Periodontal Status of Green Marble Mine Labourers in Kesariyaji, Rajasthan, India

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Aims: The purpose of the present study was to assess the prevalence and pattern of periodontal disease among green marble mine labourers and to use the data to provide a baseline for planning and evaluation of oral health care.

Materials and Methods: The study area was located in the Udaipur district of Rajasthan, India, divided into four geographical zones: Masoron ki ovri, Rushabhdev, Khandiovri and Kagdar Bhatiya. This study comprised 513 male subjects in four age groups (18 to 25, 26 to 34, 35 to 44 and > 45 years) collected using the stratified cluster sampling method. The data were collected by World Heath Organization (WHO) oral health assessment form, and clinical examination was conducted by the methods recommended by the WHO oral health surveys. There were three examiners, all of whom were calibrated before the survey for inter-examiner variability. The reliability was tested by means of weighted kappa statistics, which were 89% for periodontal data. Data were statistically analysed using SPSS/PC+ (SPSS software, Illinois, USA).

Results: The prevalence of periodontal disease was found to be 98.2%. Bleeding on probing and calculus were widespread. The mean number of healthy sextants decreased abruptly with an increase in age. The greatest periodontal destruction was manifested in the 35 to 44-year-old age group, with 0.4 sextants having deep pocket probing depths.

Conclusions: The present level and pattern of periodontal disease in marble mine workers is severe, and the implementation of oral health promotion and prevention is urgently needed.

Key words: community periodontal index, marble mine labourers, periodontal status

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Trends in periodontal diseases have seen a rapid change all over the world. Periodontitis is one of the most widespread chronic diseases in the world. Due to an increase in adverse tobacco habits, periodontal diseases are one of the major challenges faced by countries such as India. The role of personal risk factors such as poor lifestyle and negative psychosocial conditions has been said to play an important role in the aetiology of adult periodontitis (Clarke and Hirsch, 1995). Previous epidemiological studies on the prevalence and severity of periodontal disease have reported that periodontal health is worse in the developing countries than in the industrialised ones. Previous studies have found that work in mines (Bieda et al, 1968; Buda et al, 1972; Knychalska-Karwan et al, 1973), metalwork (Dunska et al, 1973) and work in the chemical industry (Domzalska et al, 1968; Florescu, 1972) may affect the pattern of periodontal disease, but no particular pattern was observed in our study and the pattern of periodontal disease in mine labourers was similar to that of the general population.

Marble mining is a major industry flourishing in Rajasthan; Kesariyaji is famous for green marble mines and it is the only place in India where green marble is produced. Most of the mine labourers use tobacco, predominantly in khaini, the chewing

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form. The purpose of the present study was to describe the prevalence and pattern of periodontal disease among green marble mine labourers and to use the data to provide a baseline for planning and evaluation of oral health care.

MATERIALS AND METHODS

The study area was located in the Udaipur district of Rajasthan, India, between 23°46′ and 25°5′ North Latitude and between 73°9′ and 74°35′ East Longitude, and is divided into four geographical zones: Masoron ki ovri, Rushabhdev, Khandiovri and Kagdar Bhatiya. There are about 80 mines spread over the study area, in which there were about 15,000 workers. Each zone was considered as a stratum and a cluster of mines were selected randomly from each zone. All the mine workers in the selected clusters were informed prior to the date of survey; and labourers who were present on the date of survey were included in the study – special leave was granted for those who participated in the survey by Green Marble Mine Owner's Association authorities. The subjects examined were representatives of the study population. The sampling procedures and exclusion criterion has been discussed in detail in a previous paper (Dagli et al, 2008).

The study was conducted during the first and the second week of February 2007.

Ethical clearance was obtained from the Ethical Committee of Darshan Dental College and Hospital, Udaipur.

The World Health Organization (WHO) sampling procedure (namely, stratified cluster sampling) was used to collect the representative population, and the samples were examined by using a mouth mirror and community periodontal index (CPI) probe. Gingival bleeding, calculus and periodontal pockets were recorded for the index tooth in each sextant (WHO, 1997).

Before the survey, all three examiners were calibrated for inter-examiner variability, and the kappa statistic was 0.89 for periodontal data (Cohen, 1960). Examinations were performed in natural light, and an artificial light source was used for adequate illumination whenever required.

If two or more teeth were absent or were indicated for extraction, then the sextant was excluded. There were no excluded sextants among the whole sample.

The distribution of samples according to age group is shown in Table 1. Most of the subjects belonged to the 18 to 25 years age group. Very few workers were in the age range of ≥ 45 years, hence the sample used.

Table 1 Sample distribution according to age group

Age group (years)	No. of individuals (n)
18 to 25	171
26 to 34	162
35 to 44	135
≥ 45	45

Statistical analysis

Chi-square test was used to find the difference between proportions of CPI scores in various age groups and degrees of freedom to assess the number of independent values in Table 2. Data processing was carried out using SPSS/PC+ software (6.0 Version).

$P > 0.05$ was accepted as statistically not significant and $P < 0.001$ was considered to be highly statistically significant.

RESULTS

The prevalence of periodontal disease was found to be 98.2% and was determined by considering subjects with CPI scores 1 to 4 as diseased and with 0 as healthy.

The healthy subjects comprised a mere 5.2% (among the 18 to 25-year-old age group), and there were no healthy subjects in other age groups.

The results showed that the proportions of subjects who reported bleeding, calculus and periodontal pockets decreased steadily with age, and a high statistically significant difference was observed among various age groups ($P < 0.001$).

Bleeding was highest in the 18 to 25-year-old age group (57.8%) and lowest in the 35 to 44-year-old age group. Calculus was the greatest problem in subjects belonging to 26 to 34-year-old age group (50.7%).

In the largest age group (18 to 25-year-old group), pocket depths of 4 to 5 mm were recorded in 10.5% of subjects and calculus was recorded in 26.3% of subjects.

No subjects belonging to age groups 18 to 25, 26 to 34 and ≥ 45 years had periodontal pockets of more than 6 mm depth and in age group 35 to 44 years this value was 6.6%.

The highest percentage of subjects with shallow and deep pockets was found in the 35 to 44-year-old age group, being 20% and 6.6%, respectively.

Table 2 Periodontal assessment by using CPI scores according to age group					
Age group (years)	**Score 0**	**Score 1**	**Score 2**	**Score 3**	**Score 4**
18 to 25	9 (5.2%)	99 (57.8%)	45 (26.3%)	18 (10.5%)	0
26 to 34	0	63 (38.8%)	81 (50.7%)	18 (10.5%)	0
35 to 44	0	45 (33.3%)	54 (40%)	27 (20%)	9 (6.6%)
≥ 45	0	27 (60%)	18 (20%)	9 (20%)	0

$\chi^2 = 144.05$; d.f. = 12; $P < 0.001$ = highly significant.

Table 3 Mean number of sextants per person with specific CPI scores according to age group				
CPI scores	**Age group (years)**			
	18 to 25	**26 to 34**	**35 to 44**	**≥ 45**
0	0.8	0.4	0	0
1	2.5	1.9	1.9	3.7
2	2.0	2.9	2.5	1.7
3	0.7	0.7	1.2	0.6
4	0	0.1	0.4	0

The mean number of sextants with evidence of any periodontal status is presented in Table 3. There were no excluded sextants in any of the age groups. Healthy sextants without any signs of periodontal disease were found only in young age groups (18 to 25- and 26- to 34-year-old group).

In the 18 to 25-year-old age group, only 0.8 sextants were found to be healthy, whereas in the older age groups this number was observed to decrease abruptly, with the absence of healthy sextants in the 35 to 44- and > 45-year-old age groups.

The greatest periodontal destruction was manifested in the 35 to 44-year-old age group with 0.4 sextants having deep pocket probing depths.

Bleeding on probing and calculus were widespread. Many of the sextants, irrespective of the age group, were recorded for bleeding on probing and calculus.

DISCUSSION

The study area is a rural area where the majority of the population belong to lower socioeconomic class and are of poor educational status. All of the subjects were below poverty line (BPL) and had government provided BPL cards with them. Socioeconomic status is an important risk indicator of periodontal disease; individuals with low socioeconomic status have a higher occurrence of attachment loss and probing depth than those with high socioeconomic status (Borrell et al, 2002; Albandar, 2002).

In India, there is no national health service as in other developed countries. Although the government provides formal medical care in the form of primary health centres and community health centres, there is no provision for dental care; thus, the study population has poor access to oral health care services. About 95% of the subjects stated that they had never been to a clinician and they completely relied on 'local quacks' for their treatment as they have no access to dental care due to the high costs involved in treatment and unavailability of dental personnel in the nearby areas. Our study also revealed poor oral hygiene habits in the study population; there were no subjects who brushed their teeth twice or more daily and oral hygiene aids most commonly used were finger with charcoal and neem stick.

Apart from poor oral hygiene habits, more than 80% of subjects were tobacco users (occasional users, ex users or regular users), either in smoking or chewing form, irrespective of the age group. However, the chewing form of tobacco usage was more predominant.

Results of this study showed the prevalence of periodontal disease in green marble mine labourers to be 100% for the 35 to 44-year-old age group. This is higher compared with the general population of India for that age group, which was found to be 89.6% (Bali et al, 2002–2003). This finding can be attributed to poor oral hygiene and adverse tobacco habits among the study population; on the other hand, a study performed by Hessari et al (2007) on the general population of Iran showed a prevalence of 99%. However, our previous report on a similar population observed that the mean caries status of the study population was better than that of the general population of the Udaipur district (Dagli et al, 2008).

Bleeding and calculus were widespread for all age groups. Similar results were observed by Wang et al (2002) and Baelum et al (2003). Destructive

periodontitis was less frequently seen in other studies (Garcia and Cutress, 1986; Pilot et al, 1986; Oliver et al, 1989; El-Quaderi and Queteish Taani, 2004). 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%).

Calculus was the most frequently observed periodontal condition in the age groups of 18 to 25 and 26 to 34 years, whereas the percentage of individuals with shallow and deep pockets was greater in the age groups of 35 to 44 and $\geq$ 45 years. Similar results were observed in studies performed by Dini and Guimaraes (1994). The percentage of healthy adults decreased with age in accordance with other studies (Miller et al, 1987; Pilot and Barmes, 1987; Miyazaki et al, 1989; Skaleric and Kovac-Kavcic, 1989; Guile, 1992). Studies performed by Albandar (2002) and Corbet et al (2001) have shown that prevalence and severity of periodontal disease increases with age.

Our study shows similar results to those from other countries in South America, Asia and Columbia where the presence of calculus was observed in over 40% of the population and severe disease in 15% of the sample (Vergel de Dios and Mabunga, 1995; Gjermo et al, 2002; Orozco et al, 2004). In accordance with the present study, various studies from Asia report a very high prevalence of bleeding and dental calculus and a low prevalence of healthy periodontal status, irrespective of age cohort or the country's level of development (Corbet et al, 2002).

Less than one sextant was healthy among those under the age of 35 years, whereas two to three sextants were found to be healthy in a study performed by Adegbembo et al (2000). The major finding in the authors' study is that 6.6% of people belonging to age group of 35 to 44 years had deep periodontal pockets, whereas 0.3% and 12.5% had deep pockets in a study performed by Maity et al (1994) in a rural population of West Bengal, India and Mengel et al (1996) in Yemen, respectively.

Of the total sample only 9 (1.7%) subjects belonging to the 18 to 25-year-old age group had healthy periodontium. Similar findings were reported by studies performed by Ahlberg et al (1996) in Finland, Shizukuishi et al (1998) in Japan, Roman and Pop (1998) in Romania and Srikandi and Clarke (1982) in Australia, where 6%, 7.4% and 9.34% of industrial workers had healthy gingiva, respectively, but studies conducted by Hugoson and Jordan (1982), Markkanen et al (1983) in Finland and Hohlfeld and Bernimoulin (1993) reported 100% prevalence of periodontal disease.

The results of the present study have shown no mean healthy sextants in the age group of 35 to 44-year-olds, whereas Mengel et al (1996) observed 1.5 healthy sextants in the same age group in the Yemen upland and Mumghamba et al (1996) found the value to be 2.5.

The mean sextants of deep pockets was 0.4 for 35 to 44-year-olds in accordance with the study performed by Buorgeois et al (1997), who observed an average of 0.1 sextants.

The mean number of excluded sextants (0%) in the surveyed population is in contrast with those found in the general population of South-East Asia (0.0 to 0.7), America (0.2 to 0.15), Europe (0.0 to 1.5), Africa (0.0 to 0.7), the Middle East (0.0 to 0.1), the Western Pacific regions (0.0 to 0.9) and French Polynesia (1.7) (Miyazaki et al, 1992).

Sheiham (1991) stated that the plan for controlling periodontal disease could include a high-risk, a population, a secondary prevention strategy or a combination of all three. Taking into account the disease status and the available resources for periodontal care in this surveyed population, the priority should be based on population strategy and primary prevention programmes to benefit the periodontal health by promoting self-care and oral hygiene.

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REFERENCES

1. Adegbembo AO, Adeyinka A, Danfillo IS, Mafeni JO, George MO, Aihveba N et al. National pathfinder survey of periodontal status and treatment needs in The Gambia. SADJ 2000;55:151–157.
2. Ahlberg J, Tuominen R, Murtomaa H. Periodontal status among male industrial workers in Southern Finland with or without access to subsidized dental care. Acta Odontol Scand 1996;54:166–170.
3. Albandar JM. Periodontal diseases in North America. Periodontol 2000 2002;29:31–69.
4. Baelum V, Pisuithanakan S, Teanpaisan R, Pithpornchaiyakul W, Pongpaisal S, Papapanou PN et al. Periodontal conditions among adults in Southern Thailand. J Periodontal Res 2003;38:156–163.
5. Bali RK, Mathur VB, Talwar PP, Chanana HB. National oral health survey and fluoride mapping, India. 2002–2003, Dental Council of India.
6. Bieda J, Gawrzewska B, Kaczmarczyk-Stachowska A, Knychalska-Karwan Z, Laskowska L, Pelc M et al. The incidence of periodontal diseases in salt mine workers in Wieliczka. Czas Stomatol 1968;21:1271–1276.

7. Borrell LN, Burt BA, Gillespie BW, Lynch J, Neighbors H. Periodontitis in the United States: beyond black and white. J Public Health Dent 2002;62:92–101.
8. Buda M, Sinho I, Mikalka S. Correlation between the chemical composition of the silicogenic dust from the atmosphere of nonferrous mines and the composition of the dental calculus of miners. Stomatologia (Bucur) 1972;19:289–295.
9. Buorgeois D, Hescot P, Doury J. Periodontal conditions in 35–44-yr-old adults in France, 1993. J Periodontal Res 1997;32:570–574.
10. Clarke NG, Hirsch RS. Periodontal risk factors for generalized periodontitis. J Clin Periodontol 1995;22:136–145.
11. Cohen J. A coefficient of agreement for nominal scales. Educ Psychol 1960;20:37–46.
12. Corbet EF, Wong MC, Lin HC. Periodontal conditions in adult Southern Chinese. J Dent Res 2001;80:1480–1485.
13. Corbet EF, Zee KY, Lo EC. Periodontal diseases in Asia and Oceania. Periodontol 2000 2002;29:122–152.
14. Dagli RJ, Kumar S, Dhani C, Duraiswamy P, Kulkarni S. Dental health among green marble mine laborers, India. JOHCD 2008;2:1–7.
15. Dini EL, Guimaraes LO. Periodontal conditions and treatment needs (CPITN) in a worker population in Araraquara, SP Brazil. Int Dent J 1994;44:309–311.
16. Domzalska E, Grabowska K, Kamocka D. The influence of chemical factors on the oral cavity in workers of the Szczecin Plant of Phosphorous Fertilizers in the light of our own investigations. Czas Stomatol 1968;21:1081–1087.
17. Dunska E, Kaczmarczyk-Stachowska A, Prostak-Kosowska K, Slowik T, Zabicki J. Serum ascorbic acid level in patients with paradontopathies working in the Coke-Chemical plant of Lenin Steel Works. Czas Stomatol 1973;26:441–443.
18. El-Quaderi SS, Queteish Taani D. Assessment of periodontal knowledge and periodontal status of an adult population in Jordan. Int J Dent Hyg 2004;2:132–136.
19. Florescu M. Dental lesion in workers from sulfuric acid industry. Stomatologia (Bucur) 1972;19:395–403.
20. Garcia ML, Cutress TW. A national survey of periodontal treatment needs of adults in the Philippines. Commun Dent Oral Epidemiol 1986;14:313–316.
21. Gjermo P, Rosing CK, Susin C, Oppermann R. Periodontal diseases in Central and South America. Periodontol 2000 2002;29:70–78.
22. Guile EE. Periodontal status of adults in Central Saudi Arabia. Commun Dent Oral Epidemiol 1992;20:159–160.
23. Hessari H, Vehkalahti MM, Eghbal MJ, Murtomaa HT. Oral health among 35- to 44-year-old Iranians. Med Princ Pract 2007;16:280–285.
24. Hohlfeld M, Bernimoulin JP. Application of the community periodontal index of treatment needs (CPITN) in a group of 45–54-year-old German factory workers. J Clin Periodontol 1993;20:551–556.
25. Hugoson A, Jordan T. Frequency distribution of individuals aged 20–70 years according to severity of periodontal disease. Commun Dent Oral Epidemiol 1982;10:187–192.
26. Knychalska-Karwan Z, Biedowa J, Gawrzewska B, Kaczmarczyk-Stachowska A, Laskowska L, Pelc M et al. Dentition of workers of the salt mines in Wieliczka. Czas Stomatol 1973;26:1291–1295.
27. Maity AK, Banarjee K, Pal TK. Low levels of destructive periodontal disease in a rural population in West Bengal, India. Commun Dent Oral Epidemiol 1994;22:60–61.
28. Markkanen M, Rajala M, Paunio K. Periodontal treatment need of the Finnish population aged 30 years and over. Commun Dent Oral Epidemiol 1983;11:25–32.
29. Mengel R, Eigenbrodt M, Schünemann T, Flores-de-Jacoby L. Periodontal status of a subject sample of Yemen. J Clin Periodontol 1996;23:437–443.
30. Miller NA, Benamghar L, Roland E, Martin J, Abt F. An analysis of the CPITN periodontal treatment needs in France. Commun Dent Health 1987;4:415–423.
31. Miyazaki H, Hanada N, Andoh MI, Yamashaita Y, Saito T, Sogame A et al. Periodontal disease prevalence in different age groups in Japan as assessed according to the CPITN. Commun Dent Oral Epidemiol 1989;17:71–74.
32. Miyazaki H, Pilot T, Leclercq M-H. Periodontal profiles. An overview of CPITN data in the WHO Global Oral Data Bank for the age groups 15–19 years, 35–44 years and 65–74 years. Geneva: World Health Organization 1992.
33. Mumghamba EG, Markkanen HA, Honkala E. Periodontal status and treatment needs in a rural area of Ukonga, Tanzania. Int Dent J 1996;46:156–160.
34. Oliver RC, Brown LJ, Loe H. An estimate of periodontal treatment needs in the U.S. based on epidemiological data. J Periodontol 1989;60:371–380.
35. Orozco AH, Franco AM, Ramirez-Yanez GO. Periodontal treatment needs in a native island community in Colombia determined with CPITN. Int Dent J 2004;54:73–76.
36. Pilot T, Barmes DE. An update of periodontal conditions in adults, measured by CPITN. Int Dent J 1987;37: 169–172.
37. Pilot T, Barmes DE, Leclerco MH, McCombie BJ, Sardo Infirri J. Periodontal conditions in adults 35–44 years of age: an overview of CPITN data in the WHO Global Oral Data Bank. Commun Dent Oral Epidemiol 1986;14:310–312.
38. Roman A, Pop A. Community periodontal index and treatment needs values (CPITN) in a factory worker group in Cluj-Napoca, Romania. Int Dent J 1998;48:123–125.
39. Sheiham A . Public health aspects of periodontal diseases in Europe. J Clin Periodontol 1991;18:362–369.
40. Shizukuishi S, Hayashi N, Tamagawa H, Hanioka T, Maruyama S, Takeshita T et al. Lifestyle and periodontal health status of Japanese factory workers. Ann Periodontol 1998;3:303–311.
41. Skaleric U, Kovac- Kavcic M. Periodontal treatment needs in a population of Ljubljana, Yugoslavia. Commun Dent Oral Epidemiol 1989;17:304–306.
42. Srikandi TW, Clarke NG. Periodontal status in a South Australian industrial population. Commun Dent Oral Epidemiol 1982;10:272–275.
43. Vergel de Dios N, Mabunga SY. Periodontal profile of Filipino residents in Imus, Cavite Philippines. In: Bartold MP (ed). Risk factors in Asian Pacific populations. Brisbane: Asian Pacific Society of Periodontology, 1995:61–74.
44. Wang HY, Petersen PE, Bian JY, Zhang BX. The second national survey of oral health status of children and adults in China. Int Dent J 2002;52:283–290.
45. World Health Organization. Oral health surveys: basic methods. 4th ed. Geneva: WHO; 1997.