

# Assessment of the Periodontal Status among Kota Stone Workers in Jhalawar, India

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## ABSTRACT

**Context:** Periodontal disease is one of the most prevalent dental diseases which affects the adult population of the world, varying only in degree from mild to severe. Its prevalence, which was reported in various studies which were conducted in different parts of the globe, signifies its need for a control.

**Aims:** To assess the periodontal status among the Kota stone workers in Jhalawar and to provide a baseline data for the planning and evaluation of the oral health care promotion programmes.

**Settings and Design:** A cross-sectional descriptive survey was conducted among the Kota stone workers who were working in the Kota stone factories which were located in the Ricco Industrial Area in Jhalawar.

**Material and Methods:** The study population comprised 420 subjects who were in the age group of 21 to 60 years. The data

were collected by means of a close ended, self administered questionnaire and clinical examination with the use of the CPI index. Statistical analyses which were used: Chi-square, Student's t-test, One way Analysis of Variance (ANOVA), and Multiple Logistic Regression.

**Results:** The socio-demographic characteristics, except the gender, were found to be significantly associated with the periodontal status in the study population ( $P \leq 0.05$ ). Multivariate analysis showed high CPI scores which were associated with males (OR=1.313), the 21-40 year age group (OR=0.548), education upto 10th class (OR=4.776), oral hygiene practices other than toothbrush with toothpaste (OR=0.774) and smoking (OR=3.994).

**Conclusion:** The observations of this study indicate the need for a reorientation of the dental care services, with further emphasis on the preventive care in such a population.

**Key words:** Cross sectional study, Periodontal disease, Periodontal index

## INTRODUCTION

The periodontium is widely affected by dental plaque; a diverse microbial community which is found on the tooth surface, which is embedded in a matrix of polymers of bacterial and salivary origin [1]. If it is not removed regularly, the plaque gets mineralized to form calculus, which in turn, initiates the inflammatory process of the periodontium. This results in tooth loss and mobility. The role of the personal risk factors such as a poor life style and negative psychosocial conditions, have been said to play an important role in the aetiology of adult periodontitis [2]. It is also generally considered to result from an imbalance between the potentially pathogenic microbes and the nature and the efficacy of the local and systemic host responses [3].

Periodontal diseases are the major dental problems which affect people worldwide as well as the Indian Community [4]. The extent and the severity of periodontal disease was shown to be different in different age groups [5]. The working population in India usually belong to the lower socioeconomic group. The workers are also involved in smoking, chewing tobacco and drinking habits, which predispose to oral diseases, particularly those which are related to the gums [6].

Kota Stone, a small scale industry, is a fine grained variety of limestone which is extracted from the Ricco Industrial Area which is located in Jhalawar, Rajasthan. It has been made popular due to its low price and beautiful colours (rich greenish blue and brown in particular). It is mainly used for construction work, like exteriors,

pathways, corridors, driveways, balconies, commercial buildings, etc. It is also suitable for use in chemical industries as flooring, wall fixing and lining.

Most of the Kota stone workers consume tobacco, predominantly in the chewing or smoking form. The exposure to respirable crystalline silica and a number of other particulate matters, along with the physically tedious work, drives these workers to consume alcohol and tobacco, which devour a significant portion of their meagre income. These habits may predispose them to the risk of oral health deterioration. The exposure to chemical, physical and biological agents in the work place can result in adverse effects on the workers, which range from simple discomfort and irritation to debilitating occupational diseases such as lung fibrosis, neuropathy, deafness, organ damage and cancers of various sites [7].

As there is a paucity of literature on the periodontal status among the Kota stone workers, this study was undertaken to assess the periodontal status of these workers at the Ricco Industrial Area, Jhalawar, Rajasthan, India, so as to provide the data which is essential for planning an oral health promotion programme for this population.

## METHODS

### The Study Area and Design

A cross sectional descriptive survey was conducted to assess the periodontal status among 21-60 years old workers of the Kota Stone Factories which were located in the Ricco Industrial area in

Jhalawar (Rajasthan), India. Jhalawar is situated in the southeastern part of Rajasthan state, at the edge of the great Malwa plateau and it has a population of 1,411,327 people (725,667 males and 685,660 females) and a literacy rate of 62.1% [8].

### Ethical Clearance and Informed Consent

The study protocol was reviewed by the Institutional Review Board and it was granted ethical clearance. An official permission was obtained from the authorities of the Ricco Industrial Area which was located in Jhalawar and written informed consents were obtained from all the participants who fulfilled the eligibility criteria of voluntary participations, being systemically healthy and non medicating, with the presence of teeth in the oral cavity.

### The Proforma Details

The survey proforma which was designed with the help of the WHO Oral Health Assessment form consisted of two sections [9]:

**General information:** The demographic data which included the name, age, gender, the level of education, oral hygiene practices and adverse oral habits.

**Clinical parameter:** The Community Periodontal Index.

### Training and Calibration

Before the commencement of the study, training and intra-examiner calibration was done in the Department of Public Health Dentistry among a pre-selected group of subjects who possessed the full range of the periodontal conditions (kappa value = 90%). A pilot study was carried out among 25 Kota stone workers, to determine the feasibility of the study and also to assess the periodontal status. Depending on the prevalence which was obtained (80%), a 95% confidence level and a 5% allowable error, the sample size was determined as 384.

### The Sampling Design

Prior to the instigation of the study, an official list of the workers was obtained from the authorities of the Ricco Industrial area. Accordingly, the total number of Kota stone workers was 850. Amongst them, only those subjects who satisfied the eligibility criteria were randomly selected and examined.

### The Data Collection

The examiner visited the Kota Stone Factories which were located in the Ricco Industrial Area in Jhalawar on the predetermined dates according to the schedule. A total of 420 subjects who were aged 21-60 years were examined, among which 350 (83.3%) were males and 70 (16.7%) were females. The examination for the periodontal status was made according to the Community Periodontal Index (CPI) by using the community periodontal index probe and a mouth mirror [9].

## STATISTICAL ANALYSIS

The recorded data was analysed by using SPSS (Statistical Package for Social Sciences) version 15 software (SPSS Inc., Chicago, Illinois, USA). The variables were assessed for normality by using the Kolmogorov-Smirnov test. Chi-square analysis was used to compare the frequency of the CPI scores and the loss of attachment according to the various socio-demographic characteristics. One way Analysis of variance (ANOVA) and the 't' test were used for comparing the mean number of sextants which were affected by periodontal diseases, according to the age

groups and the gender respectively. Multiple Logistic Regressions were used to establish the factors which significantly contributed to periodontal disease. The level of significance was set at  $p \leq 0.05$ .

## RESULTS

[Table/Fig-1] represents the significant differences in the periodontal status among the study population, according to the age, oral hygiene practices, adverse habits and the level of education. The older age group (51-60 years) revealed significantly highest prevalence of the destructive periodontal disease (Shallow pockets: 36.9% and deep pockets: 23.1%) ( $p=0.043$ ). A significant decrease in severe periodontal disease was found with escalating levels of education ( $p=0.000$ ). In relation to the oral hygiene practices, those who used finger and charcoal (Shallow pockets: 25% and deep pockets: 75%) and neem sticks (Shallow pockets: 50% and deep pockets: 20%) ( $p=0.000$ ) showed the utmost prevalence of the periodontal pockets. The areca nut, lime and tobacco users depicted the highest prevalence of the shallow pockets (71.4%) followed by the smokers (48.4%). The highest prevalence of bleeding gums (89.5%) was demonstrated in alcohol users. No significant gender difference was evident in the periodontal status.

[Table/Fig-2] highlights the significant variations in the loss of attachment according to the education, the oral hygiene practices, the adverse habits and gender. The highest frequency of a 4-5 mm loss of attachment was evident among the group with no education (70.8%) ( $p=0.001$ ), among those who used neem sticks as an oral hygiene aid (100%) ( $p=0.01$ ) and among those with one or the other adverse habits. The nine to eleven mm loss of attachment was comparatively less prevalent among the study population. Males depicted a greater preponderance than the females ( $p=0.000$ ).

[Table/Fig-3] illustrates the mean number of sextants who were affected by periodontal disease, according to the age and gender. The mean number of healthy sextants was the highest ( $0.71 \pm 1.67$ ) and the lowest ( $0.08 \pm 0.36$ ) among the 21-30 and the 31-40 years age group respectively. The mean number of sextants with bleeding, calculus, shallow pockets and deep pockets did not vary significantly with the age. According to the gender, a significant difference was evident only with respect to the deep pockets ( $p=0.039$ ).

[Table/Fig-4] shows the odds ratios, as was depicted by the multiple logistic regression analysis. A significant amount of risk for periodontal disease was observed among the 41-60 years age group [OR=0.548], males [OR=1.313], smokers [OR=3.994] and among those who used other oral hygiene practices [OR=0.774].

## DISCUSSION

It is believed that periodontal disease is triggered by a disruption of the balance between the host resistance and the factors which provoke that disease. It is a chronic condition that is affected by various factors which are related to the everyday life, over a long period. The Kota stone workers may be identified as the high risk group due to a high prevalence of the adverse habits and the poor oral hygiene habits (82.4% subjects never cleaned their teeth). Apart from the poor oral hygiene habits, a majority of the subjects had a history of adverse habits such as chewing tobacco, gutkha and areca nut, drinking alcohol, etc. A majority of the population belonged to the lower socioeconomic class and was of a poor educational status. A poor oral hygiene and a high prevalence of the use of adverse habits may be attributed to the lack of awareness or unaffordability about/for the oral hygiene aids and the dental care services.

Characteristics	Score 0 n (%)	Score 1 n (%)	Score 2 n (%)	Score 3 n (%)	Score 4 n (%)	Total n (%)	p value
<b>Age group (years)</b>							
21-30	7(5.1)	43(31.4)	28(20.4)	35(25.5)	24(17.5)	137(32.6)	0.043
31-40	0	47(33.1)	31(21.8)	34(23.9)	30(21.1)	142(33.8)	
41-50	0	30(39.5)	9(11.8)	24(31.6)	13(17.1)	76(18.1)	
51-60	0	18(27.7)	8(12.3)	24(36.9)	15(23.1)	65(15.5)	
<b>Education</b>							
Illiterate	0	39(21.1)	28(15.1)	58(31.4)	60(32.4)	185(44)	0.000
Upto 10 <sup>th</sup> class	1(0.5)	80(39)	46(22.4)	58(28.3)	20(9.8)	205(48.8)	
Above 10 <sup>th</sup> class	6(20)	19(63.3)	2(6.7)	1(3.3)	2(6.7)	30(7.1)	
<b>Oral Hygiene Practices</b>							
No cleaning	0	110(31.8)	64(18.5)	103(29.8)	69(19.9)	346(82.4)	0.000
Toothbrush+Toothpaste	7(19.4)	21(58.3)	3(8.3)	2(5.6)	3(8.3)	36(8.6)	
Finger+Toothpowder	0	6(30)	7(35)	5(25)	2(10)	20(4.8)	
Finger+Charcoal	0	0	0	2(25)	6(75)	8(1.9)	
Neem stick	0	1(10)	2(20)	5(50)	2(20)	10(2.4)	
<b>Adverse Habits</b>							
No Habits	5(31.3)	11(68.8)	0	0	0	16(3.8)	0.002
Smoking	0	5(16.1)	2(6.5)	15(48.4)	9(29)	31(7.4)	
Arecanut+lime+tobacco	0	0	3(21.4)	10(71.4)	1(7.2)	14(3.3)	
Tobacco chewing	0	34(29.8)	57(50)	15(13.2)	8(7)	114(27.1)	
Gutkha chewing	0	0	10(9.8)	47(46.1)	45(44.1)	102(24.3)	
Pan Masala	0	71(57.3)	4(3.2)	30(24.2)	19(15.3)	124(29.5)	
Alcohol	2(10.5)	17(89.5)	0	0	0	19(4.5)	
<b>Sex</b>							
Male	1(0.3)	121(34.6)	68(19.4)	93(26.6)	67(19.1)	350(83.3)	0.831
Female	6(8.6)	17(24.3)	8(11.4)	24(34.3)	15(21.4)	70(16.7)	
Total	7(1.7)	138(32.9)	76(18.1)	117(27.9)	82(19.5)	420(100)	

**[Table/Fig-1]:** Periodontal assessment using CPI scores according to various socio-demographic characteristics

Chi-square test,  $p \leq 0.05$  is considered as statistically significant

In India, there is no national oral 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 the oral health care services. As an initial step, the baseline information on the periodontal status is necessary to commence the planning of an oral health promotion programme which is based on a high risk approach. The lack of literature on the periodontal status of the Kota stone workers prompted us to undertake the present study, to assess the periodontal status among the Kota stone workers of Jhalawar.

In many studies, the prevalence of periodontal disease was found to be nearly 100% in adults [10-12]. Several studies have shown that only 3-3.5% of the 18-68 years old subjects had a completely healthy periodontium, i.e. without any need for treatment [13, 14]. However, there is a considerable range in the findings of different epidemiological studies. This may be due to the use of different examination methods and instrumentations, the severity of the gingival inflammation in the population which was studied and the differences in the interpretation of the findings.

In the present study, the prevalence of periodontal disease of any degree was found to be 98.3%, that is, only 1.7% of the Kota Stone workers were free of periodontal disease. This prevalence was comparable to those which were obtained among Germany factory workers [15] and marble mine [16] and beedi factory

workers in India [17], who found that none of the workers were free of periodontal disease.

Bleeding and destructive periodontitis was most prevalent in all the age groups, except in the 51-60 years age group, in which the shallow pockets found a most prevalent place. Similar results were observed in other studies [18-20]. The percentage of the subjects with pockets increased with the age, which was in accordance with other studies [21,22]. A significantly higher odds ratio for periodontal disease, which was depicted in the present study among the older age group, was in corroboration with other studies [23,24] which had shown that the prevalence and the severity of periodontal disease increased with age.

In the present study, an odds ratio of 1.313 revealed a more risk of periodontal disease in males than in females. This was in accordance with the findings of the studies which were done on Japanese factory and beedi factory workers [17].

Apart from the age and gender, in the present study, the multiple logistic regression analysis also revealed poor oral hygiene practices and adverse habits as the significant predictors for an increased risk of periodontal disease. The subjects who used oral hygiene aids other than tooth brush and tooth paste (finger and tooth powder, finger and charcoal or neem stick) had a significantly higher risk of periodontal disease. The role of the dental plaque, as the principal aetiological factor in the development of periodontal

Characteristics	0-3 mm n (%)	4-5 mm n (%)	6-8 mm n (%)	9-11 mm n (%)	Total n (%)	p value
<b>Age group (years)</b>						
21-30	16(11.7)	91(66.4)	28(20.4)	2(1.5)	137(32.6)	0.123
31-40	25(17.6)	96(67.6)	19(13.4)	2(1.4)	142(33.8)	
41-50	10(13.2)	43(56.6)	19(25)	4(5.3)	76(18.1)	
51-60	8(12.3)	47(72.3)	10(15.4)	0	65(15.5)	
<b>Education</b>						
Illiterate	30(16.2)	131(70.8)	24(13)	0	185(44)	0.001
Upto 10 <sup>th</sup> class	21(10.2)	132(64.4)	44(21.5)	8(3.9)	205(48.8)	
Above 10 <sup>th</sup> class	8(26.7)	14(46.7)	8(26.7)	0	30(7.1)	
<b>Oral Hygiene Practices</b>						
No cleaning	51(14.7)	227(65.6)	60(17.3)	8(2.3)	346(82.4)	0.010
Toothbrush+Toothpaste	0	24(66.7)	12(33.3)	0	36(8.6)	
Finger+Toothpowder	4(20)	12(60)	4(20)	0	20(4.8)	
Finger+Charcoal	4(50)	4(50)	0	0	8(1.9)	
Neem stick	0	10(100)	0	0	10(2.4)	
<b>Adverse Habits</b>						
No Habits	0	8(50)	8(50)	0	16(3.8)	0.000
Smoking	8(25.8)	10(32.3)	13(41.9)	0	31(7.4)	
Arecanut+lime+tobacco	3(21.4)	7(50)	4(28.6)	0	14(3.3)	
Tobacco chewing	14(12.3)	72(63.2)	22(19.3)	6(5.3)	114(27.1)	
Gutkha chewing	21(20.6)	73(71.6)	7(6.9)	1(1)	102(24.3)	
Pan Masala	8(6.5)	95(76.6)	20(16.1)	1(0.8)	124(29.5)	
Alcohol	5(26.3)	12(63.2)	2(10.5)	0	19(4.5)	
<b>Sex</b>						
Male	41(11.7)	245(70)	60(17.1)	4(1.1)	350(83.3)	0.000
Female	18(25.7)	32(45.7)	16(22.9)	4(5.7)	70(16.7)	
Total	59(14)	277(66)	76(18.1)	8(1.9)	420(100)	

**[Table/Fig-2]:** Periodontal assessment using Loss of attachment scores according to various socio-demographic characteristics  
Chi-square test ,  $p \leq 0.05$  is considered as statistically significant

Variables	CPI scores				
	Healthy	Bleeding	Calculus	Shallow pocket	Deep pocket
<b>Age groups (years)</b>					
21-30	0.71±0.06	1.73±0.44	2.71±0.64	0.77±0.05	0.07±0.04
31-40	0.08±0.03	1.33±0.32	3.32±0.53	1.12±0.08	0.15±0.06
41-50	0.22±0.07	1.38±0.29	3.17±0.46	1.06±0.69	0.17±0.05
51-60	0.55±0.03	1.77±0.54	2.64±0.51	0.89±0.54	0.15±0.06
Total	0.44±0.02	1.6±0.04	2.89±0.55	0.93±0.63	0.13±0.05
F value	5.096	0.905	1.702	0.918	0.618
P value	0.002	0.439	0.166	0.432	0.604
<b>Sex</b>					
Male	0.45±0.03	1.58±0.04	2.86±0.54	0.94±0.06	0.16±0.06
Female	0.39±0.04	1.71±0.03	3.02±0.58	0.88±0.07	0.00±0.00
Total	0.41±0.05	1.64±0.72	2.98±0.04	0.91±0.09	0.08±0.02
t value	0.343	0.4	0.441	0.296	2.075
p value	0.732	0.689	0.659	0.767	0.039

**[Table/Fig-3]:** Distribution of Mean number of Sextant affected by periodontal diseases according to age groups and gender  
Test used: ANOVA, t-test,  $p \leq 0.05$  is considered as statistically significant

diseases, has been shown by Loe and co-workers [25,26] in the 1960s and as the level of the oral hygiene is directly related to the amount of plaque build-up on the teeth, it is reasonable to predict that the level of oral hygiene in a population is positively correlated

with the prevalence and severity of the periodontal diseases. On a population level, several studies have clearly shown that this assumption is valid. In the 1950s, the results of epidemiological studies which were done in Norway indicated that the groups with

Characteristics	Odds ratio	P value	95% Confidence interval
<b>Age</b>			
21-40 years	-	0.011	(1.420-5.565)
41-60 years	0.548		
<b>Sex</b>			
Male	1.313	0.000	(0.030-0.326)
Female	-		
<b>Education</b>			
Upto 10 <sup>th</sup> class	4.776	0.671	(0.406-6.059)
Above 10 <sup>th</sup> class	-		
<b>Oral Hygiene Practices</b>			
Toothbrush+Toothpaste	-	0.045	(0.271-5.811)
Others	0.774		
<b>Adverse oral habits</b>			
Smoking	3.994	0.039	(2.571-60886)
Others	-		

**[Table/Fig-4]:** Odds ratio and 95% confidence interval for periodontal status according to Multiple Logistic Regression

a poor oral hygiene showed a higher prevalence and severity of the periodontal tissue loss than the population with good oral hygiene [27,28].

The present study demonstrated smoking as a significant risk factor, with an odds ratio of 3.994, as compared to other adverse habits. A similar pattern was also observed among Japanese factory workers. It has been said that at least 200 substances that are toxic to the biological system have been isolated from tobacco smoke [6]. The buccal cell concentration of the carotenoids, retinoids, and the tocopherols were generally lower among the heavy smokers versus the light smokers [29], which increases the susceptibility of periodontal disease and they may be the reason for the higher incidence of periodontal disease in the smokers group. Cross-sectional studies have consistently shown the higher prevalence, extent, and severity of various periodontal disease outcomes in smokers than in non-smokers [30,31]. It has been further noted that the prevention of smoking should thus be a very important goal in any health education program, if one desires to maintain optimum oral health.

In the present study, the prevalence of severe periodontal disease significantly increased with decreasing levels of education. This finding of our study was in agreement with those of a study which was done on beedi factory workers [17]. This may be due to the fact that the level of education itself determines the income or the socioeconomic status, which in turn determines the awareness level and the utilization pattern of the dental health services. However, the education level did not account as a significant risk predictor in the multiple logistic regression analysis, which may be attributed to an overall low education level among the study population.

## CONCLUSION

As has been suggested from the findings which have been reported in this study, a comprehensive oral health promotion programme is highly desirable in the study population, which addresses the need for awareness creating activities which pertain to the oral hygiene maintenance in particular. Smoking cessation counseling should be an integral part of the community-based primary prevention programs and in the clinical management of periodontal disease.

The financial barriers to the utilization of the dental care services can be minimized by the provision of employed group benefits for dental care to this worker population.

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## REFERENCES

- [1] Marsh PD. Microbial Ecology of Dental Plaque and its Significance in Health and Disease. *Adv Dent Res.* 1994;8:263-71.
- [2] Dharmashree S, Chandu GN, Pusphanjali K, Jayashree SH, Shafiulla MD. Periodontal status of industrial workers in Davangere City, Karnataka – a descriptive cross sectional study. *J Indian Assoc Public Health Dent.* 2006;7:20-24.
- [3] Sood M. A Study of Epidemiological Factors Influencing Periodontal Diseases in selected Areas of District Ludhiana, Punjab. *Indian J Community Med.* 2005;30:70-71.
- [4] Shah N. Oral and dental diseases: Causes, Prevention and treatment strategies. *NCMH Background papers-Burden of Disease in India.* 2007;275-98.
- [5] Agarwal V, Khatri M, Singh G, Gupta G, Marya CM, Kumar V. Prevalence of periodontal diseases in India. *J Oral Health Comm Dent.* 2010;4:7-16.
- [6] Yoshida Y, Ogawa Y, Imaki M, Nakamura T, Tanada S. Lifestyles and Periodontal Disease of Japanese Factory Workers. *Environ Health Prev Med.* 1997;1:188-92.
- [7] Verma DK, Purdham JT, Roels HA. Translating evidence about occupational conditions into strategies for prevention. *Occup Environ Med.* 2002;59:205-14.
- [8] Government of India, Ministry of Home Affairs [Homepage on the Internet]. New Delhi: Office of the Registrar General & Census Commissioner, India; c2010-11 [Cited 2011 November 24]. Census of India 2011. Our Census, our Future. Available from: <http://censusindia.gov.in/>
- [9] World Health Organization, Oral health surveys. Basic methods 4th ed, Geneva: WHO, 1997.
- [10] Sheiham A. The prevalence and severity of periodontal disease in British populations. *Br Dent J.* 1969;126:115-22.
- [11] Markkanen H, Rajala M, Paunio I. Evaluation of periodontal status in a Finnish industrial population. *Community Dent Oral Epidemiol.* 1979;7:96-100.
- [12] Hugson A, Jordan T. Frequency distribution of individuals aged 20-70 years according to severity of periodontal disease. *Community Dent Oral Epidemiol.* 1982;10:187-92.
- [13] Bellini HT, Gjermo P. Application of the Periodontal Treatment Need System (PTNS) in a group of Norwegian industrial employees. *Community Dent Oral Epidemiol.* 1973;1:22-29.
- [14] Markkanen H, Rajala M, Paunio K. Periodontal treatment needs of the Finnish population aged 30 years and over. *Community Dent Oral Epidemiol.* 1983;11:25-32.
- [15] Hohlfield M, Bernimoillin J-P. 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;20:551-55.
- [16] Kumar S, Dagli RJ, Chandrakant D, Prabhu D, Suhas K. Periodontal Status of Green Marble Mine Labourers in Kesariyajji, Rajasthan, India. *Oral Health Prev Dent.* 2008;6:217-21.
- [17] Shaikh H, Shankar S, Vinay S. Assessment of periodontal status and treatment needs among Beedi factory workers Harapanahalli town, Davangere district, Karnataka. *JIADS* 2011;2:13-17.
- [18] 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;52:283-90.
- [19] 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;38:156-63.
- [20] Dini EL, Guimaraes LO. Periodontal conditions and treatment needs (CPITN) in a worker population in Araraquara, SP Brazil. *Int Dent J.* 1994;44:309-11.
- [21] Skaleric U, Kovac- Kavcic M. Periodontal treatment needs in a population of Ljubljana, Yugoslavia. *Community Dent Oral Epidemiol.* 1989;17:304-06.
- [22] Guile EE. Periodontal status of adults in Central Saudi Arabia. *Community Dent Oral Epidemiol.* 1992;20:159-60.

- [23] Albandar JM. Periodontal diseases in North America. *Periodontology* 2000 2002; 29:31-69.
- [24] Corbet EF, Wong MC, Lin HC. Periodontal conditions in adult Southern Chinese. *J Dent Res*. 2001;80:1480-85.
- [25] Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. *J Clin Periodontol*. 1965;36:177-87.
- [26] Silness J, Loe H. Periodontal disease in pregnancy. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand*. 1964;22:121-35.
- [27] Lovdal A, Arno A, Waerhaug J. Incidence of clinical manifestations of periodontal disease in light of oral hygiene and calculus formation. *J Am Dent Assoc*. 1958;56:21-33.
- [28] Schei O, Waerhaug J, Lovdal A, Arno A. Alveolar bone loss as related to oral hygiene and age. *J Periodontol*. 1959; 30:7-16.
- [29] Gabriel HE, Liu Z, Crott JW, Choi SW, Song BC, Mason JB et al. A Comparison of Carotenoids, Retinoids, and Tocopherols in the Serum and Buccal Mucosa of Chronic Cigarette Smokers versus Nonsmokers. *Cancer Epidemiol Biomarkers Prev*. 2006;15:993-99.
- [30] Axelsson P, Paulander J, Lindhe J. Relationship between smoking and dental status in 35-, 50-, 65-, and 75-year old individuals. *J Clin Periodontol*. 1998;25:297-305.
- [31] Bergström J, Eliasson S, Dock J. Exposure to tobacco smoking and periodontal health. *J Clin Periodontol*. 2000;27:61-68.

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