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Research Article

ORAL HEALTH STATUS AMONG WORKERS OF BATTERY FACTORIES IN MORADABAD: A CROSS SECTIONAL STUDY

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A B S T R A C T

Introduction: Oral health is an integral part of general health which not only depends on the environment in which an individual dwells but also the one in which he/she works. Exposure to various harmful substances in acid battery factory e.g. lead, sulphuric acid, affects various organ systems in the body with tissues of the oral cavity being no exception. **Aim:** The aim of this study is to assess the oral health status among production line workers of battery factories in Moradabad. **Materials and Methods:** A cross-sectional study was conducted among 800 production line workers of twenty four battery factories in Moradabad. The study group comprised of all the workers in the factories including the production line. Oral health status was assessed using the WHO oral health assessment form, 2013. Statistical analysis was performed using SPSS version 19. **Results:** The mean age of the study group (production line workers) was 29.15 ± 7.91 years and of control group (nonproduction line workers) was 35.49 ± 7.62 years. Mean years of experience were 9.90 ± 7.35 for production line workers and 7.07 ± 5.97 years for nonproduction line workers. Periodontal pockets were found to be present in 31.11% of workers when compared to 12.2% of control group workers ($P = 0.001$). Prevalence of dental erosion was found to be 49.5% among study groups as compared to 4.4% among the controls ($P < 0.001$). **Conclusion:** This study demonstrate the association of various oral conditions with workplace environment. The present study points the need of establishing appropriate educational, preventive, and treatment measures coupled with efficient scrutiny and monitoring in the workplace environment.

INTRODUCTION

Oral health is an integral part of general health which not only depends on the environment in which a person lives but also the one in which he/she works. Exposure to various harmful substances in acid battery factory affects various organ systems of the body including tissues of the oral cavity. There are a number of factors which influence both general and oral health among which one of the most important factors is environment.[1,2]

Factors such as age, sex, socioeconomic status, genetics, self-efficacy, and other performance components in an individual have an effect on occupational performance. As well, environmental factors, including social, physical, cultural, and institutional characteristics, interact with personal factors to either facilitate or hinder the performance of roles and a person's occupational performance.[3] The relationship between person, occupation, and the environment is not only linear but also a dynamic constantly interacting relationship that influences the way in which persons perform daily tasks and activities.[4,5]

An "occupational disease" is any disease contacted primarily as a result of exposure to risk factors arising from work activity. Some well-known occupational diseases include occupational lung diseases and occupational skin diseases.[6]

Lead is also one such element which is widely used in battery factories and has a marked effect on the health of factory workers. The perilous chemicals used in the battery-making process are lead oxide, spongy lead, and sulfuric acid.The workers, especially, those in production line are exposed to these chemicals through means of inhalation, ingestion, or dermal contact and are a major cause of toxicity.[7,8]

The dental changes in workers of battery factories and galvanizing occupations include gingivitis, periodontal conditions, erosions, abrasion, and decayed, missing, and filled teeth (DMFT). The long standing process of exposures to acid fumes may irritate soft tissues resulting in periodontal changes or oral mucosal lesions.[9] Studies have also reported an relationship between occupational exposures to acids and

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symptoms of periodontal disease such as gingival bleeding and periodontal pockets ≥4 mm among exposed workers.[10,11] Studies have shown dental erosion, tooth wear, poor oral hygiene, and presence of periodontal pockets in battery workers. Other studies also found deteriorated oral health status among workers of battery factory. Occupational diseases can be prevented, but particular attention needs to be paid to the health and safety of workers in hazardous occupations.[12]

There are many small- and large-scale battery factories employing many workers who constitute a major part of the Moradabad population.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted over 2 months from March to April 2018 among workers of battery factories in moradabad. Before conducting the study, ethical clearance was obtained from the institutional review board and informed consent from the managers of the factories as well as the workers. A pilot study was performed in the month of February 2018 for 1 week to check the feasibility. Training and calibration for recording of the WHO basic oral health survey 2013 were done in the department (Cohen's kappa = 0.87).

All the battery manufacturing units present in the Moradabad were included for the purpose of the study. Using 19.1% prevalence from the previous study and 3% as precision, 0.05 alpha error sample size came out to be 377 which was rounded off and taken as 400 in both the groups.[12] Thus, a total of 24 factories and 800 workers (400 production line workers and 400 nonproduction line workers) who gave consent were selected based on the following inclusion and exclusion criteria:

Inclusion criteria

The workers (production and nonproduction line) with the minimum experience of 1 year in the battery factory were included in the study.

Exclusion criteria

- Workers who had hyposalivation, salivary hypofunction, and vomiting as side effects
- Workers suffering from specific systemic medical conditions including eating disorder and acidic reflux conditions leading to vomiting were excluded from the study.

Age, years of experience, educational status, and dietary history were recorded on a pro forma from the workers. Oral health assessment was done using structured pretested oral health assessment form (the WHO basic oral health survey 2013). The Type III examination using mouth mirror and probe in natural light was carried out for each worker.

Statistical analysis was performed using SPSS version 19. Normality was checked using Shapiro–Wilk test. Student's *t*-test was used for variables which were parametric and Mann–Whitney U-test for variables which were nonparametric (nonhomogeneously distributed data) to compare mean, and Chi-square test was used to compare parameters between both groups.

RESULTS

Mean age of the production line workers was 29.15 ± 7.91 years, whereas it was 35.49 ± 7.62 for nonproduction line workers. Mean work experience was 9.90 ± 7.35 years in production line workers and 7.07 ± 5.97 years in nonproduction line workers. Educational level of the population revealed that 283 (42.3%) were illiterate in production line worker group and 39 (9.9%) in the nonproduction line worker group. Among total participants, primary education, middle primary, and high school education were completed by 282 (43.1%), 77 (14.2%), and 2 (0.4%) in the production line group and 208 (32.0%), 196 (29.3%), and 99 (17.3%) in the nonproduction line group, respectively.

Comparison of the mean DMFT between the study (1.44± 1.47) and control groups (1.36 ± 1.53) showed nonsignificant difference ($P = 0.16$) [Table 1].

Table 1 Dental caries experience (decayed, missing, and filled teeth) between the study and control groups

Group	N	DMFT
Study group	400	1.44±1.47
Control group	400	1.36±1.53

P=0.16. DMFT – Decayed, missing, and filled teeth

Periodontal status was compared based on community periodontal index (CPI) and loss of attachment (LOA) scores; shallow pockets and deep pockets were found among 29.6%, 15.1%, and 7.7%, 4.5% of the study and control group workers, respectively ($P = 0.001$) [Table 2].

Table 2 Periodontal status between both the groups based on community periodontal index scores

CPI Score	Group	
	Study group (%)	**Control group (%)**
Absence of condition	244 (56.7)	268 (74.4)
Presence of shallow pockets (4-5 mm)	130 (29.6)	113 (7.7)
Presence of deep pockets (≥6 mm)	26 (15.1)	19 (4.5)
Total	400 (100.0)	400 (100.0)

P=0.001. CPI – Community periodontal index

In the study group, prevalence of dental erosion (49.5%) was more as compared to the control group (4.4%). Enamel, dentinal, and pulpal erosions were reported in 19.9%, 21.4%, and 8.2% of workers, respectively [Table 3].

Table 3 Dental erosion between the study group and control group

Dental erosion	**Group**	
	Study group (%)	**Control group (%)**
Code 0 (no erosion)	221 (50.5)	378 (95.6)
Code 1 (enamel erosion)	53 (19.9)	12(3.2)
Code 2 (dentinal erosion)	64 (21.4)	10 (1.2)
Code 3 (pulp involvement)	62 (8.2)	0
Total	400 (100.0)	400 (100.0)

P<0.001

DISCUSSION

The battery factory workstations usually contains acid vapours which gets continuously discharged from the containers and is a mixture of dilute sulfuric acids.It was found from many studies that higher concentrations of acid fumes in the working

environment are directly related to the higher proportions of workers with loss of tooth substance.[8]

While comparing for dental caries in both the groups it was found that there isstatistically nonsignificant difference between the groups ($P = 0.16$) which was similar to the results from the study done by Fukayo *et al*.[13] The main reason for comparing dental caries in both the groups could be the cariostatic action of an environmental acid. The oral cavity gets exposed to the acid fumes in workplace through inhalation which then affects the competition between strains of oral streptococci and thus reduces dental caries.

Upon Comparison of periodontal status in between both groups showed pockets i.e. 44.7% of production line workers as compared to 12.5% of nonproduction line workers.

Moreover Acid exposure may also affect the immunologic defenses or protective components of the saliva which plays an important role in the pathogenesis of periodontal diseases. It may also cause changes in the intra- and extra-cellular pH which plays an important role in the control of cell growth and differentiation and thus leads to periodontitis. Furthermore, changes in intra- and extra-cellular pH due to acid mists play an important role in the control of cell growth and differentiation.

Industrial environmental factors have also been reported to cause dental erosion. In the present study, enamel erosion was seen among 19.9% of the study group workers and 3.2% of controls, dentinal erosion among 21.4% of the study group workers and 1.2% of controls. None of the control group subjects had pulp involvement due to erosion, whereas 8.2% of study group workers had pulp involvement. The findings were similar to the study conducted by Amin *et al*.[14], Khurana *et al*.[15], and Gomes.[16] The response of enamel to acids makes it vulnerable to decalcification and thus dental erosion. Exposure to inorganicacids also leads to immune reactions such as decrease in the phagocytic capacity of macrophages and cytotoxic activity of tumor necrosis factor and increase the number of chromosomal abnormalities in the human lymphocytes.15

Limitations

Although the oral health status of the workers was assessed in the present study, acid concentration could not be assessed in the workplace air. Furthermore, hyposalivation could not be checked using any biochemical test which makes a few limitations of the study.

CONCLUSION

The present study showed a significant difference between both the groups for periodontal status, dental erosion, and oral mucosal lesions, thus showing poor oral health among production line workers as compared to their nonproduction line counterparts. Oral manifestations of occupational origin are readily predisposed and aggravated by neglect of oralhealth, and the problem of prevention of oral occupational hazards must be attacked both by improving the working conditions and by establishing and maintaining oral health.

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