An Assessment of Oral Health Status among Lead Battery Factory Workers in Ghaziabad UP a Cross Sectional Study

Akanksha Monga[1], Thanveer K[2], Bhuvandeep Gupta[3], Aparna Aggarwal [4], Nisha Yadav[5], Meena Jain[6], Ankur Sharma[7]

[1]Sr. Lecturer, Department of Public Health Dentistry and Research & Innovation Catalyst, Manav Rachna Dental College, FDS, MRIIRS, Faridabad, [2]Professor, Department of Public Health Dentistry, Teerthankar Mahavir University, Moradabad, [3]Professor, Department of Public Health Dentistry, ITS Dental College, Greater Noida, [4]Associate Professor, Department of Oral Medicine & Radiology, Vitaldent Advanced Dental Clinic, Faridabad, [5]Sr. Lecturer, [6]Associate Professor and Head, [7]Lecturer, Department of Public Health Dentistry, Manav Rachna Dental College and Research & Innovation Catalyst, FDS, MRIIRS, Faridabad

Abstract

Introduction: Industrial workers are a well-defined group of a population. They have frequent shifts, low socio-economic status and neglected oral hygiene as they are at risk for health and dental problems. Industrial revolution has provided a lot of scope in employment worldwide for many which has improved the standard of living of many individuals. Health at workplace is considered essential now a days in various countries due to this rapid economic growth and industrial progress. In various industries like acid battery industry, chemical and textile industry, are exposed to hazardous substances and radiations. Studies have also reported a positive association between battery exposures to strong acids and periodontal pockets or gingival bleeding among exposed workers. Therefore, the purpose of the present study is to assess the oral health status of lead battery factory workers in Ghaziabad Uttar Pradesh. **Material and Method:** The "World Health Organization (WHO) oral health assessment form -2013" was used to record the clinical findings.[25] For the diagnosis of dental caries, WHO type III examination was carried out using mouth mirrors and explorers while using adequate illumination. The components of the form used were - General information, Dentition status (crown, root), periodontal status, loss of attachment, dental erosion, and oral mucosal lesions. **Results:** The mean DMFT scores were (5.72 3.17) females had more number of teeth with gingival bleeding compared to males. It was also found 72.3% of battery factory workers had pocket depth more than 6mm. 51.5% workers in the study had LOA of score 3 (as per WHO proforma) Mean number of teeth affected with erosion was more in males (4.76 4.02)

Conclusion: Oral health statuses of factory workers are highly affected due to lead acid used in industries.

Keywords *– Oral health, Lead workers, dental erosion, oral lesions*

Introduction

Human health is determined by many factors and environment is one among them which is very important. The study of any disease means studying man and his environment so, key to man's health depend mostly on his environment. Initially, disease was thought to be due to cosmological and magical effect of God. Hippocrates was the first person who related the environment and the disease[1].

The latest concept of the environment is not restricted to physical environment only, but it also means social, economic and occupational condition. Occupational environment is related to work place conditions which

Corresponding author:
Dr. Nisha Yadav
Address - BDS, MDS, Sr. Lecturer, Department of Public Health Dentistry and Research & Innovation catalyst, Manav Rachna Dental College, FDS, MRIIRS, Faridabad, Email- nisha.mrdc@mrei.ac.in
Mob- +91 9911227035

affect the health of working personnel[2].

Industrial workers are a well-defined group of a population. They have frequent shifts, low socio-economic status[3] and neglected oral hygiene[4]as they are at risk for health and dental problems. Industrial revolution has provided a lot of scope in employment worldwide for many which has improved the standard of living of many individuals. Health at workplace is considered essential now a days in various countries due to this rapid economic growth and industrial progress. In various industries like acid battery industry, chemical and textile industry, are exposed to hazardous substances and radiations.[5] This results in deterioration of the health of workers of these industries. Some studies have proven that there is an association between occupational exposure and increased incidence of diseases[6,7,8,9].

It has been already known that the teeth of industrial workers are affected who are exposed to inorganic acids at workplace[10,11,12]. These acids have high corrosive effect on tooth structure which causes inflammatory reactions. Further, these inflammatory reactions cause a decrease in salivary Ph[13]and compromised immunity, thus making the person more prone to various infections in oral cavity. Soft tissues also gets irritated due to chronic exposure to these acids which results in other oral diseases such as periodontal disease or oral mucosal lesions.[14] Exposure to these acidic contaminants can occur in factories of sulfuric acid, lead acid, petrochemical, metals and semiconductors etc[15]

Sometimes, pathologic changes in oral cavity may be the first sign that indicates absorption or toxicity related to certain toxic agents.[16] Due to the substantial increase in the use of chemical substances that have adverse effects on oral health, industrial dentistry has become a subject of major consideration and constituted a new branch in the field of dentistry. Many adverse oral health conditions were reported among workers exposed to lead and the most common reported adverse effects were the Dental erosion cases with decay, missed and filled teeth, gingivitis, pockets and other periodontal conditions including periodontal attachment loss (PAL).[17]It is mainly in the battery industry, where vast quantities of lead acid are used as an essential part of the battery making process.[18] Other than lead, nicotine and alcohol are also responsible for occurrence of severe forms of periodontal destruction, such as PAL.[19,20]

Exposure to acid mists causes periodontal diseases. This occurs due to changes in intracellular and extracellular pH which affects cell growth and differentiation. The prevalence of dental erosions is higher in workers in battery and galvanizing occupations. Battery workers have the highest prevalence 60% of erosion.[21]Acidic mist exposure can erode the enamel and dentin of teeth and makes teeth vulnerable to acidic de-calcification. Mainly the anterior teeth exposed to the atmosphere are affected and completely dissolved. Some studies have also reported a positive association between battery exposures to strong acids and periodontal pockets or gingival bleeding among exposed workers.[22, 23]

There is very little information on the effects of occupational hazards on oral health status of individuals in developing countries [24]. Therefore, the purpose of the present study is to assess the oral health status of lead battery factory workers in Ghaziabad Uttar Pradesh.

Material and Methods

A cross-sectional study was conducted in district Ghaziabad lead battery factory workers from April 2019 to August 2019. Ethical clearance was obtained from institutional ethical committee (IEC).All information regarding battery factory workers was obtained from Ghaziabad Battery Udyog association. Permission to conduct the study was obtained from Ghaziabad Battery Udyog association. A group of 50 subjects were selected from a factory to conduct pilot study to check the feasibility. The examiner was calibrated and trained in department of public health dentistry before the main study. The entire sampling frame that is, all the battery factory workers in Ghaziabad city who had given consent, willing to participate and who will be present on the day of study will constitute the final sample of this study. There were 25 factories and 1 factory was included in pilot study the total population came among

them was 1111. Informed written consent was taken from the workers of the factory before their participation in the study in order to prevent any inconvenience and to ensure full cooperation. Out of 1111, 998 were present on the days of data collection from them 850 gave consent for participation in the study. Therefore, the response rate came out to be 85%.

The "World Health Organization (WHO) oral health assessment form 2013" was used to record the clinical findings.[25] For the diagnosis of dental caries, WHO type III examination was carried out using mouth mirrors and explorers while using adequate illumination. Factory workers were allowed to sit on a chair or stool as per availability. A table to place the instruments was placed within easy reach of examiner. The recording assistant was allowed to sit close to the examiner. Periodontal assessments were done by community periodontal index (CPI)-probes. The diagnosis of oral lesions was carried out using WHO criteria[26].

The components of the form used were General information, Dentition status (crown, root), and periodontal status, loss of attachment, dental erosion and oral mucosal lesions. The data was analyzed using Statistical Package for Social Sciences (SPSS Inc., Chicago,IL, USA) version 23.0.

Results

This study was conducted on 850 battery factory workers of Ghaziabad to assess their oral health status. The mean age of the study population was (38.95 ± 13.22) with the youngest age being 18 and the oldest being 78.Among the 850 battery factory workers studied, 647(76.1%) were males and 203 (23.9%) were females.

Mean number of teeth present in the study population was (28.79 ± 3.82) which was found to decrease as age increases Mean DMFT score for the study population was 5.72 ± 3.17 with highest mean DMFT found in the >64 years age group and the least mean DMFT score of 4.82 ± 2.22 seen among 35-44 year olds. Males and females had similar mean DMFT scores.

Root Caries

Mean number of teeth affected with root caries increased with age. Mean number of teeth with root caries was 0.38 ± 0.78 with male workers having comparatively higher mean root caries (0.47 ± 0.81) when compared to females (0.13 ± 0.62).

Gingival Bleeding

Female subjects were seen to be having more mean number of teeth with gingival bleeding (9.67 ± 6.16) compared to males (8.23 ± 4.68).

Periodontal Pocket

On examination for periodontal pockets, it was found that 615(72.3%) of the battery workers had deep pockets (pocket depth 6 mm or more), 130 (15.2%) had shallow pockets (4 -5 mm pocket depth) and 105 (12.3%) were free from any periodontal pockets.

Loss of Attachment

A loss of attachment score of 3 (Cemento-enamel junction is between 6 to mm and between the upper limit of black band and 8.55 ring of CPI probe) was seen in 435 (51.1%) of the subjects.

Dental Erosion

Mean number of eroded teeth was 4.48 ± 3.82 with the least number of teeth with erosion seen in <35 years old (2.81 ± 2.99) and the highest mean number of teeth with erosion was seen among 45-54 year old (7.4 ± 3.33).Teeth of male workers had higher mean number of affected teeth (4.76 ± 4.02) in comparison to female workers who had 3.59 ± 2.95 mean number of teeth with erosion.

Oral Mucosal Lesions

On examination for oral mucosal lesions, 195 (23%) of the battery workers did not have any kind of lesions. 128 (15%) of the workers had aphthous, herpetic or traumatic ulceration on lips, buccal mucosa and tongue. Lichen planus was seen in 14 (1.6%) of workers on their buccal mucosa. 17 (2%) workers were having candidiasis

on their tongue and 21 (2.47%) had ANUG (acute necrotizing gingivitis)

Table 1 Age wise distribution of study subjects according to the No. of teeth with gingival Bleeding

Age	No. ofteeth with gingival bleeding (Mean ± S.D)
<35	7.95 ± 4.77
35 – 44	9.77 ± 6.0
45-54	8.60 ± 3.96
55-64	9.12 ± 4.28
<64	7.13 ± 4.96
Total	8.58 ± 5.1

Table 2 Distribution of study subjects according to severity of dental erosion

Severity of Dental erosion	Frequency (n)	Percentage (%)
No sign of erosion	256	30.1%
Enamel lesion	233	27. 41%
Dentinal lesion	266	31.2%
Pulpal Involvement	95	11.1%

Table 3 Age wise distribution of study subjects according to the No. of teeth with shallow pocket

Age	No. of teeth with shallow pocket (Mean ± S.D)
<35	2.44 ± 2.48
35 – 44	1.97 ± 2.12
45-54	2.79 ± 2.38
55-64	1.77 ± 1.88
>64	0.94 ± 1.15
Total	2.2 ± 2.3

Table 4 Distribution of study subjects according to highest score of loss of attachment

Loss of attachment	Frequency (n)	Percentage (%)
0	112	13.1%
1	83	9.7%
2	220	25.8%
3	435	51.1%

Table 5

	MALE	FEMALE	X2 value	P
Decayed	554	198	182.3	<0.001
Missing	355	85	97.18	<0.001
Filled	59	10	5.004	0.172
Root caries	177	9	65.36	<0.001
Gingival Bleeding	571	184	0.887	0.210
LOA	545	193	28.96	<0.001
Erosion	462	193	13.24	0.004

Discussion

It has been observed that oral injuries are common with direct contact in occupational exposure.[24]In battery industries, sulfuric acid has been used in large quantity. This sulfuric acid contains >20% of sulfur dioxide dissolved in the acid, which has a sharp penetrating odor. Acid mist is frequently detected in the lead factory area as it continuously discharges from open containers and leakage from pipes. Exposure is detectable to human beings at a level of 0.5 to 0.7 mg/m^3, is irritating at 1.0 to 2.0mg/m^3 and causes coughing at 5.0 to 6.0 mg/m^3. [2]

In different study settings acid mist concentration varied from .08 to 5mg/m[26,4,5]. High concentration of acid fumes in the working environment is related to the higher prevalence of teeth erosion.[27,28]

In our study it was found that dental caries experience is 95.8% with maximum caries in subjects of age below 35 years whereas the caries prevalence was 71.1% for age above 35 years in the study done by Rushabh J Dagli et al[29]and the dental caries experience came out to be 62.5% in the study done by P. Basavraj et al [30]

Results of this study showed the prevalence of periodontal disease in battery factory workers to be 88.9%. Bleeding was observed for all age groups. Similar results were observed by Wang et al (2002)[31] and Baelum et al (2003)[32]. Periodontitis was less frequently seen in other studies (Garcia and Cutress, 1986)[33](Oliver et al, 1989)[34] (El-Quaderi and QueteishTaani, 2004)[35].

The results of this study are in accordance with the findings of the WHO Global Oral Data Bank, as most of the patients show some type of bleeding when different sextants are evaluated (over 90%).

In the present study, 69.8% showed some degree of dental erosion, this may be attributed to the working environment. The reason for this could be the Lead and sulfuric acid being used as one of the ingredients in the production work of factory. Whereas, Zabiñska O et al (1982)[36], Lie T et al (1988)[37]found most of the workers with dental erosion (90%) 23.7% of the workers with more than 10 years of working experience showed 3rd degree of Dental erosion compared to 0% from 1-10 years and the difference is statistically significant. This is in agreement with the study done by Amin WM et al (2001)[38]. They studied dental erosion on workers of battery industries of Jordan and found significant increase in the erosion among the study. In our study we found highest mean number of eroded teeth was 7.40 among 45 – 54 years of age group.

Limitations

1. Grouping the participants into study and comparison group was not done based on the working site of the study participants.

2. Work experience was not counted as more no. of subjects were below 35 years of age.

3. The exposure level of the participants to the acid fumes was not measured quantitatively.

Conclusion

Industrial sector plays a key role in national development. The factory employees who form the lifeline of any factory area, working in a confined factory environment in par with machines are at high health risks. However, many a times they are not given due importance. Hence, continuous professional research and development is essential to improve overall health and development of such population, so as to have a healthy productive labor population for development of any nation.

As a revitalization of existing oral health service which is mainly of treatment aspect, it should be oriented more towards preventive health care. So we conclude that in such population continuous research and interventions are needed to improve the overall health status of these specific occupational subjects.

Recommendations

In the light of the present alarming findings associated with excessive exposure to sulphuric acid fumes in the workplace, occupational health authorities are invited to implement effective safety measures, including:

- Efficient surveillance and routine monitoring of acid fumes in workplace air
- Installation of efficient ventilation and exhaust systems of the work sites
- Automation of manufacturing processes
- To reduce the threshold limits below the level that is safe for teeth might be the measure of choice to decrease the risk of dental erosion
- Government must take suitable measures and a strict law for the rights of workers regarding health should be formulated along with regular inspections and follow up.

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