0), 2.9 (± 3.3), and 1.6 ± (2.8), respectively. There were statistically significant differences in the number of dental caries between officers and non-officers as shown in Figure 1 (p < 0.001).

The prevalence of periodontal disease between officers and non-officers is demonstrated in Table 3. Overall,

Table 2. Demographic data of the participants (n = 602)

Baseline characteristics	n (total = 602)	Frequency (%)
Sex		
Male	600	99.7%
Female	2	0.3%
Age		
< 30	212	35.2%
30–39	207	34.4%
40–49	133	22.1%
≥ 50	50	8.3%
Mean age 35.26 (S.D. = 9.7797)		
BMI		
Underweight (< 18.5)	25	4.1%
Normal (18.5–22.99)	199	33.1%
Overweight (23–24.99)	135	22.4%
Obese I (25–29.99)	193	32.1%
Obese II (≥ 30)	50	8.3%
Smoking		
Yes	205	34.1%
No	397	65.9%
Alcohol drinking		
Yes	375	62.3%
No	227	37.7%
Department		
Deck	179	27.7%
Engine	174	28.9%
Other	249	41.4%
Rank		
Officer	213	35.4%
Non-officer	389	64.6%
Underlying disease		
Dyslipidemia	155	25.8%
Impaired fasting glucose	58	9.6%
Hypertension	38	6.3%
Diabetes mellitus	10	1.7%

calculus was observed in 42% of seafarers. The majority of the officers' periodontal findings were normal, followed by calculus (30.5%) and gingivitis (13.6%). In contrast, non-officers demonstrated lower rates of normal gum health

Table 3. Dental and periodontal findings in seafarers

	Officer n = 213 (%)	Non-officer n = 389 (%)	Total n = 602 (%)	p-value
Dental Caries				
Absent	150 (70.4%)	190 (48.4%)	340 (56.5%)	< 0.001*
Present	63 (29.6%)	199 (51.6%)	262 (43.5%)	
Periodontal findings				
Normal	125 (55.7%)	137(35.2%)	262 (43.50%)	< 0.001*
Calculus	65 (30.5%)	191 (49.1%)	256 (42.50%)	< 0.001*
Gingivitis	29 (13.6%)	79 (20.3%)	108 (17.90%)	0.0405*
General periodontitis	3 (1.4%)	12 (3.1%)	15 (2.50%)	0.201
Localized periodontitis	1 (0.5%)	3 (0.8%)	4 (0.70%)	0.672

All values are expressed as frequency with percentages (in parentheses). Chi-square was used to test the statistical difference of periodontal findings between officers and non-officers; *p ≤ 0.05 is considered statistically significant
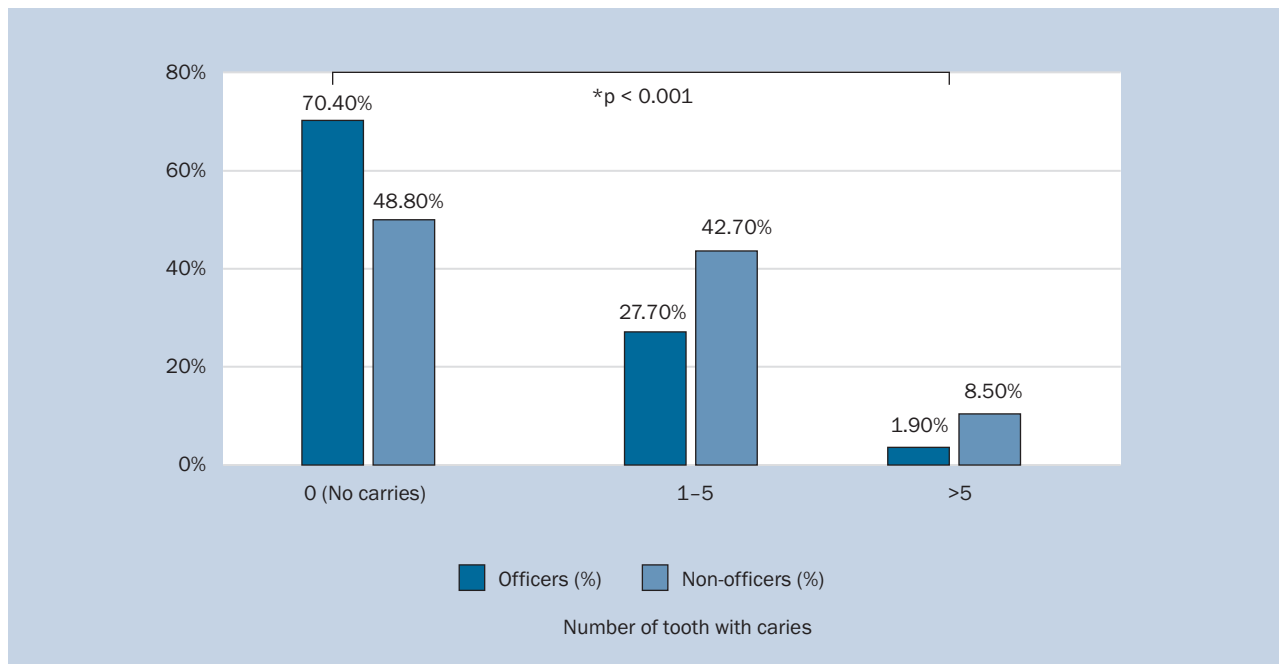

Figure 1. Comparison of number of dental caries between officers and non-officers (%). Chi-square was used to test the statistical difference of dental caries between officers and non-officers

(35.2%) but a higher prevalence of calculus (49.1%) and gingivitis (20.3%).

The distribution of dental readiness classification among seafarers is demonstrated in Figure 2. Nearly half (49.83%) of the population was categorized as Class 1, 44.85% as Class 2, and 5.32% as Class 3. According to our study, non-officers were significantly more likely to be not dentally fit compared to officers (AOR = 2.179, 95% CI: 1.396–3.402, p < 0.001). Additionally, being underweight was significantly associated with a higher likelihood of not being dentally fit compared to those with a normal BMI

(AOR = 3.48, 95% CI: 1.28–9.43, p = 0.014) as shown in Table 4.

Approximately 70% of the population required dental treatment, with dental scaling considered as the most needed treatment for both officers and non-officers, as depicted in Table 5.

DISCUSSION

To our knowledge, this is the first study on dental health status conducted among seafarers in Thailand. The findings of the study highlight several important aspects that require
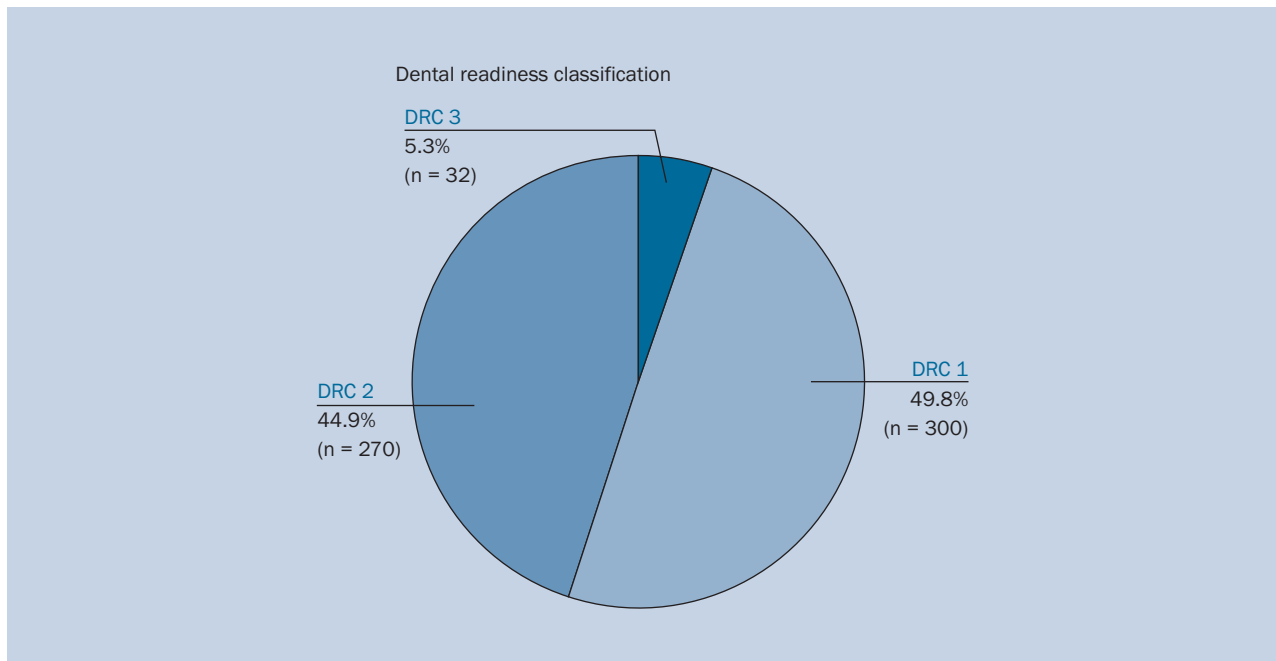
Figure 2. Pie chart represents the distribution of dental readiness classification (DRC) among seafarers

more attention from healthcare providers and the maritime industry.

Several studies found that periodontal diseases were associated with obesity, though the exact mechanisms were still unclear [29, 30]. Approximately 22.4% of our study population were overweight and over 40% were classified as obese. When comparing the results to previous studies, the proportion of obese seafarers was notably higher than previously reported, ranging from 10–18% [31, 32]. This could be attributed to stress-related eating habits, poor diet choices, lack of physical activities, and the consumption of sugary drinks like tea and coffee due to irregular working hours and lifestyle. Targeted interventions are needed to promote healthy behaviors and mitigate the risks associated with obesity among seafarers. Although our study indicates that underweight seafarers were associated with having worse dental health, the small sample size of underweight seafarers (4.1% of the study population) may limit the reliability of drawing this conclusion.

The prevalence of smoking and alcohol consumption among seafarers remains a significant concern, with approximately one-third (34.1%) reported as current smokers and a majority (62.3%) engaging in alcohol drinking. While smoking is a known risk factor correlated with poor dental fitness, our study did not find a significant association between smoking and poor dental health among seafarers. However, it is noteworthy that non-smokers had a higher

proportion of good dental health compared to smokers. To enhance understanding of the relationship between smoking status and dental health in future research, detailed information on smoking habits, including duration of smoking, frequency of smoking, and quantity of cigarettes smoked per day, can provide a better understanding of the impact of smoking on dental health.

Consistent with a previous study in Malaysia [24], a substantial portion (43.5%) of seafarers in our study exhibited dental caries. However, this prevalence was lower than in studies conducted in India, which ranged as high as 59% [13], 82% [33], and 90% [34]. The increased occurrence in India may be due to extensive working hours that sometimes need 24-hour operations. This may lead to increased food and caffeine intake, especially at night.

Seafarers classified under other departments were part of the non-officers group. Non-officers had higher odds of having worse dental health in contrast to officers. Possible explanations include non-officers potentially having lower socioeconomic status, limited access to dental care, and lower health literacy. Additionally, non-officers might be more likely to engage in behaviors that contribute to poor oral health, such as smoking, unhealthy dietary habits, and inadequate oral hygiene practices.

The dental readiness classification results revealed that a significant proportion of seafarers required dental treatment, with approximately 70% of the population classified

Table 4. Factors associated with dental readiness classification among seafarers

Factors	DRC		COR	AOR
	DRC 1	DRC 2&3		
Age				
< 30	106	106	1	1
30–39	96	111	0.87 (0.59–1.27)	1.03 (0.68–1.55)
40–49	71	62	1.15 (0.74–1.77)	1.09 (0.68–1.74)
≥ 50	29	21	1.38 (0.74–2.57)	1.15 (0.60–2.23)
Rank				
Non-officer	235	154	**3.33 (2.34–4.74)***	**2.18 (1.40–3.40)***
Officer	67	146	1	1
Department				
Deck	67	112	1	1
Engine	73	101	1.21 (0.79–1.85)	1.14 (0.73–1.77)
Other	162	87	**3.11 (2.09–4.64)***	**1.81 (1.11–2.93)***
Smoking				
No	175	222	1	1
Yes	127	78	**2.07 (1.46–2.92)***	1.37 (0.91–2.05)
Alcohol				
No	106	121	1	1
Yes	196	179	1.25 (0.9–1.74)	0.93 (0.64–1.35)
BMI				
Underweight (< 18.5)	19	6	**3.40 (1.30–8.87)***	**3.48 (1.28–9.43)***
Normal (18.5–22.99)	96	103	1	1
Overweight (23–24.99)	74	61	1.302 (0.84–2.02)	1.27 (0.80–2.02)
Obese (≥ 25)	113	130	0.93 (0.64–1.36)	1.10 (0.74–1.64)

Bold values indicate statistical significance at p < 0.05 level (*p < 0.05)

COR — crude odds ratio; AOR — adjusted odds ratio; CI — confidence interval

Table 5. Treatment needs of officers and non-officers

Treatment needs	Officers n = 213 (%)	Non-officers n = 389 (%)	Total n = 602 (%)
Required Treatment	125 (58.7%)	297 (76.3%)	422 (70.1%)
Dental scaling	87 (40.8%)	236 (60.7%)	323 (53.7%)
Root planing	3 (1.4%)	8 (2.1%)	11 (1.8%)
Root canal treatment	3 (1.4%)	6 (1.5%)	9 (1.5%)
One surface filling	22 (10.3%)	50 (12.9%)	72 (12%)
Two or more surface filing	32 (15%)	119 (30.6%)	151 (25.1%)
Extraction	34 (16%)	134 (34.4%)	168 (27.9%)
Third molars extraction	29 (13.6%)	112 (28.8%)	141 (23.4%)

as needing intervention. About one-quarter of seafarers needed dental extractions, with most of them involving third molars. Due to the restricted availability of dental treatment on board, seafarers are recommended to undergo third molar extraction. This can help prevent dental issues including impaction and infection during long voyages, minimizing emergency risks, and providing optimal performance at sea.

LIMITATION

There are some limitations in our study. First, the cross-sectional design of the study limits our ability to establish causality between variables. Generalizability may be limited due to the focus on a specific population of seafarers. Also, certain data rely on self-reported information, potentially influencing the results of our study. Furthermore, the lack of detailed information on dietary habits, oral hygiene practices, and physical activity levels among seafarers may limit our understanding of the factors contributing to dental outcomes. Future research incorporating objective measures and longitudinal designs could address these limitations and provide a more comprehensive understanding of the factors influencing the oral health of seafarers.

CONCLUSION

In conclusion, this study emphasizes the prevalence of dental problems among Thai seafarers, revealing a significant burden of dental caries and periodontal disease in this population. A dental examination, ideally conducted by a dentist, should be incorporated into the pre-boarding fitness assessment for all seafarers. Implementing preventive measures, such as providing brochures or playing videos on dental care that include brushing techniques, routine checkups, and lifestyle factors like smoking and diets within outpatient departments (OPDs) while seafarers await a physician, could enhance seafarers' oral health, thereby reducing dental problems at sea.

ARTICLE INFORMATION AND DECLARATIONS

Author contributions: Sirada was responsible for study conceptualization, data collection, data analysis and wrote the manuscript; Narissara, Atipong and Hansa were responsible for data management, supervised the study and revised the manuscript; all authors read and approved the final manuscript.

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