

Oral Health Status and Oral Health-Related Quality of Life (OHRQoL) among Steel factory workers of Visakhapatnam-A cross-sectional study

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ABSTRACT

Introduction: The occupational environment influences oral health to a greater extent. The unique environment in the steel factory might influence oral health and oral health-related quality of life of its workers, especially those who are exposed to its environment. **Aim and Objectives:** To determine oral health status and Oral Health-Related Quality of Life among production line and administration workers of a steel factory and assess their relationship with occupation exposure. **Method:** A cross-sectional study was conducted among 533 production line and 517 administration workers of the steel factory aged 31–60 years using simple random sampling. The collected data includes information on demographic factors, adverse habits of the study subjects, and oral health-related quality of life using Oral Health Impact Profile-14 (OHIP-14). The oral health status was assessed using the WHO oral health assessment form 2013. **Statistical Analysis:** SPSS Version 20 was used for statistical analysis. A student t-test was done to compare means. **Results:** The prevalence of dental caries is 62.5% in the production line and 74.9% in administration workers, and the prevalence of periodontal status is 91.6% and 74.8%, respectively. The mean of OHIP-14 was 2.13 ± 0.73 in the production line and 2.33 ± 0.77 in administration workers. All domains of OHIP-14 were found to have high statistical significance with dental caries, periodontal pocket depth, loss of attachment, oral mucosal lesions, dental erosion, and dental trauma in both study groups ($P < 0.001$). **Conclusion:** OHIP-14 scores were related significantly with oral health status indicators in both study groups. The prevalence of the periodontal disease, oral mucosal lesions, and OHIP-14 scores was found to be significantly higher among production line workers.

Keywords: Cross-sectional study, Oral Health, Workers, Prevalence, Dental Caries, Periodontal Disease.

Introduction

Oral health is a valuable asset of every individual apart from being an essential component of general health.^[1] Occupation-related diseases are predisposed by the complex and varied occupational environment.^[2,3] World Health Organization estimated that in

the year 2007, the global labor force was half of the world's population (about 3300 million). Statistics show that 30%–60% of world adult females and 60%–70% of the world's adult males are officially enrolled as the working population.^[4]

India is placed second after China with a working population of 487 million workers in the year 2012. On average, an individual spends one-third of his lifetime at his workplace; making the working environment a significant factor in determining health.^[5] India stands 2nd in the production of steel worldwide, providing

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employment opportunities to many workers.^[6] Release of certain gases like coke oven gas, carbon dioxide, tar, benzyl, and carbon monoxide in the steel factory results in several kinds of ailments like discoloration of lips, periodontal diseases, and their long term exposure may lead to carcinoma of lips.^[7,8] Therefore, steel and iron workers are especially prone to occupational health problems and experience more sickness absenteeism, affecting their Oral Health-Related Quality of Life^[9]

Oral Health-Related Quality of Life is defined as “a multidimensional construct that reflects (among other things) people’s comfort when chewing, sleeping, and involving in social interaction; their confidence; and their contentedness with regard to their oral health.”^[10]

Oral Health-Related Quality of Life (OHRQoL) is a relatively new but rapidly growing phenomenon, which has cropped up over the past 20 years. A shift in the perception of health from merely the absence of disease and infirmity to complete physical, mental, and social wellbeing, was analyzed by Slade and others, as reflected in the definition of the WHO. This shift occurred in the later part of the 20th century.^[11]

As the work environment forms the major factor for the determination of health, special consideration should be given for oral health as it plays a crucial role in the general health and well-being of individuals.^[12,13] The assessment of the oral health status of these recruits will also provide future opportunities to maintain the industrial health of the workers as the majority of people employed in the factories are exposed to a hazardous work environment, which further worsens their life.^[14]

In accord with the aforesaid information and since Oral Health Status and Oral Health-Related Quality of Life (OHRQoL) of steel factory workers among Indian population have not yet reported in the literature, therefore, this study aimed to determine oral health status and Oral Health-Related Quality of Life among the production line and administration workers of a steel factory, Visakhapatnam.

Materials and Method

Study design

The present cross-sectional study was conducted on workers of a steel factory, Visakhapatnam, Andhra Pradesh, India. This steel factory is the first integrated shore-based steel plant with approximately 33000 employees in which around 26000 work in the production line and 7000 in the administration side.

Oral Health Status and Oral Health-Related Quality of Life of the study participants were assessed using a self-administered, pretested proforma, Oral Health Impact Profile (OHIP-14) and WHO oral health assessment form 2013 over a period of 1 month. The steel factory workers were divided into two groups mainly—production and administration groups based on the difference in their work environment.

Ethical clearance and informed consent

The ethical clearance (ANIDS/IEC/2020001) for the study was obtained from the Institutional Review Board provide the date of the approval Date of approval 20th January 2020. The permission to conduct the study was obtained from the concerned authorities and written informed consent was obtained from the study subjects after explaining to them the purpose and methodology of the study.

Sampling

The calculated sample size was 1024 as per formula $N = 4pq/L^2$ (p = present prevalence, $q = 1-p$, $L = 25\%$ of p), used for the calculation of sample size determination in the previous studies^[15] taking the prevalence rate as 80% and permissible error level as 25%.

After substitution of the values the sample size arrived at 1024, which was rounded off to 1050.

A simple random sampling technique was used for selecting the desired sample. 533 production lines and 517 administration workers were selected randomly from the compiled list of steel plant workers Visakhapatnam, India.

Inclusion criteria

1. Workers with more or equal to 10 years working experience in the factory (as a minimum of 10 years exposure is required for symptoms to appear.)

Exclusion criteria

1. Workers employed on contractual/temporary basis.
2. Workers with less than 10 years of experience.
3. Workers who did not give consent and not present on the day of study

Data collection

Interviewer

A self-administered, pretested proforma and Oral Health Impact Profile (OHIP-14) was administered to workers of the production line and administration sector of a steel factory in Visakhapatnam in the English and the local language (Telugu). Socio-demographic information, personal habits information, and information regarding their oral health practice was collected using a proforma and OHIP-14 was for assessing their Oral Health-Related Quality of Life. The Oral Health Impact Profile consisted of 14 multiple choice questions assessing oral health-related problems in seven theoretical areas, including functional limitation, pain, physiological discomfort, physical disability, psychological disability, social disability, and handicap. Based on the presence or absence of the problem and its severity, each question had three options each, these options being always, sometimes, and never. The study proforma and OHIP-14 was administered to the participants after providing necessary instructions followed by a clinical examination.

Questionnaire validation: A pilot study was conducted among 100 subjects who were not included in the main study and comprised 10% of the study sample to check for reliability and validity. Reliability was measured through test-retest, and it showed that measured kappa (κ) is 0.88 and weighted kappa (κ) is 0.92. Internal consistency measured through Cronbach's alpha (α) was 0.76. Construct validity was assured using Spearman's correlation coefficient.

Clinical examination

The clinical examination of the steel factory workers was carried out to assess their oral health status based on the WHO oral health assessment form 2013. Type III Examination of the steel factory workers was carried out using a plain mouth mirror and WHO probe to assess their dental caries experience, periodontal status, oral mucosal lesions, dental trauma, dental erosion, dental, and prosthetic status. All protocols and standard procedures were followed to safeguard the infection control during the study. Subjects requiring emergency treatment (for pain) were referred to Visakhapatnam Steel General Hospital.

Training and calibration of examiners

All the examinations were carried out by three qualified examiners. Before the commencement of the study, the examiners were standardized and calibrated in the Department of Public Health Dentistry, by the Head of the Department, to ensure uniform interpretation, understanding, and the application of codes and criteria for the diseases to be observed and recorded and to ensure a consistent examination for assessing the Oral Health Status, and the interexaminer reliability was 93%. The diagnostic variability was found to be low (Kappa value 0.86).

Statistical analysis

The obtained data was entered into an Excel sheet after coding. This was later transferred to the SPSS (Statistical Package for Social Sciences) software version 20, which was used for statistical analysis. The independent t-test was used to find an association between the different domains of the OHIP and Oral Health Status between the production and administrative staff of Steel Factory. Confidence Interval was taken as 95%. The significance level was fixed at 5%.

RESULTS

The present study was conducted on a study population of 1050 subjects (533 production line workers and 517 administration workers), of which in the production workers 29.3% were in 31–40 age group, 33.2% were in 41–50 age group, 37.5% were in 51–60 age group. Whereas, in the administration workers, 12.4%, 37.5%, and 37.5% in the age groups 31–40, 41–50, 51–60, respectively. There were no females in production workers and 65 females in the administration sector. Most of the production line workers possessed diploma (399) and most of the administration workers were graduated (195) [Table 1].

Oral health status of the production line and administration workers of steel factory showed, the prevalence of dental caries being 62.5% in the production line and 74.9% in administration workers on the other hand periodontal status was poor in production line workers with a prevalence of 91.6% while 74.8% was observed in administration workers. Prevalence of dental erosion and dental trauma was more among production line workers (29.5% and 37.5%), respectively over administration workers (12.6% and 12.4%), respectively [Table 2].

The mean OHIP-14 was 2.13 ± 0.73 in production line workers and 2.33 ± 0.77 in administration workers. Based on the results of OHIP-14, it became obvious that the workplace environment seemed to negatively impact the OHRQoL of the production workers more than administration workers [Table 3].

Functional limitation due to dental caries was more in administrative workers 2.6 ± 0.373 compared to production line workers (2.29 ± 0.55), which is highly significant. Also, functional limitation due to dental trauma was more in the administration workers with mean 3 ± 0 over production workers 2.5 ± 0.56 , which was also highly significant.

Physical pain due to poor periodontal status, loss of attachment dental trauma, and dental erosion were more in production line workers over administration sector workers, and it was highly significant.

Psychological discomfort due to poor periodontal status, loss of attachment dental erosion, dental trauma, and oral mucosal lesions was more in production line workers over the administration workers and showed a highly significant difference.

Physical disability due to dental caries was seen more in administration workers over production line workers, and the difference was highly significant while for oral mucosal lesions and dental trauma it is vice versa.

Psychological disability due to dental caries was more in administration workers over production line workers, and values are statistically significant while psychological disability due to periodontal status, dental erosion, dental trauma, and oral mucosal lesions was more in production line workers and also found to be highly significant.

Social handicap due to periodontal status, loss of attachment, dental trauma, dental erosion, and oral mucosal lesions were more in production line workers over administration workers, and the difference was highly significant. While social handicap due to dental caries was seen more in administration workers, and the difference was also highly significant.

Handicap due to periodontal status, loss of attachment, and dental erosion was seen more in production line workers over administration workers while dental caries were seen more in administration workers, and these differences were highly significant [Table 4].

Table 1: Demographic data of Production line and Administration workers of Steel factory

Demographic variables			Gender			
			Male		Female	
			n	Percentage	n	Percentage
Age	Production line workers	31-40	156	29.3	65	12.6
		41-50	177	33.2		
		51-60	200	37.5		
	Administration Workers	31-40	64	12.4		
		41-50	194	37.5		
		51-60	194	37.5		
Education	Production line workers	Diploma	399	74.9	65	12.5
		Graduation	89	16.7		
		Post graduation	45	8.4		
	Administration workers	Diploma	128	24.8		
		Graduation	195	37.7		
		Post graduation	129	25		
Total			985	93.8	65	6.19

Table 2: Oral Health status of Production line and Administration worker of Steel Factory

Oral health status	Production line workers		Administration workers			
	Male		Male		Female	
	n	Percentage	n	Percentage	n	Percentage
Dental caries	333	62.5	322	62.3	65	12.6
Periodontal status	488	91.6	387	74.8		
Loss of attachment	488	91.6	387	74.8		
Dental erosion	157	29.5	65	12.6		
Dental Trauma	200	37.5	64	12.4		
Oral mucosal lesions	22	4.1	0	0		
Total	533	50.76	452	43.04	65	6.19

Table 3: Distribution of Production line and Administration workers of Steel Factory using OHIP-14

OHIP ITEMS	Production line workers	Administration workers
	Mean±SD	Mean±SD
1. Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	2.26±0.736	2.5±0.706
2. Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	2.35±0.635	2.5±0.709
3. Have you had painful aching in your mouth?	1.94±0.860	2.12±0.782
4. Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	2±0.724	2.25±0.830
5. Have you been self-conscious because of your teeth, mouth or dentures?	1.91±0.829	2.26±0.829
6. Have you felt tense because of problems with your teeth, mouth or dentures?	1.95±0.750	2.39±0.694
7. Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	1.95±0.752	2.25±0.832
8. Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	1.96±0.860	2.37±0.698
9. Have you found it difficult to relax because of problems with your teeth, mouth or dentures?	1.96±0.860	2.37±0.698
10. Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	2.09±0.716	2.37±0.858
11. Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	2.26±0.676	2.12±0.929
12. Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	2.35±0.632	2.25±0.830
13. Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	2.52±0.580	2.50±0.709
14. Have you been totally unable to function because of problems with your teeth, mouth or dentures?	2.43±0.647	2.5±0.709

Table 4: Multiple comparison of OHIP-14 and Oral health status of Production line and Administration workers of Steel Factory

Ohip item	Oral health status	Production line workers Mean±Standard deviation	Administration workers Mean±Standard deviation	P
Functional Limitation	Dental caries	2.29+0.55	2.6+0.373	0.001**
	Periodontal status	2.49+0.58	2.28+0.58	0.980
Physical pain	Loss of attachment	2.5+0.57	2.3+0.58	0.980
	Dental erosion	2.5+0	2.23+0.68	0.99
	Dental Trauma	2.5+0.56	3+0	0.001**
	Oral mucosal lesions	2.5+0	-	0.983
	Dental caries	1.96+0.77	2.16+0.74	0.261
	Periodontal status	1.99+0.77	1.98+0.68	0.001**
Psychological discomfort	Loss of attachment	1.99+0.77	1.98+0.68	0.001**
	Dental erosion	3+0	1.93+0.77	0.001**
	Dental Trauma	1.99+0.83	1.5+0.0	0.001**
	Oral mucosal lesions	2+1.97	-	0.883
	Dental caries	1.96+0.64	2.34+0.69	0.245
	Periodontal status	2.10+0.69	1.91+0.63	0.001**
Physical disability	Loss of attachment	2.10+0.68	1.91+0.63	0.001**
	Dental erosion	3+0	1.79+0.52	0.001**
	Dental Trauma	2+0.71	3+0	0.001**
	Oral mucosal lesions	1.5+0.0	-	0.001**
	Dental caries	2+0.66	2.16+0.553	0.001**
	Periodontal status	2.25+0.63	1.88+0.66	0.982
Psychological disability	Loss of attachment	2.25+0.63	1.88+0.65	0.982
	Dental erosion	1.86+0.65	2.5+0	0.001
	Dental Trauma	3+0	2.12+0.49	0.002**
	Oral mucosal lesions	1.5+0.0	-	0.02*
	Dental caries	2+0.5	2.41+0.67	0.019*
	Periodontal status	2.41+0.67	2.07+0.52	0.026*
Social handicap	Loss of attachment	2.41+0.67	0.026*	
	Dental erosion	2.03+0.57	1.5+0	0.001**
	Dental Trauma	2.12+0.49	3+0	0.001**
	Oral mucosal lesions	1.5+0	-	0.001**
	Dental caries	2.08+0.731	2.32+0.45	0.001**
	Periodontal status	2.33+0.52	2.08+0.73	0.001**
Handicap	Loss of attachment	2.33+0.52	2.08+0.73	0.001**
	Dental erosion	3+0	2+0.38	0.001**
	Dental Trauma	2.31+0.49	1+0.0	0.001**
	Oral mucosal lesions	3+0	-	0.001**
	Dental caries	2.43+0.372	2.58+0.345	0.001**
	Periodontal status	2.48+0.36	2.33+0.236	0.001**
Handicap	Loss of attachment	2.48+0.36	2.33+0.236	0.001**
	Dental erosion	3+0	2.53+0.37	0.001**
	Dental Trauma	2.5+0	2.53+0.37	0.981
	Oral mucosal lesions	2.5+0.43	-	0.76

Discussion

This study primarily focused on Oral Health Status and Oral Health-Related Quality of Life among production line workers and administration workers of a steel factory, Visakhapatnam, Andhra Pradesh.

The observations of the present study could not be compared with earlier studies as there is a paucity of data on the oral health status of these populations. Occupation has a relationship on health and well-being and there are diverse aspects of

this relationship.^[16] A crucial role in the determination of an individual's overall health is played by work and work-related environment. An increasing trend toward industrialization reflects the growth of a nation, which is actually only one side of the coin. This side manifests the growth and progress while the other side is associated with advancement in occupational health problems and related diseases. There are plentiful causative factors, of which, the occupational environment is one of the main factors behind the onset of periodontal and oral mucosal diseases.^[17]

The working environment in the steel factories of our country creates a unique environment, which might have a dreadful influence on oral health as well as general health of the production line and administration workers.

The comparison of the present study can be done with other workers and the general adult population as no previous comparable data is available for this specific occupation group.

Oral health status of the production line and administration workers of the steel factory was assessed and compared in this study

Prevalence of periodontal status (Community Periodontal Index scores and Loss of Attachment codes), is 91.6% in the production line and 74.8% in administration workers, which did not match with the study conducted by Masalin *et al.*^[18] this could be because the production line workers were engaged in shift work and have poor sleep quality. This was in accordance with the study done in Saudi Arabia on factory workers^[19] in which shift workers usually have poor sleep quality as compared to nonshift workers (administration workers). Sleep deprivation adversely affects cognition and motor performance. This might impair an individual's capacity to maintain adequate oral hygiene practices.^[20]

Oral mucosal lesions were seen in production line workers the probable reason for this would have been working in an environment where exposure to materials like tar cause carcinomas over time or maybe due to frequency of adverse oral habits among the workers, due to stress and strenuous load associated with their work environment.

The study showed that the administration workers had a higher incidence of dental caries over their counterparts in the production sector. This could probably due to a higher scope for snacking during work hours in administration workers. A more rationale reasoning may also be, in workplace uniform donned by production line workers, which doesn't easily permit them to off their protective equipment and hence decreases scope for snacking during the work period.

The study also revealed a higher incidence of dental trauma such as fractured teeth in the production line workers. This is probably due to their compelling work routine, which requires them to be on their toes and attend to various high-end machinery be a source of injury to the orofacial region.

Another classical finding in the study was the presence of erosion of teeth, more significant erosions on the labial surfaces of teeth in production line workers. The reason behind this could be thought of as continued exposure to chemicals (coke, tar, etc) that are released in the work environment. These chemicals, although could not be identified exactly on prolonged exposure to the oral cavity led to erosions on the labial surfaces of teeth.

The OHIP -14 was assessed among the study subjects and an overall mean of 2.13 ± 0.73 was found in workers of the production line and an overall mean of 2.33 ± 0.77 was found in administration workers. Majority of the subjects in production line always or sometimes had much of impact due to oral health problems on the quality of life on the other side of coin majority of workers in administration sector never had much of impact due to oral health problems on the quality of life this possibly could be the result of exposure to other risk factors for a prolonged period over a person's life creating an aggregated effect over time.

OHIP scores were significantly related to clinical oral health status indicators in both production line and administration workers. The effect of oral health status on all the domains of OHRQoL was more on production line workers, except dental caries, which was more in administration workers.

Although oral health problems are rarely life-threatening they still remain a major public health concern because of their burden due to high prevalence and it is now widely recognized that oral health can contribute to social, economic, and psychological consequences. OHRQoL is important because of its implications for oral health disparities and access to care. In a developing country like India, factory workers are one of those groups who have minimal exposure to dental health professionals, since most of them are uneducated and they hail mostly from rural areas where there is a lack of facilities offering dental services. So studies assessing the oral health status of factory workers are important since it helps the primary care physicians to eradicate oral health disparities and also helps the factory workers in improving their knowledge regarding the importance of oral health. Including OHRQoL. These studies often add a powerful dimension in the planning and development of health promotion programs by identifying groups who are vulnerable to low OHRQoL. Dental researchers can arrange and implement programs aimed at improving oral health and elevating OHRQoL.

Limitations

Most questions are related to the patient perception of the problem and not the actual problem itself, a lack of understanding of any particular question might affect the scores.

Dental caries was at assessed tooth level, which is less sensitive compared to the tooth surface.

The present study is cross-sectional in nature, a prospective study is needed to assess whether poor dentition status influenced Oral Health-Related Quality of Life.

CONCLUSION

The present study revealed that oral health conditions like periodontal status, loss of attachment oral mucosal lesions, dental trauma, and dental erosion were noticed more in production

line workers of steel factory and their oral health-related quality of life is poor over its counterparts may be due to the exposure towards harmful gases during their working hours, which confirmed the association between the deterioration of oral health status and hazardous workplace environment. Oral health status was significantly related to various components of oral health-related quality of life of the study population. Occupational health should be given more importance in the prevention of oral diseases, which may arise due to the work environment by setting up hospitals/clinics, regular check-ups, and immediate referral. The early recognition and the treatment of oral diseases may go a long way in helping the people in need. There is a high need for planning health education programs for the production line workers.

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Conflicts of interest

There are no conflicts of interest.

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