

# ASSOCIATION BETWEEN CIGARATTE SMOKING AND PERIODONTITIS IN PAKISTANI POPULATION

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## ABSTRACT

*The study was done to identify the association between cigarette smoking and periodontitis in patients reporting to tertiary care dental centre. It is a comparative cross sectional study which was conducted in the Department of Operative Dentistry at Armed Forces Institute of Dentistry, Rawalpindi. The study was completed in 6 months from Mar 2007 to Sep 2007.*

*200 patients including 100 smokers and 100 non smokers were selected. Patients were clinically evaluated by measuring the probing depth, clinical attachment level (CAL), tooth mobility and furcation involvement between the two groups. There was a significant association between cigarette smoking and periodontitis. Mean probing depth in smokers was 3.56 and 3.09 in non smokers, mean CAL in smokers was 2.53 and 1.96 in non smokers, mean furcation involvement in smokers was 0.36 and 0.14 in non smokers and mean tooth mobility in smokers was 0.32 and 0.17 in non smokers.*

*There was a marked association between cigarette smoking and periodontitis. The results of this study suggest that cigarette smoking significantly worsen periodontal health and greater probing depth, clinical attachment level, tooth mobility and furcation defects have been found in smokers than in non smokers.*

**Key words:** *Periodontitis, cigarette smoking, probing depth, clinical attachment level, furcation involvement, tooth mobility.*

## INTRODUCTION

Periodontal disease is one of the main causes of tooth loss worldwide.<sup>1-6</sup> The primary cause of periodontitis is bacterial infection of long duration. In addition, there are several risk factors that may increase the probability and severity of periodontitis, one of which is smoking. Smoking is a pollution and injurious to health.<sup>7</sup>

Periodontitis is the result of a response of the host to bacterial aggregations on the tooth surfaces. The outcome of this is an irreversible destruction of the connective tissue attachment, which results in periodontal pocket formation and eventual loss of alveolar

bone.<sup>18</sup> Destructive periodontitis has been described as a consequence of the interaction of genetic, environmental, microbial and host factors. Among those risk factors identified for periodontitis are age, gender, socioeconomic status, and genetic predisposition, bacterial colonization, certain systemic conditions and smoking.<sup>9-12</sup> Oral hygiene has been consistently demonstrated by cross sectional studies to have a significant effect on periodontal health.<sup>13</sup>

Cigarette smoking is a major risk factor for periodontitis.<sup>7</sup> Persons who smoke had deeper probing depths (PD), more attachment loss, and more alveolar bone loss than persons who did not smoke.<sup>14,15</sup> Cigarette

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smoking also affects disease progression i.e. periodontitis. Smokers develop more sites with increased PD and alveolar bone loss.<sup>4,16</sup> Break down remained more severe in smokers even when the confounding influence of oral hygiene accounted for.<sup>17</sup>

Nicotine and carbon monoxide in tobacco smoke negatively influence wound healing. Nicotine may cause a vasoconstriction in the peripheral blood vessels and thus may reduce the clinical signs on gingivitis. The induced vasoconstriction could contribute to impaired gingival blood flow and decrease the amount of oxygen and blood constituents that reach the gingiva. Nicotine metabolites concentrate in the periodontal tissues and can have local effects as well as the potential to affect the systemic host response.<sup>18</sup>

The capacity to remove tissue waste products would also be reduced leading to tissue damage or a compromised immune response. The smokers have also lower amounts of GCF compared to non-smokers.<sup>19</sup>

Smoking affects the mineral content of bone tissue. Progressive loss of bone with advancing age is more prominent. Treatment in smokers resulted in lesser probing depth reduction and smaller clinical attachment level (CAL) gain. Moreover, smokers are at a higher risk for recurrent diseases during periodontal maintenance care than nonsmokers.<sup>20,21</sup>

This study was aimed to determine the effect of cigarette smoking on periodontal health in comparative cross sectional study of adults in a small group of Pakistani population.

## METHODOLOGY

The present comparative cross sectional study was carried out on patients visiting out Patient Departments of Operative Dentistry/Periodontology at Armed Forces Institute of Dentistry, Rawalpindi from March 2007 to Sept 2007. Out of total 200 patients, 100 were smokers and 100 non smokers. Age limit was 18-60 years including both male and female, individuals resident of Rawalpindi/Islamabad. One maxillary and one contra lateral mandibular quadrant were selected having at least six teeth in each quadrant. Both smokers and non smokers were evaluated. Smokers had

smoked at least 10 cigarettes per day for at least five years. On the basis of history smoker patients themselves were included in Group A (Smokers) and non smokers patients were included in Group B (Non-smokers).

Third molars, primary dentition, past smokers and smokers consuming less than 10 cigarettes per day, patients having complicating medical condition, pregnancy, patients using any drug which may affect the periodontium like phenytoin, cyclosporin, nifedipine etc., history of cardiovascular diseases or other conditions that required prophylactic antibiotics like rheumatic fever were excluded from the study.

Smokers and Non smoker individuals, were informed about the study and after they fulfilled the inclusion and exclusion criteria, an informed consent for participation in the study was requested. The non-smokers were enrolled from among subjects who visited AFID for regular checkups. All smoker subjects and non smokers included in this study were sampled from people living in the region of Rawalpindi and Islamabad.

Patients were clinically evaluated by examining intraorally in a dentist's chair under good light, using mouth mirror, Marquis Colour coded periodontal probe having length 12 mm to find out probing depth (pocket) along tooth root surface, clinical attachment level, and furci areas at the junction of multirrooted teeth.

Tooth mobility was checked by using handle of dental mirror and finger and graded accordingly.

Measurements were made at three sites per tooth, midbuccal, and mesial and distal using Marquis colour coded periodontal probe. Demographic data was obtained.

History regarding past medical diseases of clinical importance e.g. diabetes mellitus, hypertension, cardiovascular diseases, arthritis, stroke, asthma, renal or hepatic problems, osteoporosis was recorded to exclude other risk determinants besides smoking.

The subjects were allocated into two groups, smokers and non smoker subjects, on the basis of answer to question in questionnaire. If the subject answered

“Yes” for smoking she/he was classified as a smoker (Group A). Those who answered “No” were classified as non smoker (Group B).

Data was analyzed on computer program SPSS.

Mean and SD were calculated for age. Frequencies and percentage were calculated for Gender, age and socioeconomic status. Means were compared using ‘t’ test. The clinical categories were evaluated by a Chi square test. Comparison was considered significant at ‘p’ value <0.05.

**RESULTS**

The study population consisted of 100 smokers with a mean (±SD) age of 40.53±9.83 and 100 non-smokers with a mean age of 38.68±12.27 years. Most of the individuals were male. Only 4 females were smokers. Two groups of age were assessed. One group had ages ≤39 years and second group had ages ≥40 years (Table-1). Mean age was 40.16±12.13. There was no statistically significant difference between two age groups (p<0.161).

Most individuals consumed 10 or less than 10 cigarettes daily (Fig 1). Only a small number of non-smokers had periodontitis. Many exhibited periodontitis with daily consumption of more than 10 cigarettes (p<.004)(Table-2).

Many individuals (66%) brushed their teeth once daily(Fig-2). 30% were engaged in twice a day tooth cleaning habits. While 14% brushed their teeth occasionally (p<0.002). The smokers exhibited somewhat lower frequency of dental care visits than nonsmokers (Fig 3). 48% individuals had once a year visit to dentist as compared to only 14% of individuals who had twice a year visit. Periodontal disease was more fre-

quent among individuals with occasional dental care visits.

A significant relationship was existed between individuals with less cigarette consumption and more cigarette consumption (p<0.000) (Fig 4) .

70% of individuals belongs to average category with no significant relation of periodontitis between average and high group individuals (p<0.015) (Fig 5).

Relationships of patient clinical parameters were assessed with smoking status (Table 3). Probing depth was divided into 2 groups one with <4mm of probing depth and second group with ≥4mm of probing depth. More probing depth (≥4.0mm) was observed in smokers as compared to non smokers (p<0.006).

Clinical attachment level (CAL) was significantly increased in smokers as compared to non-smokers. More individuals were found having grade I and grade II mobility in smokers than non smokers (p<0.023). Furcation involvement was significantly increased in smokers as compared to non-smokers (p<0.001).

Relationships of clinical parameters were also assessed with periodontal status (Table 4,5). 24% of individuals were having periodontitis with deep probing depth i.e. ≥4mm (p<.000).Up to 2mm of CAL, periodontitis was not observed. Between 2.0-<3.0mm CAL 1 had Periodontitis and between 3.0-≥4.0 mm of CAL 47 had Periodontitis (p<.000).Most of the individuals with grade I and grade II mobility were exhibited with periodontitis (p<.000).

No furcation involvement was observed in most of the individuals. But Class 1 and Class II furcations involvement were mostly seen in patients with periodontitis (p<.000).

TABLE 1: AGE AND GENDER DISTRIBUTION

	Smoking Status		Total	P value
	Smoker	Non smoker		
<b>Age in groups</b>				
≤39	47	55	102	0.16
≥40	53	45	98	
<b>Gender</b>				
Male	96	68	164	0.000
Female	4	32	36	

TABLE: 2: PATIENT DEMOGRAPHIC CHARACTERISTICS

	No Periodontitis	Periodontitis	Total	%	P Value
<b>Age</b>					
<39 years	85	17	102	51%	0.010
≥40 years	67	31	98	49%	
<b>Gender</b>					
Male	120	44	164	82	0.032
Female	32	4	36	18	
<b>Socioeconomic Status</b>					
Average	113	27	140	70%	0.015
High	39	21	60	30%	
<b>Years smoking</b>					
No	84	16	100	50%	0.000
10 years	44	10	54	27%	
15 years	24	10	34	17%	
20 years	–	12	12	6%	
<b>Daily cigarette consumption</b>					
No	84	16	100	50%	0.004
<10 per day	48	16	64	32%	
>10 per day	20	16	36	18%	
<b>Frequency of tooth brushing</b>					
Once daily	88	24	112	66%	0.095
Twice daily	40	20	60	30%	
Occasionally	24	4	28	14%	
<b>Dental care visits</b>					
Six monthly	22	6	28	14%	0.028
Once a year	80	16	96	48%	
Occasionally	50	26	76	38%	

TABLE: 3: RELATIONSHIP OF PATIENT CLINICAL MEASUREMENTS WITH SMOKING STATUS

	Smoking Status		Total	%	P Value
	Smoking	Non smoking			
<b>Probing depth</b>					
<4mm	68	84	152	76%	0.006
≥4mm	32	16	48	24%	
<b>Tooth mobility</b>					
No	72	83	155	77.5%	0.023
Grade 1	24	17	41	20.5%	
Grade 2	4	–	4	2%	
<b>Furcation Area Involvement</b>					
No	72	86	158	79%	0.001
CL I	20	14	34	17%	
CL II	8	–	8	8%	
CL III	–	–	–	–	
<b>Clinical attachment level</b>					
0.5-<2.0	25	40	65	32.5%	0.011
2.0-<3.0	40	41	81	40.5%	
3.0-≤4.0	35	19	54	27%	

TABLE: 4: RELATIONSHIP OF PATIENT CLINICAL MEASUREMENTS WITH PERIODONTAL STATUS

	Periodontal Status		Total	%	P Value
	No Periodontitis	Periodontitis			
<b>Probing depth</b>					
<4mm	152	—	152	76%	0.000
≥4mm	—	48	48	24%	
<b>Tooth mobility</b>					
No	143	12	155	77.5%	0.000
Grade 1	9	32	41	20.5%	
Grade 2	—	4	4	2%	
<b>Furcation Area Involvement</b>					
No	143	15	158	79%	0.000
CL I	9	25	34	17%	
CL II	—	8	8	8%	
CL III	—	—	—	—	
<b>Clinical attachment level</b>					
0.5-<2.0	65	0	65	32.5%	0.000
2.0-<3.0	79	1	80	40.0%	
3.0-≤4.0	8	47	55	27.5%	

TABLE: 5: INDEPENDENT SAMPLE STATISTICS

	Smoking Status	N	Mean	Std. Deviation	P Value
<b>Clinical Attachment Level</b>	Smokers	100	2.53	1.17	.000
	Non smokers	100	1.96	.90	.000
<b>Tooth Mobility</b>	Smokers	100	.32	.55	.025
	Non smokers	100	.17	.38	.025
<b>Furcation Areas</b>	Smokers	100	.36	.63	.002
	Non smokers	100	.14	.35	.003
<b>Probing Depth</b>	Smokers	100	3.56	1.19	.001
	Non smokers	100	3.09	.67	.001

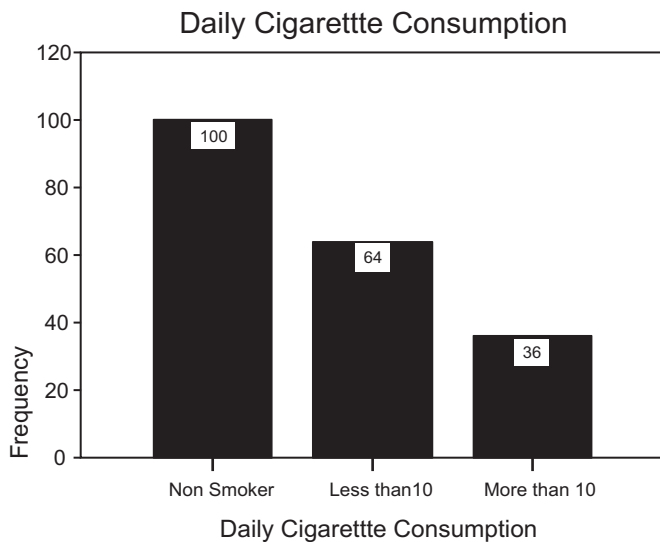


Fig 1: Frequency of Daily Cigarette Consumption

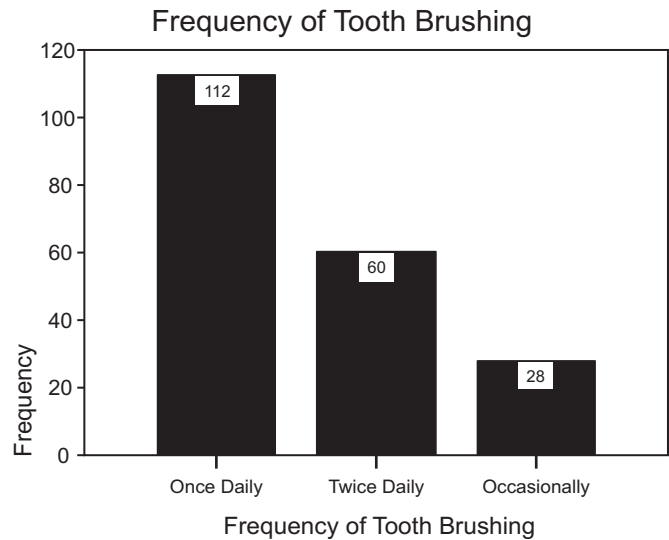


Fig 2: Frequency of Tooth Brushing

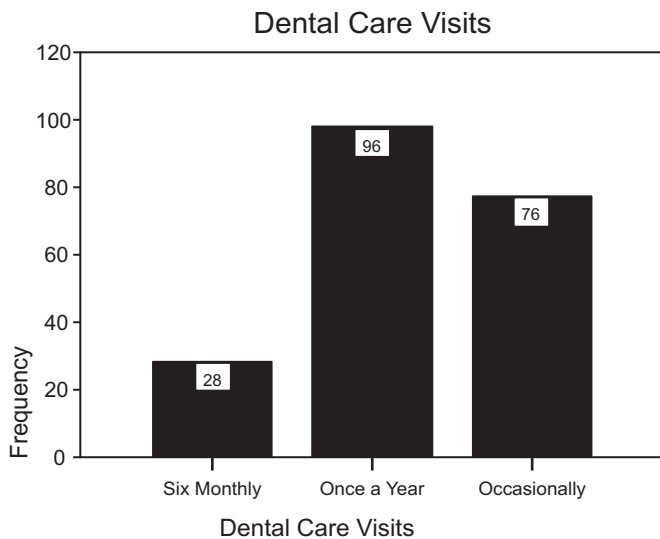


Fig 3: Frequency of Dental Care Visits

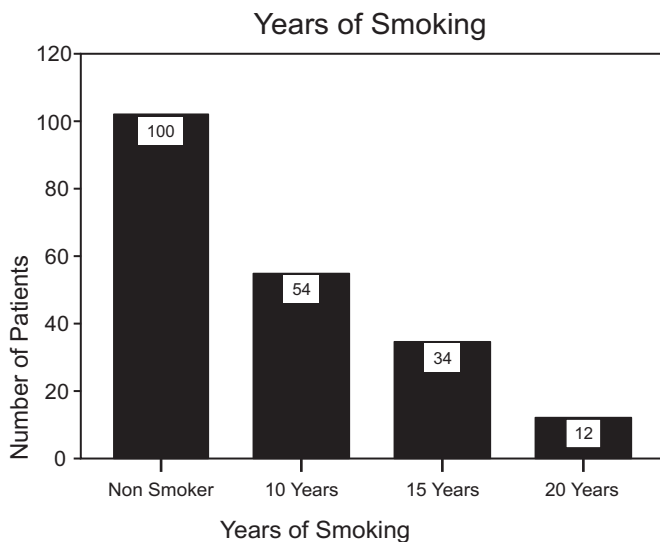


Fig 4: Frequency of Years of Smoking

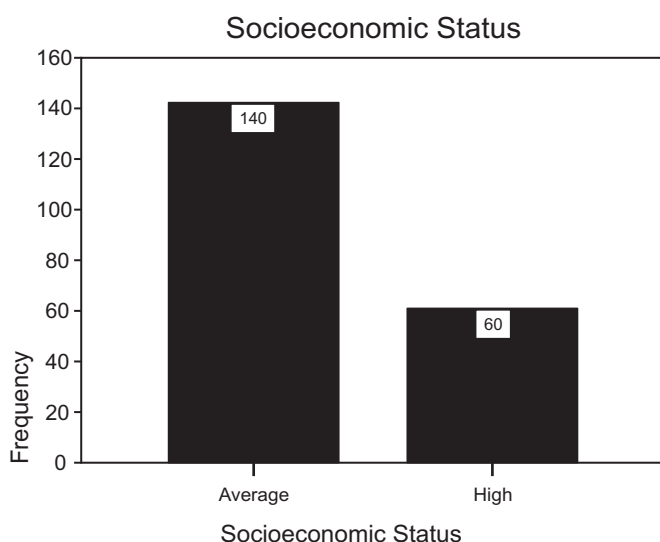


Fig 5: Socioeconomic Status

## DISCUSSION

This study was done to compare the demographic and periodontal clinical parameters between smokers and non smokers. The hypothesis of our study was that there is a significant association between cigarette smoking and periodontitis as compared to non smoking. In our study greater clinical periodontal breakdown including probing depth, CAL, furcation involvement, tooth mobility was found in smokers as compared to non smokers. The difference in scores between smokers and non smokers was statistically significant, p value being <0.05 supporting the hypothesis of the study.

The strong association between cigarette smoking and periodontitis in this study is generally consistent with the findings of many other epidemiological studies of cigarette smoking and periodontitis, including cross sectional,<sup>10,11,22</sup> case control,<sup>23,24</sup> and longitudinal studies.<sup>25,26</sup> Although these studies have used a wide variety of case definitions for disease, divergent study populations, and different study designs, they have almost uniformly reported moderate to strong degree of association between smoking and periodontitis and a dose response relation between exposure and disease. Furthermore, recent literature reviews that have summarized these and other epidemiologic studies as well as clinical humans and animal studies or in vitro investigations all essentially conclude that cigarette smoking is a major risk factor for the onset or progression of periodontal destruction.<sup>27-29</sup>

In this study clinical parameters were obtained from contra lateral sides of the mouth. Although whole mouth examination gives a better presentation for the extent and severity of periodontitis, it is time consuming. It has been demonstrated that half mouth examination can be used as an alternative for whole mouth assessment.<sup>30</sup>

The relationship between periodontitis and sociodemographic variables including age, gender, socioeconomic status, dental care visits, frequency of tooth brushing, and daily cigarette consumption was in conformity with previous cross sectional studies.<sup>14,31,32</sup> Statistically periodontitis was not significantly associated with frequency of tooth brushing. This may be due to the increased consciousness of the individual with periodontal disease.

The correlation between smoking and periodontitis was weaker than observed in other studies.<sup>33</sup> In our study analysis comparatively younger group was used than other studies, as mostly were the serving military personnel with age limit 18-60 years.

Guillermo<sup>34</sup> conducted a study to examine the influence of cigarette smoking on periodontal condition of a young, healthy population. Most of the parameters between his study and our study were similar except the mean age which was  $19.38 \pm 0.72$  as compared to our study where mean age which was  $39.60 \pm 11.13$ . The above mentioned study was conducted among the young healthy adults while in our study the age range was 18 to 60 years showing increased probing depth and CAL values.

Natto and Mustafa<sup>35</sup> conducted a study in Saudi Arabia to find out the detrimental effects of tobacco smoking on periodontal health. The association between cigarette smoking and probing depth was statistically significant ( $p < 0.001$ ).

Kitti and Suphot<sup>7</sup> conducted a study to find out risk factors for periodontal disease in old Thai adults with age limit  $>60$  years and found strong relationship between smoking and periodontitis. Our study showed that with average income group out of 140 only 27 exhibited periodontitis as compared to high group individuals in which out of 60, 21 exhibited periodontitis. This study contradicts the previous study conducted by Kitti and Suphot<sup>8</sup> in which they showed that low income individuals show high percentage of periodontitis as compared to high income individuals. This is perhaps due to the difference of eating habits in Pakistan between low socioeconomic group and high socioeconomic group. As more refined diet is being used in the high socioeconomic individuals as compared to the average socioeconomic individuals who consumed relatively fibrous diet.

Mahuca and colleagues<sup>34</sup> evaluated the degree of periodontal disease and its relationship to smoking habits in a population of young healthy male Spanish military recruits. Young smokers diagnosed with aggressive form of periodontitis were shown to have more affected teeth and a higher mean loss of periodontal attachment than non smokers with these conditions Mullally and Linden<sup>36</sup> had reported that cigarette smokers were significantly at risk for furcation involvement

in smokers than non smokers. The study showed a significantly increased number of molar teeth furcation defects. In our study furcation involvement was also significantly increased in smokers as compared to non smokers ( $p < 0.001$ ). Class II furcation cases were seen only in smokers.

Several limitations of this study are obvious in interpreting the findings. First, as the data was based on comparative cross sectional study, it could not be determined whether the exposure to smoking preceded the onset of disease, nor it could be differentiate periodontal sites with active disease from those with long standing periodontal pocketing or loss of attachment.

Secondly, only contralateral quadrants of the mouth and three sides per tooth were examined which may cause some disease sites to be missed leading to the underestimating the large sample of population affected by periodontitis.<sup>37</sup>

Thirdly, study represents only a segment of people with middle and upper class socioeconomic status. They may not represent the general population because the sampling technique was convenience leading to biasness in the findings to some extent.

## REFERENCES

- 1 Ainamo J, Sarkki L, Kuhalampi ML, Palolampi L, Piirto O. The frequency of periodontal extractions in Finland. *Community Dent Health* 1984; 1: 165-72.
- 2 Haddad I, Haddadin K, Jebrin S, Ma'ani M, Yassin O. Reasons for extraction of permanent teeth in Jordan. *Int Dent J* 1999; 49: 343-46.
- 3 Murray H, Locker D, Kay EJ. Patterns of and reasons for tooth extractions in general dental practice in Ontario, Canada. *Community Dent Oral Epidemiol* 1996; 24: 196-200.
- 4 Ong G, Yeo JF, Bhole S. A survey of reasons for extraction of permanent teeth in Singapore. *Community Dent Oral Epidemiol* 1996; 24: 124-27.
- 5 Al-Shammari KF, Al-Khabbaz AK, Al-Ansari JM, Neiva R, Wang HL. Risk Indicators for Tooth Loss Due to Periodontal Disease. *J Periodontol* 2005; 76: 1910-18.
- 6 Babar Z, Kaleem M, Manzoor MA. Risk indicators for tooth loss due to periodontal disease in Pakistani adults. *Pak Oral Dent J* 2007; 27: 167-74.
- 7 Torrungruang K, Tamsailon S, Rojanasornsith K, Sutdhibhisal S, Nisapakultorn K, et al. Risk indicators of periodontal disease in older Thai adults. *J Periodontol* 2005; 76: 558-65.
- 8 Bergstrom J, Eliasson S. Cigarette smoking and alveolar bone height in subjects with high standard of oral hygiene. *J Clin Periodontol* 1987; 14: 466-69.

- 9 Grossi SG, Genco RJ, Machtei EE, et al. Assessment of risk for periodontal disease. II. Risk indicators for alveolar bone loss. *J Periodontol* 1995; 66: 23-29.
- 10 Grossi SG, Zambon JJ, Ho AW, et al. Assessment of risk for periodontal disease. Risk indicators for attachment loss. *J Periodontol* 1994; 65: 260-67.
- 11 Haber J, Wattles J, Crowley M, Mandell R, Joshipura K, Kent RL. Evidence for cigarette smoking as a major risk factor for periodontitis. *J Periodontol* 1993; 64:16-23.
- 12 Moore PA, Weyant RJ, Mongelluzzo MB, et al. Type 1 diabetes mellitus and oral health: Assessment of periodontal disease. *J Periodontol* 1999; 70: 409-17.
- 13 Meisel P, Siegemund A, Grimm R, et al. The interleukin-1 polymorphism, smoking, and the risk of periodontal disease in the population-based SHIP study. *J Dent Res* 2003; 82: 189-93.
- 14 Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: Findings from NHANES III. National Health and Nutrition Examination Survey. *J Periodontol* 2000; 71: 743-51.
- 15 Ogawa H, Yoshihara A, Hirotoimi T, Ando Y, Miyazaki H. Risk factors for periodontal disease progression among elderly people. *J Clin Periodontol* 2002; 29: 592-97.
- 16 Al-Wahadni A, Linden G. The effect of cigarette smoking on the periodontal condition of young Jordanian adults. *J Clin Periodontol* 2003; 30: 132-37.
- 17 Kerdvongbundit V, Wikesjo ME. Effect of smoking on periodontal health in molar teeth. *J Periodontol* 2000; 71: 433-37.
- 18 Brian H. Mullally. The Influence of Tobacco Smoking on the Onset of Periodontitis in Young Persons. Palmer RM, Scott DA, Meekin TN, Poston RN, Odell EW, Wilson RF. Potential mechanisms of susceptibility to periodontitis in tobacco smokers. *J Periodontol Res* 1999; 363-69.
- 19 Preber H, Bergstrom J. Effect of cigarette smoking on periodontal healing following surgical therapy. *J Clin Periodontol* 1990; 17: 324-28.
- 20 Haas R, Haimbock W, Mailath G, Watzek G. The relationship of smoking on periimplant tissue: A retrospective study. *J Prosthet Dent* 1996; 76: 592-96.
- 21 Genco RJ. Current view of risk factors for periodontal diseases. *J Periodontol* 1996; 67: 1041-49.
- 22 Bergstrom J, Preber H. Tobacco use as a risk factor. *J Periodontol* 1994; 65(Suppl.): 545-50.
- 23 Bergstrom J. Cigarette smoking as risk factor in chronic periodontal disease. *Community Dent Oral Epidemiol* 1989; 17: 245-47.
- 24 Haber J, Kent R. Cigarette smoking in a periodontal practice. *J Periodontol* 1992; 63: 100-106.
- 25 Beck J, Cusmano L, Green-Helms W, Koch G, Offenbacher S. A 5-year study of attachment loss in community-dwelling older adults: incidence density. *J Periodont Res* 1997; 32: 506-15.
- 26 Dolan T, Gilbert G, Ringelberg M, et al. Behavioral risk indicators of attachment loss in adult Floridians. *J Clin Periodontol* 1997; 24: 223-32.
- 27 Shizukuishi S. smoking and periodontal diseases. *Clin Calcium* 2004; 17(2): 226-32.
- 28 Salvi G, Lawrence H, Offenbacher S, Beck J. Influence of risk factors on the pathogenesis of periodontitis. *J Periodontol* 2000 1997;14:173-201. .
- 29 Gelskey S. Cigarette smoking and periodontitis: Methodology to assess the strength of evidence in support of a causal association. *Community Dent; Oral Epidemiol* 1999; 27: 1
- 30 Dowsett S, Eckert G, Kowolik M. The applicability of half-mouth examination to periodontal disease assessment in untreated adult populations. *J Periodontol* 2002; 73: 975-81.
- 31 Dowsett S, Eckert G, Kowolik M. The applicability of half-mouth examination to periodontal disease assessment in untreated adult populations. *J Periodontol* 2002; 73: 975-81.
- 32 AI-Zahrani MS, Bissada NF, Borawskit EA. Obesity and periodontal disease in young, middle-aged, and older adults. *J Periodontol* 2003; 74: 610-15.
32. Sritara P, Cheepudomwit S, Chapman N. Twelve year changes in vascular risk factors and their associations with mortality in a cohort of 3499 Thais: The Electricity Generating Authority of Thailand Study. *Int J Epidemiol* 2003; 32: 461-68.
- 33 Shizukuishi S, Hayashi N, Tamagawa H. Lifestyle and periodontal health status of Japanese factory workers. *Ann Periodontol* 1998; 3: 303-11.
- 34 Machuca G, Rosales I, Lacalle J, Machuca C, Bullon P. Effect of Cigarette smoking on periodontal status of healthy young adults. *J Periodontol* 2000; 71: 73-8.
- 35 Natto S, Baljoon M, Bergstrom J. Tobacco smoking and periodontal health in a Saudi Arabian Population. *J Periodontol* 2005; 76: 1919-26.
- 36 Mullally BH, Linden GJ. Molar furcation involvement associated with cigarette smoking in periodontal referrals. *J Clin Periodontol* 1996; 23: 658-61.
- 37 Hunt R, Fann S. Effect of examining half the teeth in a partial periodontal recording of older adults. *J Dent Res* 1991; 70: 1380-85.