Original

Tooth loss, prosthetic status and treatment needs among industrial workers in Belgaum, Karnataka, India

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Abstract: The health of industrial workers often goes uncared for due to their stressful working conditions, busy schedules and poor economic conditions. A cross-sectional survey was conducted to determine the prevalence of tooth loss, prosthetic status and treatment needs among industrial workers in Belgaum, Karnataka, India according to the criteria described in the World Health Organization (WHO) Oral Health Assessment form (1997). A total of 614 workers participated in the study. Information was obtained regarding their oral hygiene practice. The presence or absence of habits, and the frequency and duration since the last visit to a dentist were recorded followed by clinical examination. Chi-square test was used to determine the association between the variables and tooth loss. There was a statistically significant difference between the number of missing teeth in different age groups, methods of cleaning, smoking habits and visits to the dentist. Regarding prosthetic status, only one worker had a fixed prosthesis in the mandibular arch. The study revealed that tooth loss was associated with oral hygiene practices, habits and visits to the dentist. Poor prosthetic status and high treatment needs were observed. This study emphasized the need for improved dental health awareness and availability of dental facilities to industrial workers. (J Oral Sci 54, 285-292, 2012)

Keywords: tooth loss; prosthetic status; treatment needs; industrial workers.

Introduction

It is a truism to say that what man is and to what disease he may fall victim depends on a combination of two sets of factors-his genetic factors and the environmental factors to which he is exposed (1). Oral health is an integral part of general health and plays an important role in improving the quality of life. The oral cavity is the port of entry for many diseases and presents several unique features that make it especially prone to occupational diseases (2).

Ramazzini (2), "the father of industrial hygiene", was the first to advocate the inclusion of the patient's occupation in medical history and to point out a number of oral symptoms.

In the modern era, the growth of a nation is measured by the amount of industrial progress. Such industrialization affects community health as well as workers' health. Occupational health problems are becoming more prevalent with rapid industrialization and mechanization in developing countries.

Industrial workers constitute well-defined population groups, and although they do not represent nationwide

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samples, such groups are often readily available and therefore have several practical advantages in epidemiologic studies (3). Industrial workers are at risk for health and dental problems as they have continuous shifts, night shifts, neglected oral hygiene, low socioeconomic status, etc.

Tooth loss is mainly attributed to dental caries and periodontal diseases, but psychosocial factors as well as age, gender, lifestyle (dietary habit, smoking, alcohol intake, etc.) and oral health behaviour may modify the progression of these disorders (4).

Belgaum city is one of the industrial hubs of Karnataka state. The workers are the backbone of these industries. The health of these workers usually goes uncared for as a result of their stressful working conditions, busy working schedules and poor economic conditions. There have been no studies evaluating the prosthetic status and treatment needs of industrial workers in India. Hence, an attempt was made to assess the tooth loss, prosthetic status and treatment needs of industrial workers in Belgaum city, Karnataka, India.

Materials and Methods

A cross-sectional study was conducted among the industrial workers of Belgaum city to determine the prevalence of tooth loss, the prosthetic status and treatment needs. Ethical clearance was obtained from the Ethical committee of K.L.E.S. Institute of Dental Sciences, Belgaum (Application number 134). There are approximately 394 industries in Belgaum city (www.belgaum.nic.in/stat.html). The 10% of these were selected by random sampling using a table of random numbers; these constituted 40 industries. Permission to examine the industrial workers was obtained from authorities of the industries. All of the workers in these selected industries constituted the sample. A total of 614 workers gave consent and volunteered to participate in the study.

Data collection took place within 3 months from July, 2006 to September, 2006. Kuppuswamy's socioeconomic scale (5) was used to check the socioeconomic status of industrial workers. Socioeconomic status was recorded by means of questions on occupation (categories: profession, semi-profession, clerical, skilled, semi-skilled, unskilled, unemployed worker), education (profession, graduate, intermediate, high school, middle school, primary school, illiterate) and family income per month (equal to or more than 28114 Rs, 14050-28113 Rs, 10533-14049 Rs, 7016-10532 Rs, 4204-7015 Rs, 1407-4203 Rs, equal to or less than 1406 Rs) from class I to class V: Upper (I), Upper Middle (II), Lower Middle (III), Upper Lower (IV), and Lower (V). Information was obtained regarding

the methods (finger/toothbrush/others), frequency (once/twice daily) and materials (toothpaste/tooth powder/others) employed for oral hygiene practice. The presence or absence of habits such as chewing, smoking and alcohol consumption was noted. The number of workers who visited dentist (in less than 2 years, in 2 to 5 years, in more than 5 years) and duration since the last visit to a dentist (less than 2 years, 2 to 5 years, more than 5 years) was also recorded.

Clinical examination was done using a mouth mirror and straight probe and the edentulousness status indicated by the number of missing teeth was recorded by a single investigator in a well-ventilated room during their working hours (i.e., 9 am to 5.30 pm) under natural lighting conditions. A clerk was trained to assist the recording procedure throughout the study. The assistant was made to sit close to the examiner so that instructions and codes could be easily heard and the examiner could see that the findings were being recorded correctly. Sterilization was carried out using electric sterilizers and an autoclave. Spot sterilization was done during the survey using chemical sterilization solution (Savlon; Johnson and Johnson Ltd., Solan, India).

Tooth loss, the prosthetic status, if any, and treatment needs were assessed according to the criteria described by the World Health Organization (WHO) Oral Health Assessment form (6). The format was reproduced from the Oral health survey basic method, 4th edition, of the WHO and was printed. Details on the format of the assessment form are given in the annexure.

The data was compiled, tabulated and subjected to statistical analysis using the SPSS package (version 15). Chi-square test was used to determine the association between the variables and tooth loss.

Results

A total of 614 industrial workers were examined, of which 78.9% were males and 21% were females with a mean age of 30.78 ± 9.91 years (range: 18-67 years).

The workers were divided into a group with 0-5 missing teeth, and a group with < 5 missing teeth. We concentrated on those with more than five missing teeth.

Among all workers, 0.7% in the 18-27 years age group, 2.7% in the 28-37 years age group, 13.3% in the 38-47 years age group, 37.2% in the 48-57 years age group and 16.7% in the 58-67 years age group had more than five missing teeth. There was a highly significant difference among different age groups in relation to number of missing teeth ($P = 0.00$). Of the workers, 4.2% belonged to the middle income group and 95.7% belonged to the lower income group. Among the middle socio-economic

Table 1 Distribution of workers based on number of missing teeth, age group and socio-economic status

Age	Number of missing teeth						
	0 (%)	1 (%)	2 (%)	3 (%)	4 (%)	≥ 5 (%)	
18-27	209 (78.6)	34 (12.8)	15 (5.6)	1 (0.4)	5 (1.9)	2 (0.7)	266
28-37	117 (52.2)	47 (21.0)	26 (11.6)	13 (5.8)	15 (6.7)	6 (2.7)	224
38-47	34 (45.3)	10 (13.3)	10 (13.3)	7 (9.3)	4 (5.3)	10 (13.3)	75
48-57	16 (37.2)	5 (11.6)	5 (11.6)	1 (2.3)	0	16 (37.2)	43
58-67	2 (33.3)	1 (16.7)	2 (33.3)	0	0	1 (16.7)	6
$\chi^2 = 166.57$; $P = 0.00$ Highly significant							
Middle SES (%)	15 (57.7)	06 (23.1)	02 (7.7)	0	0	3 (11.5)	26 (4.2%)
Lower SES (%)	365 (62.1)	91 (15.5)	56 (9.5)	22 (3.7)	22 (3.7)	32 (5.4)	588 (95.7%)
$\chi^2 = 4.78$; $P = 0.44$ Not significant							

Table 2 Distribution of workers based on number of missing teeth, and methods, frequency and type of materials used for cleaning teeth

Number of missing teeth	Method of cleaning		Frequency		Material used		
	Finger ($n = 116$)	Toothbrush ($n = 498$)	Once ($n = 500$)	Twice ($n = 114$)	Toothpaste ($n = 462$)	Toothpowder ($n = 138$)	Others ($n = 14$)
0	62 (53.4)	316 (63.5)	300 (60.0)	78 (68.4)	286 (61.9)	86 (62.3)	6 (42.9)
1	19 (16.4)	78 (15.7)	84 (16.8)	13 (11.4)	76 (16.5)	18 (13.0)	3 (21.4)
2	17 (14.7)	41 (8.2)	49 (9.8)	9 (7.9)	39 (8.4)	18 (13.0)	1 (7.1)
3	3 (2.6)	19 (3.8)	19 (3.8)	3 (2.6)	17 (3.7)	4 (2.9)	1 (7.1)
4	7 (6.0)	17 (3.4)	22 (4.4)	2 (1.8)	21 (4.5)	3 (2.2)	0
≥ 5	8 (6.9)	27 (5.4)	26 (5.2)	9 (7.9)	23 (5.0)	9 (6.5)	3 (21.4)
	$\chi^2 = 72.38$, $P = 0.00$		$\chi^2 = 6.33$, $P = 0.27$		$\chi^2 = 13.78$, $P = 0.18$		

χ^2 = chi square test value, $P < 0.05$ = statistically significant

status workers, 11.5% had more than five missing teeth and among the lower socio-economic status workers, 5.4% had more than five missing teeth. There was no statistically significant difference between the different socio-economic status groups in relation to the number of missing teeth ($P = 0.44$) (Table 1).

It was found that 18.9% of the workers used their fingers for cleaning their teeth, and 81.1% cleaned their teeth with a toothbrush. Among the workers who used their fingers to clean their teeth, 6.9% had more than five missing teeth. Among the workers who used toothbrushes to clean their teeth, 5.4% had more than five missing teeth. There was a statistically significant difference in the number of missing teeth between the methods used for cleaning teeth ($P = 0.00$). The 81.4% of the workers cleaned their teeth once daily and 18.6% cleaned their teeth twice daily. The 5.2% and 7.9% of the workers who cleaned their teeth once and twice daily, respectively, had more than five missing teeth. There was no statistically significant difference between the number

Table 3 Distribution of workers based on number of missing teeth, tobacco chewing habits, smoking habits, and alcohol consumption

Number of missing teeth	With chewing habits (%)	Without chewing habits (%)	Smoking (%)	Non smoking (%)	Alcohol (%)	Non alcohol (%)
1	50 (51.5)	47 (48.5)	90 (92.8)	7 (7.2)	29 (29.9)	68 (70.1)
2	30 (51.7)	28 (48.3)	44 (75.9)	14 (24.1)	13 (22.4)	45 (77.6)
3	11 (50.0)	11 (50.0)	17 (77.3)	5 (22.7)	9 (40.9)	13 (59.1)
4	12 (50.0)	12 (50.0)	17 (70.8)	7 (29.2)	12 (50.0)	12 (50.0)
≥ 5	11 (31.4)	24 (68.6)	25 (71.4)	10 (28.6)	14 (40.0)	21 (60.0)
	$\chi^2 = 4.72$, $P = 0.31$		$\chi^2 = 13.33$, $P = 0.00$		$\chi^2 = 7.71$, $P = 0.10$	

χ^2 = chi square test value, $P < 0.05$ = statistically significant

Table 4 Distribution of workers based on number of missing teeth, visits to the dentist, frequency and duration since last visit to dentist

Number of missing teeth	Visit to dentist		Frequency of visit			Duration of last visit		
	Yes ($n = 214$)	No ($n = 400$)	≤ 2 yrs ($n = 152$)	2-5 yrs ($n = 43$)	≥ 5 ($n = 19$)	≤ 2 ($n = 98$)	2-5 yrs ($n = 95$)	≥ 5 yrs ($n = 21$)
0	52 (24.3)	326 (81.5)	35 (23.0)	12 (27.9)	3 (15.8)	31 (31.6)	15 (15.8)	4 (19.0)
1	70 (32.7)	27 (6.8)	55 (36.2)	9 (20.9)	8 (42.1)	36 (36.7)	27 (28.4)	9 (42.9)
2	42 (19.6)	16 (4.0)	32 (21.1)	7 (16.3)	3 (15.8)	20 (20.4)	19 (20.0)	3 (14.3)
3	16 (7.5)	6 (1.5)	12 (7.9)	4 (9.3)	0	4 (4.1)	12 (12.6)	0
4	12 (5.6)	12 (3.0)	6 (3.9)	6 (14.0)	0	5 (5.1)	7 (7.4)	0
≥ 5	22 (10.3)	13 (3.2)	12 (7.9)	5 (11.6)	5 (26.3)	2 (2.0)	15 (15.8)	5 (23.8)
	$\chi^2 = 198.01$, $P = 0.00$		$\chi^2 = 18.61$, $P = 0.04$			$\chi^2 = 27.29$, $P = 0.00$		

χ^2 = chi square test value, $P < 0.05$ = statistically significant

of missing teeth between those who brushed once and those who brushed twice daily ($P = 0.27$). The 75.2% of the workers used toothpaste, 22.5% used tooth powder and 2.3% used other materials (i.e., charcoal powder, ash, tobacco, etc.) to clean their teeth. Of these, 5.0% of those using toothpaste, 6.5% of those using tooth powder and 21.4% of those using other materials as dentifrice had more than five missing teeth. There was no statistically significant difference in the number of missing teeth between the type of dentifrice used for cleaning teeth ($P = 0.18$) (Table 2).

The 31.4% of the workers who had tobacco chewing habits and 68.6% of the workers who had no tobacco chewing habits had more than five missing teeth. There was no statistically significant difference between the number of missing teeth in workers with and without tobacco chewing habits ($P = 0.31$). The 71.4% of the workers who had a smoking habit and 28.6% of those who had no smoking habit had more than five missing teeth. There was a statistically significant difference in the number of missing teeth between the workers with and without a smoking habit ($P = 0.00$). The 40% of the workers who had an alcohol consumption habit and 60% of those who had no alcohol consumption habit had more than five missing teeth. There was no statistically significant difference in the number of missing teeth between

Table 5 Distribution of workers based on reasons of tooth loss

No. of workers with tooth loss	Caries (%)	Periodontal diseases (%)	Trauma (%)	Others (%)
236	189 (80.1)	29 (12.3)	15 (6.3)	3 (1.3)

Table 6 Distribution of workers according to their prosthetic status in the maxillary and mandibular arch

	Prosthetic Status	
	Maxillary arch (n = 236)	Mandibular arch (n = 236)
No prosthesis	236 (100%)	235 (99.6%)
Bridge	0	0
More than one bridge	0	1 (0.4%)
Partial denture	0	0
Both bridge and partial denture	0	0
Full removable denture	0	0
Not recorded	0	0

Table 7 Distribution of workers according to their prosthetic treatment needs in the maxillary and mandibular arch

Prosthetic status	Maxillary arch	Mandibular arch
No prosthesis	96 (40.6%)	72 (30.6%)
Need for one unit prosthesis	72 (30.5%)	72 (30.6%)
Need for multi unit prosthesis	62 (26.3%)	85 (36.2%)
Need for a combination	3 (1.3%)	4 (1.7%)
Need for full prosthesis	3 (1.3%)	2 (0.9%)
Not recorded	0	0

workers with and without an alcohol consumption habit ($P = 0.10$) (Table 3). Out of the 614 workers surveyed, 34.8% of the workers had visited a dentist in their lifetime while 65.1% had not. The 10.3% of the workers who had visited a dentist and 3.3% of those who had not visited a dentist had more than five missing teeth. There was a statistically significant difference in the number of missing teeth between those who had and those who had not visited a dentist ($P = 0.00$). Out of the 214 workers who had visited a dentist, the frequency of visits was at least once every 2 years in 71%, once every 2-5 years in 20.1%, and once in over 5 years in 8.9% of the workers. The 7.9% of the workers who visited a dentist once every 2 years, 11.6% of the workers who visited a dentist every 2-5 years, and 26.3% of the workers who visited a dentist more than 5 years ago, had more than five missing teeth. There was a statistically significant difference in the number of missing teeth based on the frequency of visits to the dentist ($P = 0.04$). Out of 214 workers, 45.8% of

the workers had last visited a dentist less than 2 years ago, 44.4% of the workers had last visited a dentist 2-5 years ago and 9.8% of the workers had last visited the dentist more than 5 years ago. The 2% of the workers who last visited the dentist 2 years ago, 15.8% who last visited between 2-5 years ago, and 23.8% who last visited the dentist more than 5 years ago had more than five missing teeth. There was a statistically significant difference in the number of missing teeth based on duration since last visit to dentist ($P = 0.00$) (Table 4).

Out of 614 workers, 80.1% had lost teeth due to caries, 12.3% had lost teeth due to periodontal problems, 6.3% had lost teeth due to trauma and 1.3% had lost teeth due to other reasons (i.e., congenital defects) (Table 5).

Regarding the prosthetic status of the 614 workers, 38.4% had lost a tooth/teeth in the maxillary and mandibular arches. The 100% and 99.6% of the workers did not have any kind of prosthesis in the maxillary arch and mandibular arch, respectively. Only one worker (0.4%) had a fixed partial denture replacing two missing teeth in the mandibular arch (Table 6).

Regarding the prosthetic treatment needs of the 614 workers, 38.4% required prosthetic treatment in the maxillary arch and 38.3% required prosthetic treatment in the mandibular arch. The 26.3% and 36.2% of the workers required a multi-unit prosthesis in the maxillary and mandibular arches, respectively. The 1.3% and 1.7% of the workers required a combination of prostheses in the maxillary and mandibular arches, respectively. The 1.3% and 0.8% workers required a full prosthesis in the maxillary and mandibular arches, respectively (Table 7).

Discussion

All countries in the world are showing an increasing trend towards industrialization (7). The amount of industrial progress reflects the growth of a nation. Industrial workers live in a highly complicated environment (1,7). As industries have progressed both in size and complexity, occupational health problems and diseases are also becoming more prominent (1,7).

This study is the first of its kind to concentrate on the prosthetic status of industrial workers in India. In the present study, a total of 614 subjects (age range, 18-67 years) were examined to assess tooth loss, prosthetic status and treatment needs among the industrial workers

in Belgaum city. Data were collected from 40 small-scale industries located in Belgaum city. The industrial workers were selected by a random sampling method and were representative of the industrial worker population. The mean age of the workers was 30.78 ± 9.91 years and the sample comprised 79% males and 21% females.

The results of this study showed that there was an increase in tooth loss with age; this result is in agreement with studies by Hayashi et al. (4) and Vysniauskaité et al. (8). In this study, the number of missing teeth was not associated with socioeconomic status, which is in contrast with a study by Sakki et al. (9) that stated that the association between the number of teeth and socioeconomic status was significant. This difference in results might be because most of the workers had a low socioeconomic status.

This study revealed that toothbrush users had less tooth loss compared to workers who used their fingers to clean their teeth; this is in agreement with a study by Jagadeesan et al. (10). Less tooth loss among toothbrush users may be attributable to the superior plaque control of toothbrushes, as the bristles of the toothbrush can reach interproximal areas as well as pits and fissures of the teeth more efficiently than fingers, resulting in better oral hygiene.

In the present study, there was no significant association between the number of missing teeth and the frequency of teeth cleaning. The results of our study are in agreement with studies by Mundt et al. (11), Kressin et al. (12) and Pihlgren et al. (13). The results obtained were in contrast to those obtained by Vysniauskaité et al. (8), according to whom tooth brushing twice a day was a significant factor for retaining teeth. This difference in results may be due to the fact that most of the industrial workers in the present study cleaned their teeth once daily.

Materials such as toothpaste, tooth powder and others (charcoal powder, ash, tobacco etc.) used for teeth cleaning were not associated with the number of missing teeth. No significant relationship was found between missing teeth and tobacco chewing, which is in disagreement with results reported by Jagadeesan (10) and Chatrchaiwiwatana (14), according to whom betel quid chewing was significantly related to tooth loss. Smoking was found to be associated with tooth loss. A greater number of missing teeth was seen among smokers as compared to non-smokers, which may be due to greater periodontal destruction among smokers than non-smokers (15). Several studies have found a positive association between smoking and tooth loss (11,13-22).

There was no association between the number of missing teeth and alcohol consumption in the present study; this is in agreement with the results obtained by Copeland et al. (17). However, the results are in contrast to those of Klein et al. (19) and Enberg et al. (23), who reported that alcohol consumption was associated with tooth loss. This could be explained by a variety of factors including poor oral hygiene, concomitant periodontal disease and vitamin deficiency seen among alcoholics. The discrepancy between these results may be because less workers reported the habit of drinking.

There were more missing teeth among the workers who visited a dentist as compared to the workers who did not visit a dentist. A probable reason for this finding could be that those who went to a dentist underwent treatment, e.g., extraction, resulting in more missing teeth and indirectly indicating that they might have had less untreated disease like dental caries or periodontal disease.

The results of the present study suggested that the workers who visited the dentist more frequently had fewer missing teeth, a result similar to the results obtained by Mundt et al. (11) and Pihlgren et al. (13), as regular dental visits may provide opportunities for the prevention and early treatment of oral diseases. The results of our study are in disagreement with those of Cunha-Cruz (18), according to whom there was no statistically significant difference in tooth loss in relation to the frequency of dental visits. This could be because a wider range of frequency of visits was considered in the present study.

In the present study, dental caries was the leading cause of tooth loss followed by periodontal diseases; this is in agreement with the results of other studies (24,25). The tooth loss may be due to rapid changes in dietary habits, combined with poor awareness of prevention, unfortunate social circumstances and insufficient dental manpower resources at the right time and right place (26).

In the present study, when the prosthetic status was observed, only one worker had a fixed prosthesis in the mandibular arch. The remaining workers did not have any prostheses in the maxillary or mandibular arch, which is in agreement with the results reported in the survey conducted by Dental Council of India (DCI), where the percentage of people wearing prostheses was low (27). The need for prostheses was marginally lower in the maxillary than in the mandibular arch, which is in agreement with the DCI survey (27).

This study revealed that tooth loss was associated with oral hygiene practices, habits and frequency of visits to the dentist. Industrial workers had poor prosthetic status and unmet treatment needs. This situation can perhaps be attributed to poor awareness, inaccessible or unavailable dental service and negligence. It requires a systematic

exploration to understand and uncover the reasons for the increased degree of unmet treatment needs among the industrial workers.

Health promotion among the industrial workers requires coordinated action by all concerned including the dental profession, local factory authorities, social and economic sectors and voluntary organizations. Factory authorities should establish regular oral health care services to provide necessary health education, and preventive and curative dental care services.

The results of the present study represent only a section of the industrial population. Thus, a similar study should be carried out on a larger scale to understand the prosthetic status and treatment needs of the industrial workers.

Acknowledgments

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Appendix

A. General information
  1. Name:
  2. Age:
  3. Gender: M/F
  4. Address:
  5. Education:
  6. Occupation:
  7. Income:
  8. SES:

B. Oral health care habits
  Methods: Finger/Toothbrush/Others
  Frequency: Once /Twice
  Materials: Tooth Paste/Tooth Powder/Others

C. Tobacco chewing habit
  Present/Absent

D. Smoking habit
  Present/Absent

E. Alcohol consumption
  Present/Absent

F. Visits to the dentist
  Yes/No
  Number of workers visiting dentist in: less than 2 years/2 to 5 years/ more than 5 years
  Duration since last visit: less than 2 years/2 to 5 years/more than 5 years

G. Number of missing tooth/ teeth:

H. Reason of tooth loss:
  Caries/Periodontal disease/Trauma/Others

I. Prosthetic status
  0: No prosthesis
  1: Bridge
  2: More than one bridge
  3: Partial denture
  4: Both bridges and partial denture
  5: Full removable denture
  9: Not recorded

J. Prosthetic treatment need
  0: No prosthesis
  1: Need for one unit prosthesis
  2: Need for multi unit prosthesis
  3: Need for a combination
  4: Need for full prosthesis
  9: Not recorded