

# Assessment of Tooth Wear Among Glass Factory Workers: WHO 2013 Oral Health Survey

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## ABSTRACT

**Background:** Glass factory workers are often exposed to the hazardous environment that leads to deleterious oral health and subsequently, general health. We planned to determine the effects of the particulates present in the milieu on the tooth wear among workers.

**Aim:** To assess tooth wear among glass factory workers in Jaipur, Rajasthan, India.

**Settings and Design:** A descriptive cross-sectional survey was conducted among 936 glass workers in Jaipur, Rajasthan, India from January-June 2014.

**Materials and Methods:** A survey proforma was designed for tooth wear evaluation with the help of WHO Oral Health Assessment form 2013 (for adults). Information regarding oral health practices, adverse habits and dietary habits, demographic

details was gathered and clinical parameters were recorded.

**Statistical Analysis:** The Chi-square test, t-test, One-way Analysis of Variance and a Stepwise multiple linear regression analysis.

**Results:** The most prevalent form of erosion was enamel erosion (589, 62.93%) with few subjects of deeper dentinal erosion and the difference was statistically significant ( $p=0.001$ ). Dental erosion was found to be higher among males compared to females. Years of experience and educational status were identified as best predictors for dental erosion.

**Conclusion:** It was concluded that there was considerable evidence of dental erosion found among the factory workers. Due to ignorance on social, cultural and health aspects, professional approach with regular dental care services for detection of early symptoms and planning of preventive strategies is warranted.

**Keywords:** Dental erosion, Hazards, Occupational health

## INTRODUCTION

In the modern era, we live in an environment which is not only physical but also social and economic. When the equilibrium between the environment and humans get disturbed, it leads to a state known as disease.

Occupational hazard can be defined as unpleasant health risk to a person usually arising out of employment. It refers to work, material, substance, process or situation that predisposes or itself causes accidents or disease at work place [1]. Occupational hazards contribute to the premature death of millions of people worldwide and result in the ill health or disablement of hundreds of millions more each year. The World Health Organisation places occupational risks as one of the leading cause of morbidity and mortality [2].

Tooth wear has been defined as loss of tooth substance resulting from abrasion, attrition and erosion acting singly or concurrently i.e. abfractions. Out of all the types of tooth wear defined by Pindborg [3], dental erosion is an irreversible pathological condition characterized by loss of hard dental tissue due to chemical produced by acids without bacterial involvement [4]. It was reported first in the 19th century [5] and since then its incidence and prevalence is increasing [6]. The management of dental erosion is an area of clinical practice that is undoubtedly expanding [7]. In the International Classification of Diseases (ICD), erosion of teeth is coded as 521.3 (ICD-9) and K03.2 (ICD-10) [8,9].

The aetiological factors can either be extrinsic or intrinsic. One of the major aetiological factor for dental erosion is the exposure of environmental pollutants like silica, acids, pharmaceuticals which over a period of time cause considerable tooth substance loss [10-12]. Example of one such occupation in which environment plays a major role is glass factory workers. The term "glass" comprises a series of products that are categorized mainly by their desired rate of cooling from fusion to a solid state [13].

There are various studies about the association between occupational exposure and greater incidence of oral diseases. A research on

59 clothing factory workers found a significant association between occupation and teeth damage [3]. Silica or quartz dust has been observed to cause tooth wear among people who are regularly exposed to its dust or vapours. Among the workers in the Danish granite industry, the prevalence of dental abrasion was 100% with high prevalence of dental caries and periodontal disease [14]. It has also been noticed that silica dust inhaled in large amount can be a risk factor for oral cancer [15]. Despite of the hazardous nature of the risks posed on the oral health of the workers in glass factories, very little research has been conducted and reported on their health and safety. Even in India, research on this group of population is limited. Owing to paucity of literature on this vulnerable population, the present study is executed to assess the tooth wear status of glass factory workers in Jaipur, Rajasthan, India.

## MATERIALS AND METHODS

Study Design, Study Population, study area and Study Duration

A descriptive cross-sectional survey was conducted among glass factory workers in Jaipur, Rajasthan, India from January-June 2014.

### Official Permission and Ethical clearance

The Ethical Committee of Pacific Dental College and Hospital reviewed the study protocol and granted ethical permission.

An official permission to conduct the study was obtained from the Manager of Glass Factory, Jaipur, Rajasthan, India.

### Informed consent

A written informed consent was obtained from all the subjects who were willing to participate after they understood the purpose and details of the study.

### Training and Calibration

Before the study started, the examiner was standardized and calibrated to ensure uniform clarifications, understanding and

presentation of the codes and criteria for the conditions to be observed for warranting steady examination. The examiner first practiced the procedure on 10 subjects with varying disease conditions, then on a group of 20 subjects, with a full range of disease conditions, twice on successive days. The intra examiner reliability was assessed using Kappa statistics, which were found to be 90%. Subjects fulfilling the eligibility criteria of voluntary participation, those who were currently not under any medications and those having at least 20 teeth excluding third molars were included in the study. Those who were not willing to participate in the study, those on daily wages in the factory, those with any chronic illness or on medication and those unable to open their mouth were excluded from the study.

### Proforma details

A survey proforma was designed with the help of WHO Oral Health Assessment form 2013 (for adults) [16] consisted of two sections:

1. A modified oral health questionnaire consisting questions regarding adverse habits.
2. General information: Demographic data including name, age, gender, location, education and years of experience.

**Clinical parameters:** Clinical parameter assessed was dental erosion.

**Pilot Survey:** Feasibility, practicability of the study and time required for examination of each subject was determined by examining 50 glass factory workers.

## MATERIALS AND METHODS

Before the commencement of the study, information regarding the glass factories in Jaipur was obtained and it was found that there was only one glass factory in the city. Thus, we selected that factory. Thereafter, list of glass factory workers was obtained from factory authorities. According to the list, there were a total of 1521 workers in the factory. Five hundred and seventy two workers in the factory were on daily wages and thus were excluded. Among the remaining, the workers who gave informed consent were included in the study. Thus, the sample size was achieved to be 936. The examination was made with the aid of a mouth mirror and CPI (Community Periodontal Index) probe according to Type III examination as described by WHO [17].

## STATISTICAL ANALYSIS

The noted data was compiled and analysed using Microsoft Excel 2010 and SPSS version 19 respectively. The description included computation of percentages, means and standard deviations. The appropriate statistical tests applied were Pearson's chi-square test ( $\chi^2$ ), t-test, One-way Analysis of Variance and Stepwise multiple linear Regression analysis. Confidence interval and p-value were set at 95% and  $\leq 0.05$  respectively.

## RESULTS

Of the total 936 subjects in the survey, most of them were males with majority of the population in the age group of 30-39 years. The mean age of the study population was  $36.06 \pm 7.18$  [Table/Fig-1].

Most of the glass factory workers had their education till primary level. Most of the workers were employed in the factory for more than 5 years [Table/Fig-2].

The prevalence of consumption of smoking tobacco i.e. cigarettes and beedi was seen among the working population and it was found to be 71.90 %. Statistically significantly, beedi smoking was most prevalent among population. Significant association was found among gender and tobacco usage with more number of males (78.69 %) using tobacco [Table/Fig-3]. The results depicted the frequency of adverse habits (alcohol consumption) among the study population with majority of subjects not consuming in the past 30 days [Table/Fig-4].

The results illustrated that majority of the population suffered from enamel erosion with highest prevalence in males of 40-49 year age group. The prevalence of dental erosion in males was highest among subjects in 20-29 year age group with mean number of affected teeth ( $3.25 \pm 6.11$ ) [Table/Fig-5].

The results also stimulated stepwise multiple linear regression analysis with dental erosion as the dependent variables and various independent variables. The best predictors in the descending order for tooth wear were years of experience, educational status, and adverse habits with variances of 5.7%, 10.9% and 16.7% respectively [Table/Fig-6].

Age	Male		Female		Total	
	n	%	n	%	n	%
20-29 years	6	75	2	25	8	0.85
30-39 years	491	69.25	218	30.75	709	75.74
40-49 years	113	76.87	34	23.13	147	15.70
50-59 years	51	85	9	15	60	6.42
60-69 years	10	83.33	2	16.67	12	1.29
Total	671	71.68	265	28.31	936	100.00
Mean age $\pm$ SD	36.01 $\pm$ 7.60		36.20 $\pm$ 5.99		36.06 $\pm$ 7.18	

[Table/Fig-1]: Distribution of study population by age and gender SD; standard deviation

## DISCUSSION

Various studies on the tooth wear status of the general population have been carried out in various workplaces however; to date; very little information is available on the dental health of glass factory workers. To the best of our knowledge, this was the first study undertaken to evaluate the tooth wear status of glass factory workers in Jaipur, Rajasthan.

The study population was in the age range of 20-69 years with majority of males. Demographics of the study population showed that major proportion of the study participants were Hindus (95.01%) with educational status till primary level (85.58%) which reveals that the glass factory workers might not have adequate knowledge about oral and occupational health. This is in accordance with the findings of Petersen et al., [14] who also reported a low level of education among Danish granite industry workers and hence, suffered from tooth wear more. Around half of the population was working in the factory from last 5-10 years. This inevitably relates with the fact that they will be having more exposure of glass dust compared to the workers who are working in the factory from less than 5 years. These findings can be correlated with the findings of Vizcaya et al., Zeleke et al., and Kelada F, Euinton LE who confirmed increased risk among workers serving for a longer period of time in various factories compared to those with less work experience [18-20].

In the present study, prevalence of dental erosion was found to be almost 77 % which was higher than the studies done by Tuominen M et al., Suyama Y et al., and Skogedal O et al., [21-23]. This finding can be a result of insufficient preventive measures to decrease acid exposure or a violation of the governmental regulations concerning maximal tolerable concentration of potentially erosive agents at workplace as stated by Kim HD et al., [24]. Traditionally, wearing masks as personal protective equipment is the most common recommendation for protection from hazardous environment. If workers do not understand the reasons for protection from hazardous environment, they are likely not to receive necessary protection [25] and get exposed to dust exposure like silica in the present study. Possible reasons for not wearing masks being that they are uncomfortable to wear for a longer period of time in hot and humid working conditions. Also, workers who consumed tobacco complained of sensation of tobacco smell while wearing masks. The present study stated that dental erosion was most prevalent in age group of 30-39 years (74.18 %). This can be correlated with

Variables	Age group (Years) n (%)					Gender n (%)		Total n (%)
	20-29 (n=8)	30-39 (n=709)	40-49 (n=147)	50-59 (n=60)	60-69 (n=12)	Male (n=671)	Female (n=265)	(936)
<b>Ethnic groups</b>								
Hindu	8 (0.89)	668(74.64)	147(16.43)	60 (6.70)	12 (1.34)	671 (74.96)	224 (25.04)	895 (95.01)
Muslims	0	41 (100)	0	0	0	0	41 (100)	41 (4.39)
Sikh	0	0	0	0	0	0	0	0
Christian	0	0	0	0	0	0	0	0
Jain	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0
<b>Location</b>								
Urban	8 (1.19)	449(66.91)	144 (21.47)	58 (8.65)	12 (1.78)	510 (76)	161 (24)	671 (71.68)
Peri-urban	0	260(98.11)	3 (1.13)	2 (0.76)	0	161 (60.75)	104 (39.25)	265 (28.32)
Rural	0	0	0	0	0	0	0	0
<b>Years of experience</b>								
<5 years	5 (2.08)	148(61.42)	68 (28.21)	13 (5.39)	7 (2.90)	188 (78)	53 (22)	241 (25.75)
5-10 years	2 (0.38)	476(90.83)	29 (5.54)	13 (2.49)	4 (0.76)	364 (69.46)	160 (30.54)	524 (55.98)
>10 years	1 (0.58)	85 (49.72)	50 (29.24)	34(19.88)	1 (0.58)	119 (69.59)	52 (30.41)	171 (18.27)
<b>Education</b>								
Up to primary	0	679(84.76)	78 (9.74)	44 (5.50)	0	561 (70.03)	240 (29.97)	801 (85.58)
Secondary	6 (5.45)	15 (13.64)	69 (62.73)	8 (7.28)	12 (10.90)	87 (79.10)	23 (20.90)	110 (11.76)
Higher sec. & above	2 (8)	15 (60)	0	8 (32)	0	23 (92)	2 (8)	25 (2.66)

**[Table/Fig-2]:** Distribution of demographic characteristics of study population by age and gender

Variables	Forms of tobacco n (%)								Total
	No habits	Cigarettes	Cigars	Smoke pipe/Hookah	Chewing tobacco	Snuff	Others (Beedi)	p-value	
<b>Age group (years)</b>									
20-29 (n=8)	2 (25)	6 (9.37)	0	0	5 (62.5)	3 (37.5)	6 (75)	0.001*	6 (75)
30-39 (n=709)	246 (34.70)	158 (22.28)	0	0	75 (10.57)	9 (1.26)	538 (75.88)		463 (65.30)
40-49 (n=147)	6 (4.08)	73 (49.65)	0	0	97 (13.68)	35 (23.80)	127 (86.39)		141 (95.91)
50-59 (n=60)	9 (15)	47 (78.33)	0	0	12 (20)	21 (35)	43 (71.67)		51 (85)
60-69 (n=12)	0	9 (75)	0	0	11 (91.67)	4 (33.33)	9 (75)		12 (100)
<b>Gender</b>									
Male (n=671)	143 (21.31)	283 (42.17)	0	0	145 (21.60)	23 (3.42)	643 (95.82)	0.001*	528 (78.69)
Female n=265)	120 (45.29)	10 (3.77)	0	0	55 (20.75)	49 (18.49)	80 (30.18)		145 (54.71)
Total (n=936)	263 (28.10)	293 (31.30)	0	0	200 (21.36)	72 (7.69)	723 (77.24)		673 (71.90)

**[Table/Fig-3]:** Percentage of subjects using tobacco by age and gender  
Test applied: Chi square test. \*p ≤ 0.05 statistically significant

Variables	Frequency of alcohol consumption n (%)								p-value
	Less than 1 drink	1 drink	2 drinks	3 drinks	4 drinks	5 or more drinks	Did not drink alcohol during the past 30 days		
<b>Age group (years)</b>									
20-29(n=8)	1 (12.5)	0	0	0	0	0	7 (87.5)	0.001*	
30-39 (n=709)	0	0	84 (11.85)	90 (12.70)	0	0	535 (75.45)		
40-49 (n=147)	0	16 (10.89)	16 (10.89)	10 (6.80)	0	0	105 (71.42)		
50-59 (n=60)	0	0	27 (45)	0	0	0	33 (55)		
60-69 (n=12)	0	0	0	2 (16.67)	0	0	10 (83.33)		
<b>Gender</b>									
Male (n=671)	1 (0.15)	16 (2.38)	113 (16.84)	92 (13.71)	0	0	449 (66.91)	0.001*	
Female (n=265)	0	0	14 (5.28)	10 (3.77)	0	0	241 (90.94)		
Total (n=936)	1 (0.10)	16 (1.71)	127 (13.57)	102 (10.90)	0	0	690 (73.72)		

**[Table/Fig-4]:** Percentage of subjects using alcohol by age and gender  
Test applied: Chi square test. \*p ≤ 0.05 statistically significant

the findings by Chikte UM et al., Petersen PE et al., and Fukayo S et al., that more anterior teeth were affected by erosion compared to posterior teeth [10,25,26].

This epidemiological survey has given insight on the information to reinforce the oral health programmes execution. Due to high

treatment demands of the study population, the health strategy that highlights oral health promotion and prevention would appear more valuable in addition to old-style curative care.

Because of the busy work schedule of the workers, long distances to travel, lack of time and manpower, it was not possible to

Variables	Dental erosion n (%)				Mean number of affected teeth	
	No signs	Enamel lesion	Dentinal lesion	Pulp involvement	p-value	p-value
<b>Age group (years)</b>						
20-29 (n=8)	8 (100)	0	0	0	0.001*	3.25 ± 6.11
30-39 (n=709)	183(25.81)	405 (57.12)	121 (17.06)	0		2.44 ± 1.73
40-49 (n=147)	2 (1.36)	145 (98.64)	0	6		2.99 ± 1.95
50-59 (n=60)	15 (25)	45 (75)	0	0		2.44 ± 2.22
60-69 (n=12)	12 (100)	0	0	0		1.39 ± 3.07
<b>Gender</b>						
Male (n=671)	118 (17.58)	472 (70.34)	121 (18.03)	6 (0.89)	0.001*	1.89 ± 0.41
Female (n=265)	102 (38.50)	123 (46.41)	0	0		2.93 ± 0.29
Total (n=936)	214 (22.86)	595 (63.56)	121 (12.92)	6 (0.64)		2.21 ± 0.86

**[Table/Fig-5]:** Prevalence of dental erosion and mean number of affected teeth in study population according to age and gender  
Test applied: Chi square test, One-way ANOVA, t- test. \* $p \leq 0.05$  statistically significant

Age	Male		Female	
	R	R <sup>2</sup>	F	P
Model				
Tooth wear				
1	0.288 (a)	0.057	65.85	0.000(a)
2	0.367 (b)	0.109	52.67	0.000(b)
3	0.399 (c)	0.167	51.09	0.000(c)

a Predictors: (Constant), Years of experience

b Predictors: (Constant), Years of experience, Educational status

c Predictors: (Constant), Years of experience, Educational status, Adverse habits

**[Table/Fig-6]:** Stepwise multiple linear regression analysis with tooth wears as dependent variable

conduct a detailed study regarding the oral health care covering the entire glass & pottery factory workers in the city. Also, because of the lack of awareness and language barrier, many responses could not be assessed. Also, because some subjects were using smokeless tobacco, chances of variability are there. The study was cross-sectional in nature, thus we were prevented from drawing implications about causal relationships. So further, longitudinal research including larger population is suggested in order to explore and identify the prevailing aetiological factors like diet responsible for the current scenario.

## CONCLUSION

There is need for a strategy to tackle the problem of lack of general amenities and necessities in the social, cultural and health aspects including its influence on oral health and disease. As a part of professional approach towards the study subjects, regular dental care services should be provided for detection of early symptoms and planning of preventive strategies. A comprehensive care especially in subjects suffering with environmental exposures should be provided.

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