Original Article

An epidemiological study to assess periodontal status among sugar factory workers of Karad taluka using community periodontal index

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Abstract

Objectives: Oral health is an integral component of general health. Periodontal disease is one of the most prevalent dental diseases among the population. Researchers have identified an association of various risk factors with periodontal disease. The study aimed to assess the periodontal status among the sugar factory workers of Karad taluka. **Materials and Methods:** The study was conducted among 1200 subjects in the age group of 25-54 years. Personal and sociodemographic data were recorded in the proforma based on the WHO oral health survey form (1997). Periodontal status was assessed using community periodontal index (CPI). For statistical analyses, Chi-square test and Multiple Logistic Regression analyses was performed. **Results:** The sociodemographic characteristics (age, sex, and socioeconomic status) and deleterious habits like tobacco chewing and smoking were found to be significantly associated with the CPI and LoA scores for the population ($P < 0.00001$). **Conclusion:** The analysis of the results obtained in this epidemiological study evidenced that periodontitis is prevalent among the sugar factory workers of Karad taluka. There is a need for emphasis on the preventive care.

Keywords: Community periodontal index, loss of attachment, periodontal health, sugar factory workers

Introduction

Oral health being an integral component of general health has impact on health and quality of life. Gingival and periodontal diseases in their various forms have affected human health since the dawn of history. Studies in paleopathology have indicated destructive periodontal disease as evidenced by bone loss in early humans.[1] Periodontal diseases are the major dental problems, which affect people worldwide.[2] The extent and the severity of periodontal disease vary according to various demographic variables and other factors.[3]

Many studies and research found that not all cases of gingivitis developed into periodontitis. The progression of the disease is dependent on the exposure of individuals to various local, environmental and genetic risk factors. Risk factor assessment is very important for prevention and control of the periodontal disease. Various risk factors such as age, education, occupation and deleterious habits like smoking and areca nut chewing have been reported to have a significant influence on the periodontal status of the population.[4,5]

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In recent years industrial health programs have recognized the necessity of maintaining oral health and have emphasized the need for special precautions to prevent oral diseases. The developing country like India, which is undergoing social changes have shown increased trend in severity of oral diseases.[6] In the current study, subjects working in sugar factory at Karad taluka (Taluka is administrative divisions of India denoting a sub-district which consist of multiple villages and a few towns; https://en.wikipedia.org/wiki/Talukas_of_India) were selected. The health programs in this taluka are limited to the basic health services not including the oral healthcare to the common people. Hence, the present study was conducted to assess the periodontal status and correlate the presence of risk factors and prevalence of the periodontal disease among sugar factory workers of Karad.

Material and Methods

In the present study, a total of 1200 sugar factory workers of Karad were included. The study subjects were divided into three age groups: 25-34 years, 35-44 years and 45-54 years. Institutional ethical clearance was obtained before commensuration of the study (Ref. No: KIMSDU/IEC/01/2013). Out of 1200 selected samples, 27 subjects were excluded from the study as they were either complete denture wearers or completely edentulous or who were not willing to participate. All the remaining 1173 people consented to participate in the study. An interview and oral examination with the help of proforma prepared for the study was conducted for the collection of the data. Personal data and information regarding oral hygiene and adverse habits of each subject were recorded in the proforma. Socioeconomic status was evaluated by Kuppuswamy's socioeconomic status scale.[7] The recording of data was based on the World Health Organization (WHO) oral health survey form (1997) that comprises coding for each parameter. Clinical examination with adequate sterilization procedure was performed by single examiner. Intra examiner calibration was performed before the study. The intra examiner degree of agreement [k = 0.91, 0.86, 0.84, and 0.81] for calculus detection, bleeding on probing, probing depth and clinical attachment loss, respectively. CPI-C-Periodontal Probe [Technical report series (TRS) 621] was used for assessment of periodontal status using community periodontal index (CPI) and loss of attachment (LOA). The dentition was divided into six sextants defined by tooth numbers 17-14, 13-23, 24-27, 37-34, 33-43, and 44-47. A sextant was examined only if there were two or more teeth present and was not indicated for extraction. When only one tooth remained in a sextant, it was excluded. Only ten index teeth were examined.[8]

Statistical analysis

The data collected were analyzed using SPSS 21 (Statistical Package for the Social Sciences 21, IBM Corporation, United States). The Chi-square test was carried out to compare the CPI and LoA scores according to various demographic characteristics. Multiple Logistic Regression analysis was used to establish the factors that significantly contributed to the periodontal disease. The level of significance was set at $P < 0.05$.

Results

[Table 1] shows the Demographic information of the study subjects. Among 1173 subjects, 75.62% were males, 52.09% from the age group of 25-34 years, 86.87% educated up to secondary level and 67.52% belonged to upper lower socioeconomic status.

[Table 2] represents the significant differences in the periodontal status among the study population, according to age, oral hygiene practice, adverse habits and the level of education. The age group (45-54 years) revealed significantly highest prevalence of the destructive periodontal disease (pockets 4-5 mm: 80.77%) ($p = 0.00001$). In relation to the oral hygiene practice, those who brushed once in a day showed the utmost prevalence of the periodontal pockets (38.01% with pockets of 4-5 mm) ($p = 0.00001$). The smokers (64.76%) and alcohol consuming subjects (64.58%) depicted the highest prevalence of the pockets of 4-5 mm and followed by the tobacco chewers (51.52%). The highest prevalence of bleeding gums (64.92%) was demonstrated in subjects with no habits. A significant gender difference was evident in the periodontal status (48.93%).

[Table 3] highlights the significant variations in the loss of attachment according to the age, socioeconomic status, oral hygiene practice, adverse habits and gender. The highest frequency of a 4-5 mm loss of attachment was evident among the subjects who belonged to the upper lower group (73.61%), in the age group of 25-34 years (76.60%), among those who brushed once a day and with one or the other adverse habits ($p = 0.00001$). Males depicted a greater preponderance of LOA than the females ($p = 0.0001$).

[Table 4] illustrated that odds ratio of age, sex, education, systemic conditions, diet, smoking habits 8.97, 0.05, 0.5, 4.65, 2.23, and 1.92, respectively. All these factors were significant predictors of CPI scores.

Table 1: Distribution of demographic variables

Distribution of study respondents by age groups			
Age group (years)	**No of respondents**	**% of respondents**	**Total *n* (%)**
25-34	611	52.09	1173 (100)
35-44	354	30.18	
45-54	208	17.73	
Distribution of study respondents by sex			
Male	887	75.62	1173 (100)
Female	286	24.38	
Distribution of study respondents by literacy levels			
Illiterate	15	1.28	1173 (100)
Up to secondary level	1019	86.87	
Above secondary level	139	11.85	
Distribution of study respondents by socioeconomic status			
Upper middle	40	3.41	1173 (100)
Lower middle	341	29.07	
Upper lower	792	67.52	

Table 2: Periodontal status assessment using CPI scores according to various characteristics

Characteristics	Score 1 *n* (%)	Score 2 *n* (%)	Score 3 *n* (%)	Total *n*	*p*
Age group (years)					
25-34	212 (34.70)	299 (48.94)	100 (16.37)	611 (52.08)	*p*=0.00001*
35-44	51 (14.41)	132 (37.29)	171 (48.31)	354 (30.17)	
45-54	6 (2.88)	34 (16.35)	168 (80.77)	208 (17.73)	
Sex					
Male	87 (9.81)	366 (41.26)	434 (48.93)	887 (75.61)	*p*=0.00001*
Female	182 (63.64)	99 (34.62)	5 (1.75)	286 (24.38)	
Literacy level					
Illiterate	2 (13.33)	6 (40.00)	7 (46.67)	15 (1.27)	*p*=0.8271
Up to secondary level	237 (23.26)	400 (39.25)	382 (37.49)	1019 (86.87)	
Above secondary level	30 (21.58)	59 (42.45)	50 (35.97)	139 (11.84)	
Socioeconomic status					
Upper middle	1 (2.50)	11 (27.50)	28 (70)	40 (3.41)	*p*=0.00001*
Lower middle	26 (7.62)	99 (29.03)	216 (63.34)	341 (29.07)	
Upper lower	242 (30.56)	355 (44.82)	195 (24.62)	792 (67.51)	
Frequency of brushing habits					
More than twice a day	0 (0)	3 (50)	3 (50)	6 (0.51)	*p*=0.0411*
Twice a day	14 (34.15)	19 (46.34)	8 (19.51)	41 (3.49)	
Once a day	255 (22.65)	443 (39.64)	428 (38.01)	1126 (95.99)	
Smoking habit					
Smoker	11 (2.17)	168 (33.07)	329 (64.76)	508 (43.30)	*p*=0.00001*
Nonsmoker	258 (38.80)	297 (44.66)	110 (16.54)	665 (56.69)	
Other Habits					
None	198 (64.92)	100 (32.79)	7 (2.30)	305 (26)	*p*=0.00001*
Tobacco chewing	52 (6.89)	314 (41.59)	389 (51.52)	755 (64.36)	
Areca nut chewing	17 (26.15)	36 (55.38)	12 (18.46)	65 (5.54)	
Alcohol consumption	2 (4.17)	15 (31.25)	31 (64.58)	48 (4.09)	

*Significant

[Table 5] analysis depicts odds ratio of age, education, frequency of brushing, diet, smoking habits, other habits 8.4, 0.4, 0.02, 13.08, 9.3, and 8.4, respectively, and are significant predictors of LOA scores.

Discussion

Health is of paramount importance in today's world. Presentation of disease-free dentition is a noble challenge, but unfortunately very few remain in this pristine state of health. As WHO says – the enjoyment of the highest attainable standards of health is one of the fundamental rights of every human being without distinction of race, religion, economic and social conditions. Oral health being an integral component of general health status has a role in the improvement of quality of life. But the present status of dental diseases in the developing countries is apparently unable to change their epidemiological picture.

In recent years, industrial health programs have recognized the necessity of maintaining oral health and have emphasized the need for special precautions to prevent the oral diseases. This is mainly because of the results of a few studies that showed a high prevalence of dental disease among industry workers.[9]

Though winds of change are sweeping the modern world, there is no or minimal impact on dental field in developing countries. The percentage of income spent on medical care has been increased in the last few decades but similar improvement is not noticed in dental care.

Among dental care management, periodontal disease is the most widely spread condition requiring special attention. To assess periodontal conditions, Community Periodontal Index of Treatment Needs (CPITN) was developed as a method in both epidemiological studies and general dental health practice. CPITN is an established index and has generated considerable data to identify periodontal conditions in different populations. The use of this index although simple, quick and highly reproducible compared to the earlier indices used for evaluation of periodontal status, it is now considered insufficient when assessing periodontal conditions.[10]

Many investigators pointed out that the depth of the periodontal pocket does not show the extent of attachment loss. This may result in severe underestimation of periodontal treatment needs in younger individuals. To overcome these limitations, the protocol for International Collaborative Study on Oral Health (ICS–II) included a method for measuring attachment loss and treatment needs were deleted. The new index called CPI with attachment loss has been included in the WHO oral health surveys basic methods (1997).[8,11]

Epidemiological studies aid in the diagnosis of community-based problems of health and disease. Epidemiological studies evaluate the need and effectiveness of health services and also help to

Table 3: Periodontal status assessment using LOA scores according to various characteristics

Characteristics	Score 0 *n* (%)	Score 1 *n* (%)	Score 2 *n* (%)	Total *n* (%)	*p*
Age group (years)					
25-34	143 (23.40)	468 (76.60)	0 (0)	611 (52.08)	*p*=0.00001*
35-44	23 (6.50)	262 (74.01)	69 (19.49)	354 (30.17)	
45-54	2 (0.96)	92 (44.23)	114 (54.81)	208 (17.73)	
Sex					
Male	51 (5.75)	655 (73.84)	181 (20.41)	887 (75.61)	*p*=0.00001*
Female	117 (40.91)	167 (58.39)	2 (0.70)	286 (24.38)	
Literacy level					
Illiterate	0 (0)	10 (66.67)	5 (33.33)	15 (1.27)	*p*=0.17656
Up to secondary level	145 (14.23)	714 (70.07)	160 (15.70)	1019 (86.87)	
Above secondary level	23 (16.55)	98 (70.08)	18 (12.95)	139 (11.84)	
Socioeconomic status					
Upper middle	2 (5)	24 (60)	14 (35)	40 (3.41)	*p*=0.00001*
Lower middle	14 (4.11)	215 (63.05)	112 (32.84)	341 (29.07)	
Upper lower	152 (19.19)	583 (73.61)	57 (7.20)	792 (67.51)	
Frequency of brushing habits					
More than twice a day	0 (0)	4 (66.67)	2 (33.33)	6 (0.51)	*p*=0.0033*
Twice a day	14 (34.15)	23 (56.10)	4 (9.76)	41 (3.49)	
Once a day	255 (22.65)	795 (70.08)	177 (15.72)	1126 (95.99)	
Smoking habit					
Smoker	2 (0.39)	352 (69.29)	154 (30.31)	508 (43.30)	*p*=0.00001*
Nonsmoker	166 (24.96)	470 (70.08)	29 (4.36)	665 (56.69)	
Other Habits					
None	132 (43.28)	172 (56.39)	1 (0.33)	305 (26)	*p*=0.00001*
Tobacco chewing	22 (2.91)	569 (75.36)	164 (21.72)	755 (64.36)	
Areca nut chewing	13 (20)	49 (75.38)	3 (4.62)	65 (5.54)	
Alcohol consumption	1 (2.08)	32 (66.67)	15 (31.25)	48 (4.09)	

*Significant

Table 4: Multiple logistic regression analysis of CPI scores

Variables	Odds Ratio	*P*	95% CI for odds	
			Lower	Upper
Age (<35 years vs>35 years)	8.9799	0.00001*	6.3316	12.7359
Sex (M vs F)	0.0540	0.00001*	0.0123	0.2376
Education (Yes vs No)	0.5182	0.0150*	0.3052	0.8799
SES (Low vs High)	1.6912	0.2380	0.7065	4.0483
Systemic condition (Yes vs No)	4.6504	0.0380*	1.0886	19.8672
Frequency of brushing (2+vs 1)	0.7585	0.6160	0.2574	2.2350
Diet (Mixed vs Veg)	2.2313	0.0050*	1.2737	3.9091
Smoking habits (Yes vs No)	1.9298	0.00001*	1.3402	2.7787
Other habits (Yes vs No)	2.3766	0.1920	0.6472	8.7274

*$p<0.05$, Significant

search for causes of disease and of health by observation of group habits, customs and models of life. [4] Epidemiological studies provide new opportunities for prevention, treatment planning and improving the effectiveness and efficiency of health services through longitudinal studies. Knowledge derived from epidemiological studies is being applied not only for the prevention of diseases but also for the promotion of positive health.

Most of the health programs in this taluka are limited to the basic health services, not including oral health care to the common people. This study will assess the periodontal status, associated with various risk factors that will provide an essential basis for promoting primary oral health care programs and will identify the areas wherein preventive measures can be applied to aid in the betterment of overall health of the population.

A total of 1173 subjects examined revealed that periodontitis is prevalent in the sugar factory workers of Karad taluka, as 37.3% of the total population had pockets of 4-5 mm (score 3) in terms of CPI score and 70.08% with LOA of 4-5 mm (score 1).

When age was taken into consideration, several studies have shown that in both emerging and industrialized countries, the pocket depth is a reasonably accurate reflection of attachment loss up to roughly age 40 years. As age progresses, attachment loss continues to increase. When the periodontal status was evaluated the age group of 45-54 years had poorer periodontal health. They had more percentage of sites with periodontal pockets with 4-5 mm. These findings corroborate with earlier studies in which they showed that subjects over the age of 40 years had more periodontal destruction.[12-14]

The present study also demonstrated a relationship between the level of education and periodontal status. The subjects who had up to or above secondary level of education had fewer sites with deep pockets compared to the illiterate group. Shwarz *et al.* and others

Table 5: Multiple logistic regression analysis of LOA scores

Variables	Odds Ratio	*P*	95% CI for odds	
			Lower	Upper
Age (<35 years vs>35 years)	8.4583	0.00001*	4.8815	14.6559
Sex (M vs F)	0.9473	0.9010	0.4032	2.2254
Education (Yes vs No)	0.4981	0.0480*	0.2499	0.9928
SES (Low vs High)	0.6151	0.5950	0.1023	3.6976
Systemic condition (Yes vs No)	0.4524	0.0970	0.1771	1.1559
Frequency of brushing (2+vs 1)	1.6905	0.0250*	1.0670	2.6783
Diet (Mixed vs Veg)	13.0899	0.00001*	3.0927	55.4024
Smoking habits (Yes vs No)	9.3307	0.00001*	3.8016	22.9013
Other habits (Yes vs No)	8.4583	0.00001*	4.8815	14.6559

*$p<0.05$, Significant

studies have shown that subjects with lower level of education had poorer oral health compared to the educated group.[15,16]

When the male subjects were compared to the female subjects it was seen that the male population had a poor oral hygiene than females ($p = 0.00001$). The poor oral hygiene could be attributed to the fact that most of the male population among the sugar factory workers was smokers. A clinical survey of periodontal conditions in Greece by Anagou *et al.* showed that the males had high plaque and bleeding scores.[17] Similar findings were also found in other studies wherein males were significantly associated with severe periodontitis.[13,16]

Socioeconomic status also affects the lifestyle of an individual and indirectly can affect the oral health status also. The present study found a significant co-relation when the socioeconomic status of sugar factory workers was compared to the periodontal status. Subjects with upper middle and lower middle class had more periodontal destruction. Loe *et al.*[5] compared 565 Norwegian male students and teachers, with 480 Sri Lankan tea laborers. He found that the Norwegian group showed better oral hygiene and mean loss of attachment was less than 1 mm. On the other hand, Sri Lankan tea laborers showed poor oral hygiene and the mean loss of attachment was more than 3 mm. Similar observation made by studies showed that poor educational background and low socioeconomic status was responsible for the increased prevalence of the periodontal disease.[18-20]

Subjects with systemic disease had poorer periodontal status compared to systemically healthy adults. Systemic diseases have a direct as well as an indirect influence over the periodontium as proven by an ample number of studies. In the present study, similar finding was observed wherein a significant value was obtained when the presence of systemic condition was correlated with CPI and LOA.[21]

Salvi *et al.*[22] in their studies have shown that diabetic individuals demonstrated a hyperinflammatory response to a comparable bacterial challenge. Diabetic individuals are 2.81 fold more susceptible to periodontal disease when LOA is taken into consideration and 3.43 times more susceptible to periodontal disease when bone loss is taken into consideration.[23]

Nutritional deficiencies can also affect the condition of the periodontium and thereby may accentuate the deleterious effects of plaque-induced inflammation in susceptible individuals. In the present study, the mixed diet pattern subjects showed 44.85% of CPI score 3 and 72.48% with LOA score 1. Similar findings were observed in the study by Legott *et al.* wherein they found in mixed diet pattern patients had the pocket depth of 4-5 mm or more.[24]

Smoking is another risk factor found in cases of severe periodontal disease. A wealth of data has been presented by various studies demonstrating that, off all the risk factors identified, smoking may be the risk factor strongly associated with periodontitis.[25] Studies have reported that non-smokers, in general, had less periodontal destruction compared to smokers. Palmer *et al.* found that smoking exerts effects on fibroblasts, leukocyte function, immune system, suppresses IgG2 in periodontitis patients and alters the short-term oxidation-reduction potential on plaque and increase the proportion of gram-negative bacteria.[26] Axelson *et al.* concluded in their study that smokers had the largest mean probing attachment loss in all age groups and smoking is a significant risk indicator for tooth loss and probing attachment loss.[27] The findings of the present study revealed an increased prevalence of CPI and LOA scores among smokers. These findings are similar to the studies conducted by Preber H *et al.*[28] and Visvanathan R *et al.*[29] who reported that smoking increases the prevalence of periodontal disease significantly.

The results of the present study are similar to the findings of other studies, which showed that subjects with the habit of tobacco consumption in chewable forms and betel nut chewing had more sites with periodontal destruction, and further associated with loss of attachment and mobility.[30-32]

Chang *et al.*[33] in his study has shown the adverse effects of arecoline on human periodontal ligament fibroblasts. Arecoline also inhibits cell attachment, cell spreading and cell migration to decrease cell growth and collagen synthesis in human cultured periodontal fibroblasts. There is also a cholinergic effect of betel quid together with calcium in saliva that leads to increased deposition of calculus. Areca nut extracts also modulate the expression of alkaline phosphatase and receptor activator of nuclear factor kappa β ligand in osteoblasts. Areca nut extracts affected the morphology and viability of osteoblasts.[34,35] In the present study, subjects with the habit of tobacco use showed more of probing depth and loss of attachment and those who used areca nut had more of calculus deposition.

Conclusion

The present study points towards an average periodontal health status among the sugar factory workers, with deterioration

of the periodontal status with age and females having better periodontal status compared to males. The lower educational and socioeconomic status, use of tobacco in different forms has led to more periodontal destruction. All of the above-mentioned parameters could act as possible risk indicators for periodontal disease.

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Conflicts of interest

There are no conflicts of interest.

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