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Assessment of oral health among seafarers in Mundra Port, Kutch, Gujarat: a cross-sectional study

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ABSTRACT

Background: *Seafarer is a person who navigates waterborne vessels or assists as a crewmember in their operation and maintenance in all tough weather, but little research has been done to identify conditions that may lead to assess seafarer general health as well as oral health.*

Aim: *To assess oral diseases including dental caries and periodontal conditions among seafarer's population arrived in Mundra Port, Kutch, Gujarat, India.*

Materials and methods: *A descriptive cross-sectional survey was conducted to assess oral health condition of seafarer community of Mundra Taluka of Kutch District, Gujarat, India, from July 2014 to September 2014.*

Results: *Total of 385 subjects participated in the survey. Adverse habits show the overall 72.3% prevalence among the study population. Occurrence rate of caries, periodontal disease and prosthetic status were 88%, 75.1% and 6.5%, respectively. The best predictors for Decayed Missing Filled Teeth (DMFT), Community Periodontal Index (CPI) and prosthetic status were oral hygiene practices, adverse habit and educational status.*

Conclusions: *Findings of the present study suggest that oral health condition of seafarer community was relatively poor, with high caries prevalence and poor periodontal health. This epidemiological survey has provided baseline information to underpin the implementation of oral health programmes.*

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Key words: oral health, periodontal conditions, dental caries, general health, seafarers

INTRODUCTION

A sailor, seaman, mariner, or seafarer is a person who navigates waterborne vessels or assists as a crewmember in their operation and maintenance. Seafarers hold a variety of professions and ranks, each of which carries unique responsibilities which are integral to the successful operation of an ocean-going vessel. A ship's crew can generally be divided into 4 main categories: the deck department, the engineering department, the steward's department, and others. The official classifications for unlicensed members of the deck department are able seaman and ordinary seaman. With some variation, the chief mate is most often charged with the duties of cargo mate. Second mates are charged with being the medical

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Table 1. The estimated ship traffic in ports

Mundra Port area receiving cargo	No of ships per year by 2013	Nature of cargo
West zone	850	Coal, steel, scrap, chemicals, dry bulk
South zone	220	Dry bulk, oil
North zone	150	Automobiles
East zone	300	Scrap, dry bulk

officer, in case of medical emergency. All 3 mates each do 4-h morning and afternoon shifts on the bridge, when underway at sea [1].

Mariners spend extended periods at sea. Most deep-sea mariners are hired for one or more voyages per year that last for several months. There is no job security after that. The length of time between voyages varies by job availability and personal preference [2, 3].

Seafaring entails working on board ships for a long period of time away from home [4]. An estimated 90% of world trade makes use of maritime transport, depending on more than 1.2 million seafarers to operate ships. Many seafarers ply waters distant from their home. Seafarers and ship-owners are often of different nationalities, and ships often operate under a flag different from their origin or ownership. Seafarers are also frequently exposed to difficult working conditions and particular occupational risks. Working far from home, they are vulnerable to exploitation and abuse, non-payment of wages, non-compliance with contracts, exposure to poor diet and living conditions, and even abandonment in foreign ports. Only standards observed by all seafaring nations can guarantee adequate protection for workers in the world's first genuinely global industry [5].

Seafaring is an exploratory profession with little research has been done to identify conditions that may lead to assess seafarer general health as well as oral health. So an attempt is made to assess seafarer's oral health.

Mundra Port is located in the Northern Gulf of Kutch connected through rail, road, air and pipelines. The Mundra Port currently has multipurpose terminals, container terminals for ships of varying sizes and nature of cargo, facilities for oil tankers and port backup facilities such as open storage area, covered godowns, chemical and oil storage tank farm, etc. This makes it a preferred gateway for cargo bound westwards. The port has been designed to handle all types of cargo viz. containers, dry bulk, break bulk, liquid cargo and automobiles. Mundra Port has a capacity to handle 185 million tonnes of cargo per annum — the largest amongst all operational ports in India. The estimated ship traffic in these ports is listed in Table 1 [6].

It handled 64 million tonnes of cargo in the financial year 2011–2012. It was ranked fourth amongst all commercial ports in India in terms of the total volume of cargo handled in a financial year. It has not only pioneered the concept of deep draft integrated port model, but also of port based special economic zone (SEZ). The multi-product SEZ consisting Mundra Port and its surrounding areas is planned to be spread over 135 km^2 (13,500 hectares). Currently, notified multi-product SEZ is spread over an area of 6473 hectares, with an additional 168 hectares notified as a Free Trade Warehousing Zone [7].

The aim of the present study was to assess oral diseases including dental caries and periodontal conditions among seafarer's population arrived in Mundra Port, Kutch, Gujarat, India.

MATERIALS AND METHODS

STUDY DESIGN, POPULATION AND DURATION

A descriptive cross-sectional study was conducted to assess oral conditions in seafarer's arrived in Mundra Port, Kutch, Gujarat, India.

The duration of the survey was from July 2014 to September 2014.

OFFICIAL PERMISSION AND INFORMED CONSENT

The ethical clearance was given by the Ethical Committee of Pacific Dental College and Hospital, Udaipur, Rajasthan, India (RT52972/29/4/2013). To conduct the study, permission was granted by the Director (officer in charge) of Mundra Port. Written informed consent was taken from all the participants in Mundra Port.

TRAINING AND CALIBRATION

Before the commencement of the study, the examiner was standardised and calibrated by the panel of experts, to ensure uniform interpretations, understanding, and application of the codes and criteria for the diseases to be observed and recorded, and to ensure consistent examination. The intra-examiner reliability for Decayed Missing Filled Teeth (DMFT) and Community Periodontal Index (CPI) were assessed using Kappa statistics, which were found to be 89% and 87%, respectively.

EXCLUSION AND INCLUSION CRITERIA

Exclusion criteria include: (1) Participants who were not interested in oral examination and (2) Participants who were suffering from systemic diseases.

Table 2. Distribution of oral hygiene practices and adverse habits of seafarers

Age groups	Oral hygiene practices				Adverse habits					
	Toothbrush + tooth-paste	Finger + tooth-paste	Sea weeds	Other aids	None	Smoking tobacco	Smoke-less to-bacco	Combi-nation of smoking and smoke-less	Alcohol	Combi-nation of tobacco and alcohol
21–30	14 (19.2%)	18 (30%)	68 (29.8%)	3 (12.5%)	48 (44.9%)	29 (29.9%)	15 (26.8%)	11 (20.8%)	0 (0%)	0 (0%)
31–40	32 (43.8%)	0 (0%)	2 (0.9%)	0 (0%)	12 (11.2%)	11 (11.3%)	3 (5.4%)	2 (3.8%)	5 (9.1%)	1 (5.9%)
41–50	6 (8.2%)	39 (65%)	73 (32%)	1 (4.2%)	40 (37.4%)	16 (16.5%)	12 (21.4%)	19 (35.8%)	25 (45.5%)	244 (17.8%)
51–60	0 (0%)	3 (5%)	58 (25.4%)	20 (83.3%)	7 (6.5%)	27 (27.8%)	14 (25%)	11 (20.8%)	19 (34.5%)	106 (7.7%)
61–70	21 (28.8%)	0 (0%)	27 (11.8%)	0 (0%)	0 (0%)	14 (14.4%)	12 (21.4%)	10 (18.9%)	6 (10.9%)	14 (1%)
Total	73 (18.9%)	60 (15.5%)	228 (59.2%)	24 (6.2%)	107 (27.7%)	97 (25.1%)	56 (14.5%)	53 (13.7%)	55 (14.2%)	17 (4.4%)
P	< 0.001*				< 0.001*					

Test applied: Chi square test, $\chi^2 = 71.33$, df = 16, p = 0.001* (statistically significant)

Inclusion criteria include: (1) Participants who were interested in oral examination and (2) Participants agreed to participate after informed consent.

SURVEY PROFORMA

A survey proforma designed with the help of Word Health Organisation Oral Health Assessment form (2013) [8] consisted of three sections: (1) General information: Demographic data including name, age and education level; (2) Information about oral hygiene practices and adverse habits; (3) Clinical parameters assessed were dental caries (DMFT index), periodontal status (CPI-LOA index) and prosthetic status.

PILOT STUDY

Before the instigation of the main study, a pilot study was conducted carried out among 25 seafarers to determine feasibility of the study and to assess oral disease. Depending upon the prevalence which was obtained (80%), a 95% confidence interval and 5% allowable error, the sample size was determined as 385. The seafarer's included in the pilot study were not involved in the main study.

THE DATA COLLECTION

The examiner visited Mundra Port which was located in Kutch District on predetermined dates according to the schedule. A total of 385 seafarer's who were aged between 21–70 years were examined, among which 364 (94.7%) were males and 20 (5.2%) were females.

STATISTICAL ANALYSIS

The recorded data was analysed by using SPSS (Statistical Package for Social Sciences) version 21 software (SPSS Inc., Chicago, Illinois, USA). The variables were assessed for normality by using Kolmogorov-Smirnov test. Descriptive statistics included computation of percentage, means and standard deviations. Statistical tests applied for the analysis were χ^2 test and Fisher exact test. For all the tests, confidence level and level of significance were set at 95% and 5%, respectively.

RESULTS

Table 2 shows that 28.8% of 61–70 years old subjects used tooth brush and tooth paste/tooth powder and 11.8% of them used sea weeds for cleaning their teeth. Majority (n = 228; 59.2%) of the study population used sea weeds for cleaning their teeth. Adverse habits show the overall prevalence were frequently present (71.9%) among the study population. The prevalence of consumption of smoking tobacco, smokeless tobacco, combinations of smoking tobacco and smokeless tobacco, alcohol and combinations of tobacco and alcohol were 25.1%, 14.5%, 13.7%, 14.2% and 4.4%, respectively.

Table 3 depicts the mean DMFT of the study population as 3.69 ± 1.57. The mean numbers of decayed, missing and filled teeth (FT) per person were 3.09 ± 2.66, 1.07 ± ± 1.64 and 0.3 ± 0.55, respectively. The significantly lowest and highest mean numbers of decayed teeth were reported among 61–70 years (1.19 ± 2.66) and 21–30 years (2.57 ± 1.53), respectively (p = 0.001).

Table 4 shows prevalence of periodontal disease among the study population. Out of 385, 83 (21.5%) study subjects had healthy periodontium. Calculus and shallow pockets (4–5 mm) was demonstrated in 20% and 33.7% of the study subjects, respectively. 4–5 mm and 6–8 mm of loss of attachment were reported with highest prevalence among 41–50 years age group (35.3%) and 51–60 years age group (64.4%), respectively (p = 0.001).

Table 3. Mean (± standard deviation) decayed teeth (DT), missing teeth (MT), filled teeth (FT) and Decayed Missing Filled Teeth (DMFT) according to age groups

Age groups	DT (88%)	MT (40.8%)	FT (24.9%)	DMFT
21–30	2.57 ± 1.53	0.12 ± 0.35	0.6 ± 0.66	1.74 ± 1.59
31–40	1.57 ± 0.53	0.41 ± 0.7	0.24 ± 0.55	1.1 ± 1.53
41–50	1.97 ± 1.18	0.72 ± 1.66	0.24 ± 0.51	1.61 ± 1.38
51-60	1.37 ± 0.81	1.42 ± 1.18	0.15 ± 0.39	1.83 ± 1.94
61–70	1.19 ± 0.93	3.83 ± 1.26	0.13 ± 0.39	2.08 ± 1.14
Total	3.09 ± 2.66	1.07 ± 1.64	0.3 ± 0.55	1.69 ± 1.57
P	0.001*	0.001*	0.001*	0.001*

Test applied: One way ANOVA, p = 0.001* (statistically significant)

Table 4. Prevalence of periodontal disease among seafarers

Age groups	Community Periodontal Index						Periodontal Loss of Attachment (PLOA)				
	Healthy	Bleeding gums	Calculus	Pocket (4–5 mm)	Pocket (≥ 6 mm)	Excluded sextant	0–3 mm	4–5 mm	6–8 mm	9–11 mm	≥ 12 mm
21–30	39 (47%)	20 (44.4%)	28 (21.5%)	13 (16.9%)	3 (7.9%)	0 (0%)	52 (29.9%)	32 (26.9%)	6 (13.3%)	13 (31%)	0 (0%)
31–40	4 (4.8%)	6 (13.3%)	6 (4.6%)	18 (23.4%)	0 (0%)	0 (0%)	16 (9.2%)	18 (15.1%)	0 (0%)	0 (0%)	0 (0%)
41–50	28 (33.7%)	16 (35.6%)	40 (30.8%)	20 (26%)	15 (39.5%)	0 (0%)	65 (37.4%)	42 (35.3%)	10 (22.2%)	2 (4.8%)	0 (0%)
51–60	8 (9.6%)	3 (6.7%)	40 (30.8%)	26 (33.8%)	0 (0%)	4 (33.3%)	26 (14.9%)	15 (12.6%)	29 (64.4%)	10 (23.8%)	1 (20%)
61–70	4 (4.8%)	0 (0%)	16 (12.3%)	0 (0%)	20 (52.6%)	8 (66.7%)	15 (8.6%)	12 (10.1%)	0 (0%)	17 (40.5%)	4 (80%)
Total	83 (21.5%)	45 (11.6%)	130 (33.7%)	77 (20%)	38 (9.8%)	12 (3.11%)	174 (45.1%)	119 (30.9%)	45 (11.6%)	42 (10.9%)	5 (1.2%)
P			< 0.001*						< 0.001*		

Test applied: Chi square test, $\chi^2 = 88.11$, df = 19, p = 0.001* (statistically significant)

Table 5 explains prevalence of the prosthetic status and needs among study population (p = 0.001). Total 94.5% of population had no prosthesis. None of the subjects presented with full removable denture at 21–50 years of age. Greater proportion of subjects (44.4%) in the age group of 31–40 years revealed the presence of bridge (p = 0.001). The significantly highest number of prosthesis like more than one bridge and partial denture were reported among same 41–50 years of age (p = 0.001). Proportion of subjects with no need of prosthesis (92.4%) was significantly lower in study population

Table 6 represents stepwise multiple linear regression analysis with DMFT (decayed missing filled and treatment needs), CPI and prosthetic status as the dependent variables and various independent variables such as oral hygiene practices, adverse habits and educational level. The best predictors in the descending order for DMFT were oral hygiene practices and educational status with variances of 1.1% and 1.3%. The best predictors in the descending order for CPI were oral hygiene practices and educational status, with variances of 3.4% and 4.8%, respectively. The best predictors for prosthetic status in the descending order were oral hygiene practices and adverse habits, with variances of 3.2% and 4.7%, respectively.

DISCUSSION

This descriptive cross-sectional study was conducted among seafarer's arrived at Mundra Port, Kandla, Gujarat. In the mentioned time period of study, a total of 544 seafarers arrived at Mundra Port during study period. Among those who gave the informed consent and fulfilled the inclusion was selected in the survey.

Seafarer of all nationality was arrived in Mundra Port with their respective cargo or transport ships. Maximum seafarers arrived at Mundra Port were from African continent (41.2%) followed by Asian (27.6%), American (13.7%) and other (17.5%), respectively.

The intended purpose of visit to Mundra Port was trade (42.7%), transportation (25.7%), import/export of marine food/ /fishing (19.7%) and others (11.9%), respectively. All the sea-

Table 5. Prevalence of prosthetic status among seafarers

Age groups	Upper arch					Lower arch					
	No prosthesis	Bridge	More than one bridge	Partial denture	Full removable denture	No prosthesis	Bridge	More than one bridge	Partial denture	Both bridge and partial denture	Full removable denture
21–30	101 (26.2%)	2 (0.07%)	0 (0%)	0 (0%)	0 (0%)	99 (34.7%)	4 (1.4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
31–40	30 (10.5%)	4 (1.4%)	2 (0.07%)	0 (0%)	0 (0%)	30 (10.5%)	2 (0.07%)	2 (0.07%)	0 (0%)	0 (0%)	0 (0%)
41–50	113 (39.6%)	2 (0.07%)	3 (1.0%)	4 (1.4%)	0 (0%)	111 (38.9%)	0 (0%)	3 (1.0%)	3 (1.0%)	2 (2.4%)	0 (0%)
51–60	78 (27.3%)	1 (0.03%)	0 (0%)	1 (0.0.3%)	1 (0.07%)	74 (25.9%)	2 (0.07%)	0 (0%)	2 (0.07%)	0 (0%)	3 (1.0%)
61–70	42 (14.7%)	0 (0%)	0 (0%)	2 (0.07%)	4 (1.4%)	42 (14.7%)	0 (0%)	0 (0%)	2 (0.07%)	0 (0%)	4 (1.4%)
Total	364 (94.5%)	9 (3.1%)	5 (1.7%)	7 (2.4%)	5 (1.7%)	356 (92.4%)	8 (2.8%)	5 (1.7%)	7 (2.4%)	2 (2.4%)	7 (2.4%)
P			< 0.001*					< 0.001*			

Test applied: Fisher exact test, p = 0.001* (statistically significant)

Table 6. Stepwise multiple linear regression analysis with Decayed Missing Filled Teeth (DMFT), Community Periodontal Index (CPI) and prosthetic status as a dependent variable

Model	R	R^2	F	P
DMFT				
1	0.11(a)	0.01	4.77	0.000(a)
2	0.24(b)	0.13	10.3	0.000(b)
CPI				
1	0.185(a)	0.034	13.6	0.000(a)
2	0.218(c)	0.048	9.55	0.000(c)
Prosthetic status				
1	0.17(a)	0.032	31.2	0.000(a)
2	0.25(d)	0.047	28.4	0.000(d)

(a) Predictors: (Constant), Oral hygiene practices; (b) Predictors: (Constant), Oral hygiene practices, Educational level; (c) Predictors: (Constant), Oral hygiene practices, Educational status; (d) Predictors: (Constant), Oral hygiene practices, Adverse habits

farer's suffering from different health ailments but only 22.3% visited dentist earlier in their entire life as no oral check-up was done except at some port. Among the seafarers population only 5.1% females arrived at Mundra Port compared to 94.8% males. the reasons behind it was long working hours or days, non-availability of basic health facilities and major threat was security concern for female seafarers.

Due to paucity of literature available on seafarers we complied to compare the finding of present study with other working populations. Almost all the seafarer population, 61 (67.7%) participants were educated up to secondary level. The reasons behind it were because of low level of family income or migration from one place to other places.

We came to know that majority of 228 (59.2%) seafarer participants chewed sea weeds to maintain their oral hygiene as compared to only 73 (18.9%) participants who used toothpaste plus toothbrush to clean their teeth. A likely elucidation could be the research doing by Dr Nicholas Jakubovics et al. of Newcastle University working to develop a new product from seaweed to protect dentures, teeth and gums from bacteria in the mouth. The team are working using an enzyme isolated from bacterium Bacillus licheniformon the surface of seaweed. They found that the isolated enzyme has tremendous potential in teeth cleaning which would provide longer and more effective protection than commercially used toothpaste. The enzyme from the marine bacterium breaks up and removes the bacteria present in plaque and can also prevent the build-up of plaque [9].

Majority of seafarers — 97 (25.1%) participants — were tobacco smokers. The reasons underlying this may be low educational status, occupation involving hard labour, stress, psychological factors and poverty.

Combined tobacco usage (smoking tobacco, smokeless tobacco and combinations of smoking and smokeless tobacco) declared by 206 (53.5%) participants constituted the highest prevalence among the adverse habits observed in salt

lake workers. The tobacco prevalence was lesser than those reported by Nagao et al. [10] among industrial workers in Japan's overseas enterprises in the United Kingdom, Rachiotis et al. [11] among Greek blue and white collar workers (48.4%).

The present study elicited smokeless tobacco use of 56 (14.5%) which was similar to the finding reported by Ansari et al. [12] among power loom workers of Allahabad, India (66.07%). 14.2% of study population had a habit of alcohol and 4.4% used both tobacco and alcohol, which was much lesser (26.3%) than reported by green marble mine labourers of India consuming alcohol [13].

Periodontal disease as assessed by CPI showed a prevalence of 75.1%. It was higher than that obtained in National Oral Health Survey and Fluoride mapping 2002–2003 of India (89.6% in 35–44 years and 79.9% in 65–74 years age groups) [14]. However, the finding is lower than the prevalence obtained among other populations of Greene marble mines workers of Rajasthan, India (98.2%) [13], and of Japanese factory workers (92.6%) [15]. Calculus was most widespread among 41–50 and 51–60 years age group, 40 (30.8%) respectively, whereas shallow periodontal pockets showed highest prevalence among 51–60 years age group (33.8%) confirming the findings of study by Lie et al. [16] among aluminium factory workers.

Periodontal attachment loss was evident among 54.6% of the present study sample, of which, loss of attachment of 4–5 mm was most prevalent 119 (30.9%). This prevalence was much higher than that detailed among the workers at a metal processing plant at Brazil (25.3%) [17].

The mean score of decayed teeth (1.57 ± 0.53) was widespread among 31–40 years age group which was similar with other study conducted by Duraiswamy et al. [18] among green marble mine workers in 2008. This might be due to high consumption of refined carbohydrates and due to sedentary lifestyle which was common among 31–40 years age group. When we compared missing teeth oldest age group (61–70 years) had the highest number of mean score (3.83 ± 1.26) and similar results were found in the study conducted by Seman et al. [19] among elderly people living in Kelantan. The overall oral health status weakens as the age advances which was the main cause for extraction. But the mean score of the FT (0.6 ± 0.66) was highest among youngest age group (21–30 years) because awareness regarding oral health care were more among young age group and they were more conscious about their aesthetics. Still the prevalence of FT was statistically diminishing with increasing age groups because of false belief of extraction rather than restoration in older age groups. However, finding of the study conducted by Anaise [20] among workers of sweet industry in Israel demonstrated the highest FT (5.21 ± 2.76) among 30–39 years age group, which was in contrast with the present study.

Prosthetic status of the study population were found to be 26 (8.9%) and 29 (11.7%) in upper and lower arch, respectively. Among them bridge, more than one bridge, partial denture and full removable denture were present among 9 (2.3%); 5 (1.2%); 7 (1.8%) and 5 (1.7%) and 8 (2%); 5 (1.2%); 7 (1.8%) and 7 (1.8%) for upper and lower arch, respectively. A similar finding was found by the study conducted by Kumar et al. [21] among green marble mine workers of Rajasthan India. The prosthetic need of the study population is approximately similar to Green marble mines workers of Rajasthan (15.5%). The reason might be seafarer's sailed in ocean water almost whole year and there is lack of facilities in their working places i.e. ship or cargo etc.

CONCLUSIONS

It's only an attempt was made to show some insight on the oral health of seafarer's. The cumulative lifetime exposure to oral health promoting or oral health damaging environments are most accurate explanations for observed oral health differences between population groups. Also, population in such socially deprived communities have competing priorities for limited quantity, lack of nutritional knowledge and lack of appropriate information on marine foods may contribute to dietary choices that are not conducive to generating or maintaining health. This epidemiological survey has provided baseline information to underpin the implementation of oral health programmes. In spite of formulating so many policies and legislations on the health of seafarer's worldwide; the issue related to occupational health protection largely remained unresolved because of lack of infrastructure to address the problem and lack of investment. Considering the absence of basic oral health care regime, a special program should be developed to improve the dental awareness and the oral conditions of this population. There is also a need to develop evidence based methods which can assess the occupational health risks and develop intervention to improve the usage of protective devices like masks, Gloves, Helmets etc. Actions should be taken to minimize occupational hazards to the teeth and oral structures and to secure restoration of any damage which might have occurred from such sources.

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