

Oral Health Status of Underground Coal Mine Workers of Ramakrishnapur, Adilabad District, Telangana, India - A Cross-Sectional Study

IRRAM ABBAS¹, SHAKEEL ANJUM MOHAMMAD², PARTHASARATHI REDDY PEDDIREDDY³, MONICA MOCHERLA⁴, YADAV RAO KOPPULA⁵, RAJASHEKHAR AVIDAPU⁶

ABSTRACT

Introduction: Standard of living and quality of life of people has been improved by the expanding industrial activity, but at the other end it has created many occupational hazards. Coal mining is one of the major age old industries throughout the world and in India. Till date very less literature is available worldwide and in India concerning the oral health status of laborers in this field.

Aim: To assess the oral health status of underground coal mine workers, oral hygiene practices, alcohol and tobacco habits.

Materials and Methods: A cross-sectional descriptive study was conducted among the underground coal mine workers of a coal mine located in Adilabad district, Telangana, according to the criteria described in the World Health Organization (WHO) Oral Health Assessment form (2013).

Statistical analysis: Descriptive statistics were done.

Results: A total of 356 workers participated in the study. Ninety percent of the subjects were with tobacco and/or alcohol habits. Dental caries was prevalent in more than half (55.6%) of the study subjects with a mean DMFT of 2.32 ± 2.99 . About 48.3% study subjects were with untreated dental caries and 20.3% subjects were with missing teeth. DMFT ≤ 6 was seen in 45.5% of subjects and 10.1% have DMFT scores ≥ 7 . Periodontal disease was the most prevalent condition seen in the population with 94.4% subjects having unhealthy periodontium in terms of gingival bleeding and/or periodontal pockets. About 186 (52.25%) and 145 (40.73%) of subjects were with 0-3mm and 4-5mm loss of attachment respectively. Fourteen percent of population showed dental traumatic injuries.

Conclusion: The findings highlighted the high caries prevalence, higher periodontal disease, traumatic injuries which requires immediate intervention.

Keywords: Dental caries, Periodontal disease, Traumatic injuries

INTRODUCTION

It is a fact of life that what man is and to what disease he may fall victim to, depends on a combination of two sets of factors- his genetic factors and the environmental factors to which he is exposed. Increased industrial activity worldwide has improved the standard of living of the people but at the same time made people prone to various occupational health hazards [1]. This deteriorates the general and oral health of people due to their exposure to hazardous occupational environment [2]. The effects of various aetiologic agents responsible for occupational disease depends on their specific chemical, physical and bacterial nature, their physical state, and their mode of entry.

Oral health is essential and integral to overall health and well being. The oral cavity serves as a connection between external environment and internal body environment and is especially prone to occupational diseases due to its direct exposure to various occupational pollutants. Oral diseases like dental caries, periodontitis, malocclusion, oral cancer and dental traumatic injuries have considerable impact on overall well being of an individual [2]. Work in mines, metal work, and work in the chemical industry may affect the disease in the periodontium and the oral mucosa [2].

Coal mining is one of the major age old industries throughout the world and in India [3]. A large number of laborers work in the coal mining industry in India [3]. As per the annual report published by Ministry of Mines, Government of India, 89 minerals are being produced in India by operating 569 coal mines, 67 oil and gas mines and 1770 non-coal mines and many more small mines [3]. It is an ancient occupation, which is recognized to be associated with injury and disease [2]. Workers exposure to coal dust and a number

of other particulate matter make them more prone for respiratory system diseases [4-6].

Coal mining industry works throughout the week for the production where the workers are engaged in the tedious work round the clock where they work in rotating shifts. They work in three shifts of eight hours each. The physically tedious work drives people to consume alcohol and tobacco [7]. these may lead to deterioration of their oral health in terms of periodontal disease and oral mucosal diseases [8-11]. Shift work, because of disruption of regular body circadian rhythm activity may lead to a number of dangerous health conditions, like cardiovascular disease, diabetes, gastrointestinal disease, nervous system disease, and obesity, increased risk of accidents or injury [12-19]. Mining has independently been associated with a number of adverse health effects such as cardiovascular, pulmonary, neurological, renal, haematological and musculoskeletal disorders [2,4-6,20-23]. Till date no literature is available worldwide and in India concerning the oral health status of laborers working in this field.

AIM

The aim of this study was to assess the oral health status of underground coal mine workers with the objectives of assessing their tobacco and alcohol habits, oral hygiene behaviours, dental caries and periodontal disease status as well as dental traumatic injuries.

MATERIALS AND METHODS

The study was intended to know the oral health status, oral-health related behaviours and tobacco and alcohol habits of the

underground coal mine workers population of Ramakrishnapur, in Mandamarri Mandal of Adilabad district, Telangana. There are 15 Opencast (OC) and 34 Underground (UG) coal mines in four districts of Telangana with manpower around 62,805. In Mandamarri there are five UG mines and one OC mine, with manpower of more than 6600. There are two mines one UG and one OC mine in Ramakrishnapur. Present study was done in the underground RK 1A Mine, Ramakrishnapur. A pilot study was conducted to know the sample size as well as feasibility of study. Based on the data obtained from the pilot study sample size was calculated as 349 using the following formula–

$$n = (z^2 \cdot p \cdot q) / d^2$$

Where n = size of the sample

d = acceptable error (kept at 5% true value)

z = value of standard variate at a given confidence interval (C.I)

here C.I set at 95% for which z-value is 1.96

p = 35% (0.35) Estimated from pilot study (prevalence of dental caries)

q = 1 - p (0.65)

Underground mine workers, rotating shift workers those who gave consent for the study were only included for the study. Subjects who were surface workers, office personnel and general shift workers and those who did not give consent were excluded. Sampling was done in two stages. As all the five UG mines have similar working environment and conditions, in the first stage one mine was randomly chosen from the five UG mines of Mandamarri. Next the subjects from chosen mine (UG mine workers) were randomly selected based on their man way roll numbers using random number generation method. The study was done in the month of June, 2014 in the premises of mine for which prior permission was taken from the concerned authorities. Ethical clearance was obtained prior to the study from "Institutional Review Board" of Sri Sai College of Dental Surgery, Vikarabad. All clinical data was recorded by one team consisting of a dentist and a recording assistant. Examiner and recording assistant had undergone theoretical and practical training by the senior dental calibrator prior to the commencement of the study. Examiner and recorder reliability was determined. The intra examiner reliability (kappa statistics), two days prior to the examination for dental caries and periodontal diseases were 0.8627 and 0.842 respectively.

The oral cavity examination was done in the daylight and whenever necessary an additional artificial light source (Headlight) was used. Examination was done using mouth mirrors and CPI probes as recommended by WHO Oral Health Surveys: Basic Methods – 5th edition 2013 [24]. The "WHO Oral Health Performa-2013" was used to record the information. Sterilization was carried out using an autoclave. On site hand disinfection was done during the survey using chemical disinfecting solution (Savlon, Johnson and Johnson Ltd., Solan, India).

Demographic data included the age, location, and number of years of education, oral hygiene practices included type of oral hygiene aid, material and frequency, tobacco and alcohol habits were the additional data recorded.

STATISTICAL ANALYSIS

The data was compiled, tabulated and subjected to descriptive statistical analysis using the SPSS package (version 21.0).

RESULTS

A total of 356 subjects were studied. The subjects were in the ages ranging from 21-60 years with mean age of the study population being 49.89±7.2. [Table/Fig-1] shows that a majority of the subjects were in the age group of 50–54 years. About half of the subjects were uneducated (zero years in school). All the subjects clean their teeth once a day regularly but only 225 subjects (63.2%) used tooth

brush and a paste as their oral hygiene aids. Ninety percent of the subjects were with tobacco and/or alcohol habits i.e. only 36 subjects (10%) were free from those habits. Of these subjects 312 (87.6%) were tobacco users and 154 (43.3%) were alcoholics either alone or in combination.

[Table/Fig-2] shows the prevalence of dental caries where more than half of the study subjects (55.6%) were caries experienced. Surprisingly most among the caries experienced subjects i.e. 172 of 198 were with untreated dental caries. Mean DMFT of the study population was 2.32±2.99. Highest DMFT score recorded was 16. Out of 11,227 total teeth examined 650 teeth were carious, 150 teeth were extracted due to caries and 25 teeth were filled due to caries. Mean number of teeth with untreated dental caries, missing teeth and filled teeth per subject were 1.83±2.73, 0.42±1.02 and 0.07±0.42 respectively.

[Table/Fig-3] shows the prevalence of periodontal disease in the study population where, 94.4% subjects were having unhealthy periodontium in terms of gingival bleeding and/or periodontal pockets. Gingival bleeding in one or more teeth was noted in 336 (94.4%) individuals. Mean number of shallow and deep pockets

Variable	Levels	No of subjects	Percentage
Age Mean 49.89±7.2	<40 years	36	10.11%
	41-49 years	77	21.62%
	50-54 years	140	39.38%
	55-60 years	103	29%
Education	0	176	49.7%
	1-7	62	17%
	8-10	68	19%
	>=10	50	14.3%
Oral Hygiene Aid	Finger	4	1.1%
	Neem stick	91	25.6%
	Tooth brush	225	63.2%
	Neem stick as well as tooth brush	36	10.1%
Frequency	Once a day	356	100%
	Twice a day	0	0%
Material	None	91	25.6%
	Tooth powder	4	1.1%
	Tooth paste	261	73.3%
Alcohol/Tobacco Habits	None	36	10%
	Only Smoking	10	2.5%
	Only Chewing	103	29%
	Only Alcoholic	8	2.3%
	Any two combination	168	47.2%
	All the three	31	9%

[Table/Fig-1]: Demographic data, oral hygiene practices, tobacco and alcohol habits.

Variable	Levels	No. of subjects	Percentage
Caries experience	No caries experience	158	44.4%
	With caries experience	198	55.6%
DMFT	D:Untreated caries	172	48.3%
	M:Missing teeth	72	20.3%
	F:Filling teeth	10	2.8%
DMFT Scores MEAN 2.32±2.99	0	158	44.4%
	1-2	64	18%
	3-4	62	17.4%
	5-6	36	10.1%
	>=7	36	10.1%

[Table/Fig-2]: Distribution of subjects in relation to dental caries status

present per subject were 1.6 ± 2.9 and 0.16 ± 0.58 respectively. Out of 2136 total sextants examined 77.3% (1651) sextants were with 0-3mm attachment loss, 21.1% (451) sextants were with 4-5mm attachment loss and 1.42% (30) sextants were with 6-8mm attachment loss. Mean number of sextants per subject with LOA 0-3mm, 4-5mm and 6-8mm were 4.63 ± 1.75 , 1.26 ± 1.70 and 0.084 ± 0.34 respectively. Excluded sextants were four.

[Table/Fig-4] shows distribution of dental traumatic injuries which were observed in 14% of subjects, where 0.9% of subjects showed enamel fracture, 5.3% showed enamel and dentin fractures, whereas 7.8% showed pulpal involvement.

Variable	Levels	No. of subjects	Percentage
Gingival bleeding	Present	336	94.4%
	Absent	20	5.6%
Periodontal pockets	Absent	247	69.4%
	Shallow pocket 4-5mm	75	21%
	Deep pocket ≥ 6 mm	34	9.6%
Loss of Attachment	0-3mm	186	52.2%
	4-5mm	145	40.7%
	6-8mm	25	7.02%

[Table/Fig-3]: Distribution of subjects in relation to periodontal status.

Variable	Levels	No. of subjects	Percentage
Traumatic injury of teeth	No injury	306	86%
	Injury involving enamel only	3	0.9%
	Injury involving enamel and dentin	19	5.3%
	Injury involving pulp	28	7.8%

[Table/Fig-4]: Distribution of subjects in relation to traumatic injuries of teeth.

DISCUSSION

Standard of living of the people has been improved by expanding industrial activity, but at the other end it has created many occupation related hazards [1]. Development in various fields such as technology, industrial, political, scientific and social fields has led to various occupational and environmental diseases. Improvement in technology has made jobs very easy in several aspects, but, at the same time, has created new occupational hazards that have drawn public attention [1]. Coal mining is one of the major age old industries throughout the world [3]. Very less has been known regarding oral health status of workers in this occupation. A cross-sectional study was carried out to assess the oral health of underground coal mine workers in Ramakrishnapur area of Adilabad district, Telangana. To the best of our knowledge there is no study available on coal mine worker group for comparison. For the purpose of discussion we have compared with few studies on nearly comparable groups of other mining industries. The workers were in the age group 21-60 years with mean age of the study population being 49.89 ± 7.2 . Most of the workers have been working in the mine since the mining has begun in that area. Majority (49.7%) were uneducated. This might be because most of the subjects were in the ages above 50 years, and Ramakrishnapur a peri urban area, even today it is with very little educational facilities.

Oral hygiene of the workers was found very poor though all of them cleaned their teeth daily. This finding is in contrast to Solanki et al., Dagli RJ et al., where 21.5% of 510 subjects and 78.9% of 513 subjects cleaned their teeth daily [25,26]. In present study, about 225 subjects (63.2%) use toothbrush and toothpaste to clean their teeth. This finding is in contrast with Solanki et al., where not even a single study subject used toothbrush or toothpaste [25].

Tobacco (87.6%) and Alcohol (43.3%) habits were very much prevalent among the subjects with 320 subjects 90% prevalence i.e. only 36 subjects (10%) are free from alcohol and tobacco

habits. This finding is similar to that of Solanki et al., where 93.7% of the workers were tobacco users and only 32 workers were free of tobacco use in any form, and 38.89% used both tobacco and alcohol [25]. In contrast to present study Rushabh J Dagli et al., found regular tobacco and alcohol habits among 49% and 24.6% of laborers respectively [26]. In another study by Santhosh Kumar et al., tobacco users were 71.9% which is nearly similar to present study [27]. Coal mining industry works round the clock for the production where the workers are engaged in the tedious work in rotating shifts. They work in three shifts of 8 hours each, morning shift, afternoon shift and night shift. Many-a-times people work overtime with extended working hours. The physically tedious work drives people to consume alcohol and tobacco.

During night shifts in order to prevent their sleep workers get habituated to chewing tobacco (84% chewers in present study). Gradually they get addicted so much that without chewing tobacco they do not even get into work. Moreover workers will be allotted tasks which they had to do in teams. This peer influence might be one of the reasons for such high prevalence of tobacco and alcohol habits.

The prevalence of dental caries in the present study was 55.6%, with a mean DMFT index of 2.32 ± 2.99 .

The findings of the present study were in contrast with those of Solanki et al., where 74% was the prevalence with a mean DMFT of 2.89 [25]. In another study by Duraiswamy et al., prevalence of dental caries was 73.7% with the mean DMFT index found to be 3.13, as compared to 2.32 in the present study [28].

None of the participant had filled teeth in Duraiswamy et al., which coincide with the present study where only 10 subjects out of 356 have filled teeth [28]. Prevalence of dental caries in present study is in accordance with AE Van Der Merwe et al., where 55.43% of 92 subjects showed dental caries [29].

Cleaton-Jones P in his study on oral health of South African Black (Xhosa) mine recruits found similar results with dental caries prevalence being 68 % and the mean DMFT per individual was 2.5 ± 2.8 [30]. About more than half of study subjects showed caries in the present study which can be attributed to their oral hygiene practices, absence of dental care in the locality, fear of dental treatment, lack of utilization of appropriate care provided by mine authorities, negligence and most of all lack of awareness about oral health.

Periodontal disease is the most prevalent condition seen in the study population with 94.4% subjects having unhealthy periodontium in terms of gingival bleeding and/or periodontal pockets. Healthy gingiva was observed in only 5.6% of the workers. These findings are in accordance with those of Solanki et al., and Rushabh J Dagli et al., where 95.1% of subjects are periodontally diseased with only 4.9% free of disease and 98.25% periodontal disease prevalence with only 1.75% of subjects having healthy periodontium respectively [25,26]. The present findings also coincide with those of Santhosh Kumar et al., where the prevalence of periodontal disease of any degree was found to be 98.2%, that is, only 1.8% of the green marble mine workers were free of periodontal disease [31]. Present study findings are in contrast to those of AE Van Der Merwe et al., where 40.2% periodontal disease prevalence was observed [29]. This study was done on archeological remnants where periodontitis was assessed based on alveolar resorption of jaw bones, which might be the reason for such lesser periodontal disease observed. In the present study mean number of shallow and deep pockets present per subject were 1.6 and 0.16 respectively. These findings are comparable with those observed in Rushabh J Dagli et al., where 0.92 and 0.15 are the mean number of shallow and deep pockets [26]. Number of subjects with Loss of Attachment (LOA) based on highest score LOA 0-3mm, 4-5mm and 6-8mm were 186(52.25%), 145(40.73%) and 25(7.02%) respectively. This finding is comparable to that of 13.7% (59), 65.9% (277) and 18% (76) of AE Van Der

Merwe et al., [29]. A very bad oral hygiene of the workers would be the foremost factor associated with gingivitis and periodontitis of the workers. Age could be another factor for such an unhealthy periodontium because the mean age of study population is around 50 years. Also, the general health condition was not assessed in the present study. This was a limitation of this study as this could have influenced their periodontal status. Workers always were exposed to coal dust and silica particles which might be associated with tooth wear, gingivitis and periodontitis. Continued usage of tobacco in either smoking form or chewing form might as well influence periodontal status of the workers. Their rotating shift work schedules could influence their body physiology and metabolism which in turn could have an indirect periodontal influence. Improper tooth brushing techniques, neem stick usage for cleaning teeth also could have an impact on gingival recession, loss of attachment.

A surprising finding in the present study was that 14% of study subjects had fractured teeth. Slippery surface of the underground mine tunnels, sloping of the tunnels, minimum lighting in the mines where workers carry only battery driven headlights to their work sites would have influence on traumatic injuries. Workers under such conditions are more prone for falls or may accidentally hit by rocks inside, which result in injuries to both general body and oral structures.

CONCLUSION

This study has revealed out the poor oral health status of underground coal mine workers. The findings highlighted the high caries prevalence, tobacco and alcohol prevalence, higher periodontal disease and dental traumatic injuries in the population which requires immediate intervention. This study has opened the door for further research and intervention in such population where more than 560 coalmines distributed over eight states in India have been under production with more than 4.5 lacs manpower. There is a need to incorporate oral health check-ups in the regular general health check-ups which are being carried out regularly at the mine. Oral health education programs, posters related to tobacco ill effects, cessation benefits must be displayed at mine premises. Tobacco cessation counseling centers must be established to provide individual attention and help to the workers who are addicted to tobacco to quit the habit. Strict laws have to be enforced to avoid tobacco in the mines so that those who don't have the habit are not influenced to take up the habit. Existing oral health service provided by mine authorities which is mainly of treatment aspect should be oriented more towards preventive health care. Continuous research and interventions are needed to improve oral as well as the overall health status of these specific occupational subjects.

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PARTICULARS OF CONTRIBUTORS:

1. Senior Lecturer, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.
2. Professor, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.
3. Professor and Head, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.
4. Reader, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.
5. Reader, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.
6. Post Graduate Student, Department of Public Health Dentistry, Sri Sai College of Dental Surgery, Vikarabad, Hyderabad, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Rajashekhar Avidapu,
Post Graduate Student, Department of Public Health Dentistry,
Sri Sai College of Dental Surgery, Vikarabad - 501101, India.
E-mail : rajashekhardr15@gmail.com

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