

Effect of Smoking on Periodontal Health: A Comparative Study

Faisal Salim, Chander Kumar, Seeme Nigar, Sabeen Masood, Muhammad Asif Raz, Bilal Sarwar

ABSTRACT

Objective: To determine the association between smoking and calculus deposition among patients presenting at a tertiary hospital of Karachi.

Study Design and Settings: A cross-sectional comparative study was conducted at periodontology OPD, Altamash Institute of Dental Medicine Karachi for six months from 15-September-2021 to 15-February-2022.

Methodology: About 150 male patients of age 11 to 60 years coming for routine check-ups were included. Patients were divided into two groups on basis of their smoking status. Clinical examination was performed for each tooth and presence of calculus was evaluated using Oral Hygiene Index (OHI). The measurement of calculus was done by visual investigation and tactile examination by using periodontal probe and mirror. For each individual, one tooth was selected from each sextant and average OHI score is calculated. Supra-gingival calculus present near marginal gingiva was labeled as mild whereas supra and sub gingival calculus with gum recession along with calculus covering more than half of tooth surface was labeled as severe.

Results: Among 75 smokers, 44% had mild and 56% had severe calculus deposition whereas among 75 non-smokers, 86.7% had mild and 13.3% had severe calculus deposition. Odds of smoking among patients with severe deposition is 8.27 times higher than odds of smoking among patients with mild calculus deposition (OR=8.27, 95% CI=3.69-18.53) and significant effect of smoking was observed on calculus deposition (p=0.001).

Conclusion: The study concluded that smoking has significant effect on calculus deposition. By taking smoking as a discriminant variable it is proved that calculus deposition is higher in smokers as compared to non-smokers.

Keywords: Smoking, periodontal health, calculus deposition, oral hygiene

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Faisal Salim

Senior Dental Surgeon, Department of Periodontology
Benai Bhutto Hospital Quetta
Email: faisal_salim28@yahoo.com

Chander Kumar

Associate Professor, Department of Periodontology
Dow University Health Sciences
Email: chander.kumar@duhs.edu.pk

Seeme Nigar

Registrar, Department of Oral Pathology
Altamash Institute of Dental Medicine, Karachi
Email: dr.seeme.nigar@gmail.com

Sabeen Masood

FCPS Resident, Department of Operative Dentistry and Endodontics
Altamash Institute of Dental Medicine, Karachi
Email: sabeen_786@live.com

Muhammad Asif Raz

Assistant Professor, Department of Management Sciences
Baluchistan University of Information Technology, Engineering and Management Sciences, Quetta
Email: asif.raz@buitms.edu.pk

Bilal Sarwar

Assistant Professor, Department of Management Sciences
Baluchistan University of Information Technology, Engineering and Management Sciences, Quetta
Email: bilal.sarwar@buitms.edu.pk

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INTRODUCTION

Periodontal disease (PD) is an infectious, chronic condition accompanied by the loss of periodontal tissue and affecting almost 20-50% of global population. It is generally accepted that PD occurs as a consequence of imbalances between local microbiota and locally mediated immune response. Chronic PD displays a gender, age, and socio-economic status differences, indicating that socio-demographic-related variables have played a significant role in the disease growth accounting for around 8% increase in prevalence rate of periodontitis in an age-standardized population from 1990 to 2019.³ One of the modifiable and unhealthy lifestyle risk factors of PD is smoking. Smoking plays a significant part in the development and progression of chronic PD.^{4,5,6,7} Worldwide, mortality rates as a consequence of smoking are estimated to be 7 million in a year.⁸ Worldwide, about 43% of the women and 57% of the men are smokers. In developing countries, the smoking rate is increasing by 3% each year, which may also leads to increase in prevalence of PD.⁶ In terms of the process by which smoking influences the development of periodontitis, multiple causes lead to the harmful periodontal impacts of smoking, comprising the modification of both host reaction and microbial mechanisms. Even healthy periodontium is damaged by smoking and

certain complications for example diabetes mellitus multiplies the destructive effect involved in smokers.¹⁰ In another study increased incidence of calculus has been indicated in Community Periodontal Index (CPI) scores in smokers.¹¹ Among the environmental factors, tobacco smoking is considered one of the true risk factors and is known to be independently related to periodontal destruction. More than seven thousand toxins are present in tobacco smoke including, carcinogens and addictive psycho-active substances like nicotine, which are detrimental to general health and also a major public health concern. In addition, the use of smokeless tobacco (SLT) as an alternative tobacco product to cigarette smoking is gradually becoming popular.

Considering the well-established deleterious effects of smoking on periodontal health, it is of great importance to understand the underlying mechanisms, which remain largely unclear. It is widely accepted that both periodontal microflora and host response play critical roles in the initiation and progression of periodontal disease. Considerable attention has been focused on the effects of smoking on host response in previous studies, which demonstrate that smoking increases the host's susceptibility and risk of infection by inducing immune dysfunction. However, it is still necessary to carry out a more detailed assessment of the effects of smoking on sub-gingival microflora that causes the infectious disease. A previous review article investigated the correlation between smoking and oral and nasopharyngeal bacterial flora, and demonstrated the adverse effects of smoking on the colonization of potential pathogens and the increased frequency of upper respiratory tract infections.¹

The aim of current study was to determine the association between smoking and calculus deposition among patients presenting at a tertiary hospital of Karachi. This study would help in promoting healthy practices and increasing awareness regarding harmful effects of smoking in general and associated with calculus decomposition.

METHODOLOGY:

A cross-sectional comparative study was conducted at the out-patient department of periodontology of Altamash Institute of Dental Medicine, Karachi for the duration of six months from 15-September 2021 to 15-February 2022, after the approval of institutional review board with ERC code: AIDM/ERC/20/2021/01. Sample size was estimated using online Open epi sample size estimator, by statistics of mean calculus index in smokers as 1.62 ± 0.36 and in non-smokers as 1.40 ± 0.55 , power of test as 80% and 95% confidence interval.¹² The estimated sample size came out as 71~75 in each group, total sample size was 150. All the male patients of age 11 to 60 years coming for routine check-ups were included in the study using non-probability convenience sampling technique. Patients who were consuming smokeless tobacco or who had systemic illness were excluded from the study. The informed consent was taken from all the

eligible participants before starting data collection. Baseline information was collected from all the patients and noted on simple pre-designed proforma. Patients were divided into two groups on the basis of their smoking status. "Group A" included 75 patients who had previous history of smoking or who were currently smokers. "Group B" included 75 patients who had never smoked in their whole life.

The clinical examination was performed for each tooth and presence of calculus was evaluated using Oral Hygiene Index (OHI) by principal investigator. The measurement of calculus was done by visual investigation and tactile examination by using periodontal probe and mirror. For each individual, one tooth was selected from each sextant and the average OHI score is calculated. Supra-gingival calculus present near marginal gingiva was labeled as mild whereas supra and sub gingival calculus with gum recession along with calculus covering more than half of tooth surface was labeled as severe. The level of calculus deposition was recorded for both groups i.e., smokers and non-smokers.

Data was analyzed using SPSS version 23. Mean and SD were calculated for numeric variables and frequency and percentage were reported for categorical variables. Comparison between both groups for calculus deposition was done using chi-square test. $P < 0.05$ was taken as statistically significant.

RESULTS

Out of 150 patients, most of the patients were of age 41-60 years (44.7%), followed by 21-40 years (39.3%) and 11-20 years (16%) respectively. About 52 had education till intermediate (34.7%), 43 had bachelors or master's degree (28.7%), 38 did matric (25.3%), 13 had primary level education (8.7%) and only 4 were illiterate (2.7%). Most of the patients brush their teeth once a day (52.7%) and 27.3% patients brush their two times in a day. About 48.7% of the patients floss their teeth occasionally and 22.7% had never used floss. However, we did not find any statistically significant correlation between both brushing habits among smokers and flossing habit among smokers ($p > 0.05$). Most of the smokers who had severe calculus in their mouths complained of frequent bleeding from gingiva ($n=25$) and bleeding while brushing ($n=12$). We found their relation to be statistically significant ($p=0.001$) (Fig 3). Out of 150 patients, 35% had severe calculus deposition and 65% had mild calculus deposition. Among 75 smokers, 44% had mild and 56% had severe calculus deposition whereas among 75 non-smokers, 86.7% had mild and 13.3% had severe calculus deposition. Hence, the odds of smoking among patients with severe deposition is 8.27 times higher than odds of smoking among patients with mild calculus deposition (OR=3.5, 95% CI=2.01-6.15). Hence, the significant effect of smoking was observed on calculus deposition ($p=0.001$). (Fig 1)

For age group 11-20 years, patients who were smokers had low frequency of severe calculus deposition. In this age

group, statistically insignificant difference was observed between smoking and calculus deposition ($p=0.473$). For age group 21-40 years, low frequency of severe calculus deposition was observed among smokers, whereas in age group 41-60 years, high frequency of severe calculus was observed among smokers. In these age groups, statistically significant difference was observed between smoking and calculus deposition ($p<0.05$). (Table 1)

Figure 1: Relation of Gingival Bleeding in Smokers and Non-smokers against calculus condition

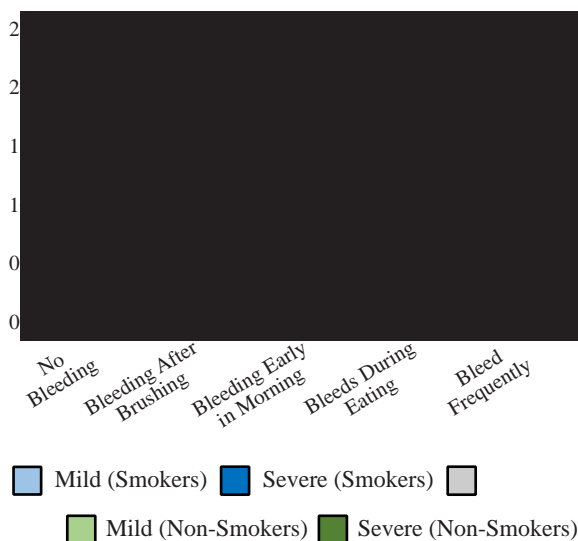


Figure 2: Age wise incidence of calculus deposition among smokers

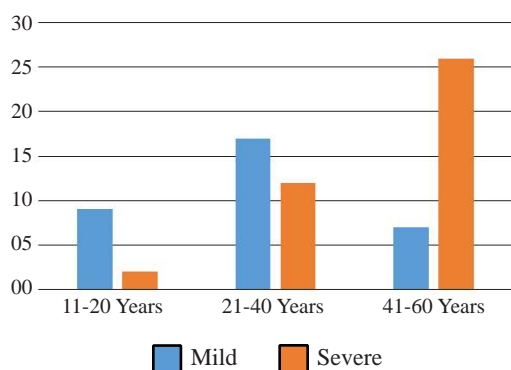


Table 1: Significant effect of smoking on calculus deposition with respect to age

Age groups	Smoking	Mild	Severe	Total	P-value
11-20 years	Yes	9 (81.8%)	2 (18.2%)	11	0.437
	No	12 (92.3%)	1 (7.7%)	13	
21-40 years	Yes	17 (56.7%)	13 (43.3%)	30	0.02
	No	25 (86.2%)	4 (13.8%)	29	
41-60 years	Yes	7 (20.6%)	27 (79.4%)	34	0.001
	No	28 (84.8%)	5 (15.2%)	33	
Total		98	52		

DISCUSSION

Smoking has become a significant public health issue due to its associated morbidity and fatality which is attributed to raise from 7 million per year to 8.3 million by 2030.⁸ This research was conducted to determine the significant effect of smoking on calculus deposition. We have included only males (100%) in our study, the females were excluded because it was difficult to enroll them and make them admit that they practice cigarette smoking. Another reason of not including females was to avoid potential bias in results due to hormone-induced microcirculatory alterations to the periodontal health condition.^{13,14} According to the results presented in the research paper by Ho K Y et al. most of the participants they studied (68.7%) started smoking in as early as 13 to 18 years of their age.¹⁵ However contrary to this, in the present study, only 32.9% of the participants who smoked were of age less than 30 years which might be because of the small sample of the population while high proportion of smokers were found in age greater than 30 years (67.1%). According to the studies by et al. and A.N. Haas et al. higher deposition of calculus is often associated with habit of smoking.^{16,17,18} because smoking reduces the speed of response of host defenses rendering the healing ability impaired and promoting the calculus formation via reduced salivary flow and vasoconstriction in gingival capillaries.¹⁹ Findings in this study indicate association of calculus presence in mouths of smokers, with ages ranging from 21 to 40 years and 41 to 60 years with statistical significance of $p=0.036$ and $p=0.001$ respectively; it is also in concordance with the aforementioned studies.¹⁵⁻¹⁸ Age can be a confounding factor in increasing the severity of calculus deposition especially among smokers.²⁰

Woelber et al. and demonstrated no difference in oral hygiene of smokers vs non-smokers via oral hygiene-related self-efficacy (OHSE) scale.^{21,22} However, smoking is a risk factor for poor periodontal disease and this study revealed the poor oral hygiene among smokers in terms of more participants complaining of frequent bleeding and bleeding after brushing.²²

Moreover, flossing has a positive impact on reducing gingival inflammation and level of plaque. The induction of chemical mineralization inhibitors in toothpastes or mouthwashes help to stop the formation of calculus forming agents by delaying the calcification of plaque which keep the deposits in an amorphous non hardened state so it can be removed with the help of brushing and flossing. It has been found that oral hygiene improving habits were influenced by the habit of smoking. Non-smokers were more conscious about the condition of their hygiene, non-smokers were more frequently brushing their teeth and were more consistent in visiting their dentists for maintaining good oral hygiene. Twice a day brushing and once per day flossing is the recommendation of The American Dental

Association (ADA) in removing the microbial plaque and to prevent gingivitis.

In the present study, age factor and less education were associated with severe calculus deposition. Aging has been studied in depth in periodontal epidemiology and has been demonstrated to be associated with poorer oral hygiene habits, which could account for age related effects.²³ Elderly individuals who need help with brushing have higher level of calculus. In addition, it has been reported that periodontal disease often occurs in elderly individuals with poor health activities and conditions.²⁴

Several limitations should be considered in the results of this study. As this study is conducted in a small population with convenience sampling with a defined age range, information can be more readily gathered in a general health study and reinforce including oral health parameters in such studies. As a result of limited availability of resources (time constraints, hesitance of some people to participate in the survey) these findings may not be representative of the entire population of Karachi. Other possible confounders such as attitude, lifestyle, stress and socio-economic status are not included in this study.

The findings of this research offer a forum for potential studies that can aid in improving oral health and hygiene. The findings of the research would be useful for both the general public and health decision leaders in creating community education campaigns regarding the impact of smoking on overall health as well as oral health. One of the limitation, current study was small size, which makes it difficult to infer the results on target population.

CONCLUSION:

The current study concluded that smoking has significant effect on calculus deposition. Dental examination is an important way in reducing calculus deposition as continuous visits improve the oral hygiene and guide the individual of treatment possibilities and to make on time decisions which ultimately reduces the amount of calculus deposition. Based on the results we can conclude that by taking smoking as a discriminant variable it is proved that calculus deposition is higher in smokers as compared to non-smokers.

Authors Contribution:
Faisal Salim: Topic selection, Data collection, Statistical Analysis, Article Writing
Chander Kumar: Supervisor, Proof reading
Semme Nigar: Data Collection, Article Writing
Sabeen Masood: Data Collection, Article Writing
Muhammad Asif Raz: Article writing, collection of references
Bilal Sarwar: Article writing, collection of references

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