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Research Article

Periodontal Disease In Coal Mine Workers

Prevalence of Periodontal Disease Among Coal Mine Workers in Tamilnadu

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Abstract: Coal miners are predisposed to poor oral hygiene and the resulting dental diseases. we planned to investigate the factors that contribute to the prevalence and severity of periodontal disease among Tamil Nadu coal mine workers. 1500 coal mine workers over the age of 18 were enrolled. A proforma was used to record information about socioeconomic status and habits, followed by a clinical examination that included periodontal parameters such as probing pocket depth (PPD), clinical attachment level (CAL), number of missing teeth, and periodontal screening and recording index (PSR). The study population was divided into three age groups. On analyzing the influence of age on the periodontal health, of the participants, PPD, PSR, and the number of missing teeth were found to be higher in the age group of 51-60 years and CAL was found to be higher in the age group of 41-50 years. Also, the periodontal health of the subjects was influenced by their tobacco usage. The PPD and PSR was found to be higher among past smokers than current users of smokeless tobacco. The number of missing teeth was found to be higher among current users of the smokeless form and clinical attachment level was found to be higher among current users of both forms of tobacco. Our findings indicate that periodontal disease was more prevalent among coal mine workers in Tamil Nadu than in the general population. This highlights the importance of including oral health education and tobacco cessation programs to educate workers on the importance of periodontal health and treatment.

Keywords: Dental, Hygiene, Workers, Coalmines and Smoking

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1. INTRODUCTION

Periodontitis is a multifactorial disease affecting the supporting structures of teeth.[1] The pathogenesis of periodontitis is greatly influenced by the presence of risk factors. Risk factors may be environmental, behavioural or biological factors that, when present, increase the likelihood that an individual will develop the disease. These factors play an important role in an individual's response to periodontal infection. Occupation, an environmental factor, plays an important role in determining oral and periodontal health. The nature and duration of work has an impact on both systemic and oral health. It is reported that people working in battery industry are more prone for skin diseases and respiratory diseases.[3] And the people working in stone mine[4] and granite mine industry[5] are more prone for dental abrasion and people working in chocolate industry[6] are more prone for dental caries. It is reported that among leather factory workers, ergonomic factors like working posture, lifting of heavy weight, standing for a long duration, holding a machine for a long time, have influence on their stress level leading to neglect of oral hygiene practices and drives them for deleterious habits.[7] Another prevalence study among workers in manufacturing unit demonstrated that tobacco usage was higher among the workers when compared with the normal population because of job stress, hazardous working conditions and pace of work[8]. Occupational stress (job stress) is a psychosocial disorder which is an impact of the interaction between the worker and his work environment. This in turn affects both the general and periodontal health of workers. Occupational stress is high among coal mine workers. Coal mining production occurs throughout the week. The workers are engaged in tedious work around the clock and work in rotating shifts in deep, open pits leading to stressful working environment and to combat with the stress they drive themself to consume alcohol and tobacco. These substances may further lead to the deterioration of their oral health that leading to periodontal diseases[9]. There is one study assessing oral periodontal status of coal mine workers in India. That study conducted among Telangana coal mine workers showed that 94.4% had unhealthy periodontium[10]. To the best of our knowledge, there are no studies assessing prevalence and severity of periodontitis among coal mine workers in Tamil Nadu. In lieu with the above lacuna, the aim was to study the factors that contribute to the prevalence and severity of periodontal disease among coal mine workers in Tamil Nadu.

2. MATERIALS AND METHODS

The present study was carried out at NLC, India Limited, Tamil Nadu. This study was approved by the Institutional review board (IRB) and the Institutional ethical committee (IEC) of Indira Gandhi Institute of Dental Sciences, Sri Balaji Vidyapeeth, Puducherry. IEC No: IGIDSIRB2016 NDP30PGVBPAI.

2.1 Sample Size Calculation

Sample size was calculated using standardized statistical software G Power 3.0. Considering 95% of prevalence from the previous study by Mohamed et al.,[110] using the formula $n \geq Z^2_{1-\alpha/2} \times p(1-p) \div d^2$, the sample size is calculated as 1268 subjects.

2.2 Study Design

A total of 1500 coal mine workers were enrolled. Information regarding socioeconomic status, habits, followed by clinical examination which included periodontal parameters like probing pocket depth (PPD), clinical attachment level (CAL), number of missing teeth and periodontal screening and recording index (PSR) were recorded using a proforma.

2.3 Subjects Selection

2.3.1 Inclusion Criteria

1. Participants with age group of > 18 years
2. Only males were included
3. Participants should have atleast 10 natural teeth excluding third molars

2.3.2 Exclusion Criteria

1. Participants with systemic diseases
2. Participants who underwent periodontal therapy in the past 6 months

2.4 Clinical Examination

Periodontal examination comprised of probing pocket depth (PPD) at six sites (mesiofacial, midfacial, distofacial and the corresponding lingual/palatal surfaces) around the teeth, clinical attachment level (**CAL)**, number of missing teeth and periodontal screening and recording index (PSR). All the parameters were recorded by a single examiner. (Fig.No.1)

2.5 Calibration

Two examiners trained and calibrated in the Department of Public Health Dentistry performed oral examinations on all study participants. The calibration and training was given by people with needed qualification and expertise till the trainers were adequately competent.

2.6 Lighting and Examination Surroundings

To avoid congestions and interference, a spotless and uncongested location was chosen for the examination. The employees/workers were made to sit in a chair in an area with plenty of natural light. The examiner was given easy access to a table with instruments as well as other armamentaria. Diagnostic oral examinations were performed by dental surgeons who had previously been trained and calibrated.

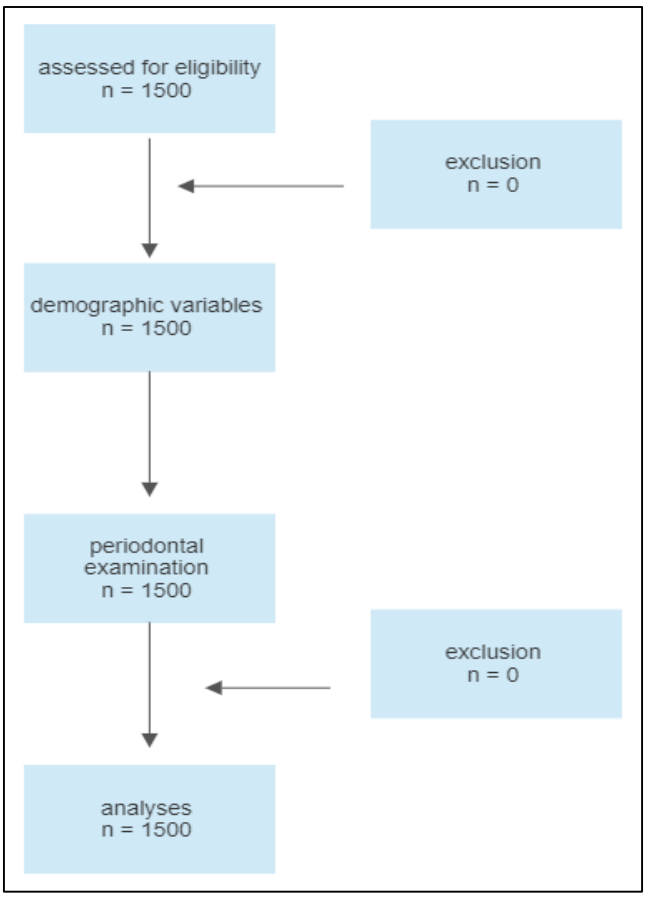
2.7 *Periodontal Screening and Recording Index (PSR)*

The periodontal status of the participants was assessed by periodontal screening and recording index (PSR). A specially designed probe that has a 0.5 mm ball tip and is color-coded from 3.5 to 5.5 mm was used. The patient's mouth was divided into six sextants (maxillary right, anterior and left; mandibular left, anterior and right). Each tooth was probed at six sites. The deepest finding was recorded in each sextant.

3. STATISTICS ANALYSIS

All data were entered in an excel chart and exported to SPSS version 21 software (USA) the mean and SD were analyzed with student t tests. E.g Demographic variables age. The non-parametric data were analyzed with Mann Whitney U tests and corelative analyses with Pearson correlation analyses. A p value of less than 0.05 was considered significant.

Consort flow chart of the study



4. RESULTS AND OBSERVATIONS

In the present cross-sectional survey, 1500 coal mine workers were enrolled on the basis of inclusion and exclusion criteria. Information regarding socioeconomic status and habits, followed by clinical examination including periodontal parameters like probing pocket depth (PPD), clinical attachment level (CAL), number of missing teeth and periodontal screening and recording index (PSR) were recorded using a proforma. In this study, participants >18 years upto 60 years of age were enrolled. They were stratified into four groups according to their age as follows: 20-30 years, 31-40 years, 41-50 years and 51-60 years. Out of the 1500 subjects, 294 (19.6%) of them belonged to 20-30 years age group, 673 (44.9%) belonged to 31-40 years age group, 512 (34.1%) of them belonged to 41-50 years age group and 21 (1.4%) belonged to 51-60 years age group. (Table 1)

Table 1: Distribution of the study subjects based on age group

Age group	Number of study subjects - n (%)
20-30 years	294 (19.6%)
31-40 years	673 (44.9%)
41-50 years	512 (34.1%)
51-60 years	21 (1.4%)

The study participants were categorized based on their tobacco form usage pattern as follows: non-users, current users of both tobacco and smokeless tobacco, past smokers with current users of smokeless tobacco, current users of smokeless form alone, current smokers without smokeless and former smokers without smokeless. The influence of age on probing pocket depth, clinical attachment level, periodontal screening and recording index and edentulousness was assessed. The mean probing pocket depth was found to be higher among 51-60 years age group (5.06 ± 0.54 mm) and lower for 20-30 years age group (4.48 ± 0.88 mm) respectively. This difference in mean PPD with regard to age of the study subjects was found to be statistically highly significant ($p < 0.001$). (Table 2)

Table 2: Influence of age on periodontal health of the subjects

Periodontal parameter	Age group	Mean ± Standard Deviation	p value
PPD (mm)	20-30 years	4.48 ± 0.88	< 0.001
	31-40 years	4.63 ± 0.85	
	41-50 years	4.93 ± 0.68	
	51-60 years	5.06 ± 0.54	

CAL (mm)	20-30 years	4.53 ± 0.90	0.001
	31-40 years	4.69 ± 0.87	
	41-50 years	6.06 ± 2.36	
	51-60 years	5.13 ± 0.54	
PSR	20-30 years	3.42 ± 0.77	< 0.001
	31-40 years	3.53 ± 0.69	
	41-50 years	3.73 ± 0.54	
	51-60 years	3.85 ± 0.30	
No. of missing Teeth	20-30 years	1.36 ± 0.54	0.211
	31-40 years	1.40 ± 0.89	
	41-50 years	1.65 ± 0.92	
	51-60 years	1.80 ± 0.46	

The mean clinical attachment level was found to be higher among 41-50 years age group (6.06 ± 2.36 mm) and lower for 20-30 years age group (4.53 ± 0.90 mm) respectively. This difference in mean CAL with regard to age of the study subjects was found to be statistically significant (p = 0.001). (Table 2). The mean periodontal screening and recording index value was found to be higher among 51-60 years age group (3.85 ± 0.30) and lower for 20-30 years age group (3.42 ± 0.77) respectively. This difference in mean PSR with regard to age of the study subjects was found to be statistically highly significant (p < 0.001). (Table 2). The mean number of missing teeth was found to be higher among 51-60 years age group (1.80 ± 0.46) and lower for 20-30 years age group (1.36 ± 0.54) respectively. This difference in mean number of missing teeth with regard to age of the study subjects was not statistically significant (p = 0.211). (Table 2). The periodontal status was assessed by periodontal screening and recording index. Out of the 1500 subjects, majority of them (82.67%) had PSR score of 4, followed by score 2 (9.73%), score 3 (7.2%), score 1 (0.33%) and score 0 (0.07%) respectively. Also, 27.67% of the subjects presented with any one of the conditions like furcation involvement, tooth mobility, mucogingival problem or gingival recession. (Table 3)

Table 3: Distribution of the study subjects based on PSR Index

PSR IndexScore	n (%)
0	1 (0.07%)
1	5 (0.33%)
2	146 (9.73%)
3	108 (7.2%)
4	1240 (82.67%)
#	415 (27.67%)

The influence of tobacco form usage pattern on probing pocket depth, clinical attachment level, periodontal screening and recording index and edentulousness was assessed. The mean probing pocket depth was found to be higher among past smokers and current users of smokeless tobacco (4.98 ± 0.71 mm) followed by current users of both forms of tobacco (4.77 ± 0.79 mm), current users of smokeless form alone (4.76 ± 0.73 mm), non-users (4.65 ± 0.87 mm) and current and former smokers without smokeless tobacco usage (4.57 ± 0.84 mm, 4.54 ± 0.64 mm) respectively. This difference in mean PPD with regard to the pattern of tobacco form usage among the study subjects was found to be statistically significant (p = 0.001). (see Table 4)

Table 4: Influence of tobacco form usage pattern on periodontal health of the subjects

Periodontal parameter	Tobacco form usage pattern	Mean ± Standard Deviation	p value
PPD (mm)	Non-users	4.65 ± 0.87	0.001
	Current users of both forms of tobacco	4.77 ± 0.79	
	Past smokers with current users of smokeless tobacco	4.98 ± 0.71	
	Current users of smokeless form alone	4.76 ± 0.73	
	Current smokers without smokeless	4.57 ± 0.84	
	Former smokers without smokeless	4.54 ± 0.64	
CAL (mm)	Non-users	4.71 ± 0.88	0.89
	Current users of both forms of tobacco	5.57 ± 0.90	
	Past smokers with current users of smokeless tobacco	5.08 ± 0.71	
	Current users of smokeless form alone	4.86 ± 0.74	

	Current smoker without smokeless	4.65 ± 0.86	
	Former smokers without smokeless	4.55 ± 0.84	
PSR	Non-users	3.52 ± 0.73	< 0.001
	Current users of both forms of tobacco	3.66 ± 0.61	
	Past smokers with current users of smokeless tobacco	3.79 ± 0.54	
	Current users of smokeless form alone	3.67 ± 0.53	
	Current smoker without smokeless	3.39 ± 0.72	
	Former smokers without smokeless	3.41 ± 0.67	
No. of missing teeth	Non-users	0.89 ± 0.58	< 0.001
	Current users of both forms of tobacco	1.13 ± 0.58	
	Past smokers and current users of smokeless tobacco	2.54 ± 0.14	
	Current users of smokeless form alone	3.63 ± 0.48	
	Current smokers without smokeless	2.01 ± 0.29	
	Former smokers without smokeless	2.14 ± 0.32	

The mean clinical attachment level was found to be higher among current users of both forms of tobacco (5.57 ± 0.90 mm) followed by past smokers and current users of smokeless tobacco (5.08 ± 0.71 mm), current users of smokeless form alone (4.86 ± 0.74 mm), non-users (4.71 ± 0.88 mm) and current and former smokers without smokeless tobacco usage (4.65 ± 0.86 mm, 4.55 ± 0.84 mm) respectively. This difference in mean CAL with regard to the pattern of tobacco form usage among the study subjects was not statistically significant (p = 0.89). (see supra Table 4). The mean periodontal screening and recording index value was found to be higher among past smokers and current users of smokeless tobacco (3.79 ± 0.54) followed by current users of smokeless form alone (3.67 ± 0.53), current users of both forms of tobacco (3.66 ± 0.61), non-users (3.52 ± 0.73) and former and current smokers without smokeless tobacco usage (3.41 ± 0.67, 3.39 ± 0.72) respectively. This difference in mean PSR with regard to the pattern of tobacco form usage among the study subjects was found to be statistically highly significant (p < 0.001) (see supra Table 4). The mean number of missing teeth was found to be higher among current users of smokeless form alone (3.63 ± 0.48) followed by past smokers and current users of smokeless tobacco (2.54 ± 0.14), former smokers without smokeless tobacco usage (2.14 ± 0.32), current smokers without smokeless tobacco usage (2.01 ± 0.29), current users of both forms of tobacco (1.13 ± 0.58) and non-users (0.89 ± 0.58) respectively. This difference in mean number of missing teeth with regard to the pattern of tobacco form usage among the study subjects was found to be statistically highly significant (p < 0.001). (Table 4 see supra)

5. DISCUSSION

The present study assessed the factors that contribute to the prevalence and severity of periodontitis among coal mine workers in Tamil Nadu. To the best of our knowledge, there are no studies assessing the factors that contribute to the prevalence and severity of periodontitis among coal mine workers in Tamil Nadu. The mining industries categories the employees into three grades Grade-I, Grade-II and Grade-III. The workers who work in the mine belong to Grade-I category. These workers are engaged in tedious work round the clock where they work in rotating shifts. They work in three shifts of eight hours each. Whereas, Grade-II and Grade-III are office employees. We enrolled a total of 1500 male Grade-I mine workers for our study. The study population belonged to the lower socioeconomic class and have primary school education as their educational status. The age range of participants in our study was 18-60 years. Beyond 60 years of age the workers are not allowed to work in the coal mine as per policy of the industry. In the present study, we further stratified age into four groups: 20-30 years, 31-40 years, 41-50 years and 51-60 years. Our study subjects were comparable in age to those of [10]. Due to tedious work, systemically healthy individuals only are allowed to work in the coal mine as per policy of the industry. So the study population was free from systemic conditions like diabetes, respiratory diseases and cardiovascular diseases. Participants who underwent periodontal therapy in the past 6 months were also excluded in the present study. The Grade-I coal mine workers work in deep pits where the concentration of oxygen is reduced. This fact along with the tiresome physical work drives the workers to smoke or use smokeless tobacco during and after their working hours to cope up with the stressful environment. In the present study, out of 1500 workers, 48.4% were users of both tobacco and smokeless tobacco, 20.1% were non-users, 18.7% were current smokers without smokeless tobacco usage, 6.6% were current users of smokeless tobacco, 3.1% were past smokers and current users of smokeless tobacco and 3.1% were former smokers without smokeless tobacco usage. This finding was in accordance with the previous studies. Among coal mine workers of Telangana, India, 87.6% were tobacco users and only 36 subjects (10%) were free from tobacco.[10] Another study among coal mine workers of Kozlu district, Turkey, 58.5% were tobacco users, 41.5% did not use tobacco in any form and none of the workers used chewing tobacco.[11] Similarly in a study among stone mine industry workers, 93.7% had the habit of either chewing (34.9%) or smoking (32.9%) tobacco and only 32 workers (6.6%) were free of tobacco use in any form[4]. Periodontal parameters recorded in this study were probing pocket depth (PPD), clinical attachment level (CAL), number of missing teeth and periodontal screening and recording index (PSR). In the present study, on analysing the influence of age on periodontal health of the participants, PPD, PSR and number of missing teeth was found to be higher in the age group of 51-60 years and CAL was found to be higher in the age group of 41-50 years.[12,13,14] This finding was in accordance with the previous study among coal mine workers of Telangana, India.[10] Similarly, among coal mine workers of Kozlu district, Turkey, shallow to deep periodontal pockets were most common in the age group of 40 to 52 years old[11]. In our study, the severity of periodontal disease in terms of PPD, CAL and PSR scores have been assessed in detail after stratifying users of various forms of tobacco (smoking and smokeless) and the current or past

usage pattern. To the best of our knowledge, no study has discussed the severity of periodontitis under such strata. The influence of tobacco usage on periodontal health of the subjects was assessed. In descending order of severity, the probing pocket depth was found to be highest among those who were past smokers with current users of smokeless tobacco (4.98 ± 0.71 mm), followed by current users of both forms of tobacco (4.77 ± 0.79 mm) and followed by current users of smokeless form alone (4.76 ± 0.73 mm). The least mean PPD was observed among non-users (4.65 ± 0.87 mm) and followed by current and former smokers without smokeless tobacco usage (4.57 ± 0.84 mm, 4.54 ± 0.64 mm) respectively[15,16,17]. This observation was similar to the study reported among industrial workers,[18] in which 46% of smokeless tobacco users had probing pocket depth ≥ 4 mm when compared to non-users. Similarly, in another study, 48% of smokeless tobacco users had probing pocket depth 4-5 mm when compared to non-users[19]. The periodontal status was assessed by periodontal screening and recording index. Out of the 1500 subjects, majority of them (82.67%) had PSR score of 4, followed by score 2 (9.73%), score 3 (7.2%), score 1 (0.33%) and score 0 (0.07%) respectively. Also, 27.67% of the subjects presented with any one of the conditions like furcation involvement, tooth mobility, mucogingival problem or gingival recession. The periodontal screening and recording index value was found to be higher among past smokers with current users of smokeless tobacco (3.79 ± 0.54) followed by current users of smokeless form alone (3.67 ± 0.53), current users of both forms of tobacco (3.66 ± 0.61), non-users (3.52 ± 0.73) and former and current smokers without smokeless tobacco usage (3.41 ± 0.67, 3.39 ± 0.72) respectively. The number of missing teeth was found to be higher among current users of smokeless form (3.63 ± 0.48) followed by past smokers and current users of smokeless tobacco (2.54 ± 0.14), former smokers without smokeless tobacco usage (2.14 ± 0.32), current smokers without smokeless tobacco usage (2.01 ± 0.29), current users of both forms of tobacco (1.13 ± 0.58) and non-users (0.89 ± 0.58) respectively. Also, when clinical attachment level was assessed, it was found to be higher among current users of both forms of tobacco (5.57 ± 0.90 mm) followed by past smokers with current users of smokeless tobacco (5.08 ± 0.71 mm), current users of smokeless form alone (4.86 ± 0.74 mm), non-users (4.71 ± 0.88 mm) and current and former smokers without smokeless tobacco usage (4.65 ± 0.86 mm, 4.55 ± 0.84 mm) respectively[20]. This was in accordance with previous study among Thai adults, in which current smokers had greater mean clinical attachment level than former smokers and non-smokers.[21] Similarly, another study determined the effect of cigarette smoking on the severity of periodontitis and reported that current smokers had higher percentage of sites with clinical attachment level than former smokers and non-smokers.[22]

6. CONCLUSION

In brief, our results conclude that in comparison with general population, the prevalence of periodontal disease was high among coal mine workers in Tamil Nadu. Even though the mining authorities provide good dental care facility, there is lack of motivation towards oral health among the coal mine workers which reflects in the severity of the periodontal disease in this population. Our study results emphasize the need to incorporate oral health education and tobacco cessation programs to educate the workers about the importance of periodontal health and treatment. Such programs will urge them to avail existing oral health care facility in their work site.

7. AUTHOR CONTRIBUTION

VB – data collection,SK – overall supervision,PB – manuscript preparation,JM – concept and design,SK concept and design

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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