



Relation of Tobacco & Systemic Disease on Oral Health of Patients in DIDC

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Abstract (English)

Dental plaque is a biofilm composed of complex microbial communities. Diabetes Mellitus is a group of disorders in which glucose levels are elevated in the blood, including abnormal metabolism of protein, fat, and carbohydrates (20). The degree and duration of diabetes mellitus (type 1 and type 2) are directly related to oral manifestations. Hypertension is when high blood pressure forces against the artery walls, eventually causing health problems. Cardiovascular diseases are conditions that affect our heart and blood vessels. Cigarettes, smokeless tobacco (betel nut/dry snuff), and other forms influence the oral cavity. People who consume tobacco are at a high risk of developing stains on teeth, dental caries, mobile teeth, and periodontal disease. The objectives of the present study are to determine the association of Tobacco consumption with caries and periodontal diseases, to determine the association of systemic diseases with caries and periodontal diseases, and to determine the association and correlation of frequency of sugar consumption with the number of carious teeth. A cross-sectional study adopting a convenience sampling technique for participant recruitment was employed. 400 adult patients attending the Outpatient Department of Dow International Dental College (chanesar goth) to seek dental treatment over six months. ICDAS, CPITN, and the Plaque index were used in this study. An association has been established between systemic diseases (diabetes mellitus, hypertension, and cardiovascular disease), gingival pocketing, and bleeding gums. The study reported that most participants who consumed tobacco had gingival bleeding issues and pocketing on the anterior and posterior dentitions. Other posterior teeth were reported to be more affected by periodontal disease, and hypertensive patients with diabetes reported gingival issues, including pocket problems, as opposed to those with cardiovascular disease. Further work is still needed to clarify these attributes on a much larger scale and broad social classes, including the upper middle class.

Keywords: Diabetes, Caries, Plaque, Periodontal disease, Gingival pocketing, Sugar

INTRODUCTION:

Dental plaque is a biofilm composed of complex microbial communities (1). The precipitation of minerals from saliva and gingival crevicular fluid converts the plaque on our teeth into calculus (2). Plaque is mineralized into calculus on an average of 10-12 days. Calculus once formed on the tooth surface acts like a protective barrier for bacteria. The bacteria then release an acid that breaks down the enamel, leading to cavity formation and caries (3).

A study in South Africa concluded that caries was affecting 93.7% of the population they assessed. The cause of such results was that dental caries remained neglected in public health policies (4).

Another study in Europe assessed dental caries in adults and senior citizens. Extensive caries were reported at around $\geq 92\%$ in adults (5). One of the causes of caries included the marketing of food and beverages high in sugar and the affordability of such processed foods (6).

Systemic Diseases:

Diabetes Mellitus is a group of disorders in which glucose levels are elevated in the blood, including abnormal metabolism of protein, fat, and carbohydrates (20). The degree and duration of diabetes mellitus (type 1 and type 2) are directly related to oral manifestations. These include xerostomia, dental caries, gingivitis, periodontal disease, and oral candidiasis (9). High blood glucose levels cause an increased level of glucose in the saliva as well. Bacteria found in our oral cavity feed on that glucose and form plaque on our tooth surface, eventually leading to cavities (39).

Hypertension is a condition in which high blood pressure forces against the artery walls, eventually causing health problems (40). Antihypertensive medication cause overgrowth of the gingiva that can make the cleaning of the oral cavity difficult. Food particles accumulate in

gingival pockets that lead to gingivitis, dental caries, and the destruction of the periodontium (41).

Cardiovascular diseases are conditions that affect our heart and blood vessels. The buildup of fatty deposits inside the arteries causes an increased risk of blood clots (42). Due to poor circulation and immune response, bacteria get the opportunity to thrive in the oral cavity leading to periodontal disease, bone loss, and dental cavities (43).

Tobacco:

Another contributive factor to dental caries in the South Asian community is the use of tobacco products, it's also a common cultural habit found in the population. A study in 2016 concluded that smokeless tobacco consumption is estimated to cause over 250,000 deaths worldwide, with an 85% majority occurring in Southeast Asia (13). Cigarettes, smokeless tobacco (betel nut/dry snuff), and other forms influence the oral cavity. People who consume tobacco are at a high risk of developing stains on teeth, dental caries, mobile teeth, periodontal disease, oral cancer, and complications post oral surgery [21]. The DNA in our body gets damaged by chemicals like aromatic amines, aldehydes, and ethylene oxide found in tobacco. They reduce the repairing capacity of our cells. The genetic changes in our cells lead to the development of oral cancer. Squamous Cell Carcinoma is the most common oral cancer [22].

A study conducted on the burden of oral cancer in Asia from 1990 to 2019 shows that South Asia is at the top, with the population of Pakistan and India highly affected by oral cancer. The major contributive factors include alcohol and tobacco usage (14). The prevalence of caries in Pakistan is linked with poor oral hygiene habits, intake of processed diet, tobacco consumption, and low socioeconomic status (15).

Sugar Consumption:

The food we eat contains sugar. It interacts with the bacteria within plaque and produces acid. That acid further causes enamel demineralization. Once enamel demineralization surpasses remineralization, tooth decay starts taking place (44).

Objectives:

1. To determine the association of Tobacco consumption with caries and periodontal diseases
2. To determine the association of systemic diseases with caries and periodontal diseases
3. To determine the association and correlation of frequency of sugar consumption with the number of carious teeth

Selective criteria for Systemic Diseases and Tobacco consumers:

As per diabetes.org.uk WHO recommends following for diagnosing an individual as diabetic [19]:

- 1) A random venous plasma glucose concentration ≥ 11.1 mmol/l or
- 2) A fasting plasma glucose concentration ≥ 7.0 mmol/l (whole blood ≥ 6.1 mmol/l) or
- 3) Two-hour plasma glucose concentration ≥ 11.1 mmol/l two hours after 75g anhydrous glucose in an oral glucose tolerance test (OGTT).

For our study we access:

- 1) Last known fasting glucose value
- 2) A fasting plasma glucose concentration ≥ 7.0 mmol/l will be considered as diabetic
- 3) Tobacco users for at least past 6 months and at least 3 times in a week in any form will be required as active tobacco users.

4) For hypertensive patients, blood pressure consistently measures >130 mmHg systolic and >80 mmHg diastolic and fluctuates every minute during the course of the day.

MATERIALS AND METHODS:

The study consists of comparing the oral health of patients that have medical comorbidities or are tobacco consumers against the oral health of a healthy individual.

A cross-sectional study adopting a convenience sampling technique for participant recruitment was employed. 400 adult patients attending the Outpatient Department of Dow International Dental College (chanesar goth) to seek dental treatment over a period of six months will be recruited for this study. The sample size consists of age groups from 25 to 75. Informed consent had been obtained from people participating in this study and was commenced after obtaining ethical approval from the institution. All patient data was recorded anonymously, but patients in need of treatment were referred to the appropriate units of the dental hospital for management. The methodology was carried out in two parts.

The first part includes a custom-made questionnaire. It was developed with reference from a previous study by the Arusha school health project that assessed the sociodemographic and behavioral correlates of oral hygiene status and oral health-related quality of life (45). It assesses medical history, past dental history, sugar consumption, tobacco consumption and brushing pattern of our participants. Demographic data was also collected which includes, age, gender, ethnicity, city, and district.

Clinical examination was carried out for the second part to assess the oral health status including, caries detection, plaque detection, and gingival health. The examination was carried out using multiple tools/instruments which included an artificial light, mouth mirror, and CPITN (Community Periodontal Index Treatment Needs) probe. The following indexes were used to help with our evaluation,

- 1) ICDAS Index detected and assessed caries [16].
- 2) CPITN index assessed the presence or absence of gingival bleeding on probing, supra or subgingival calculus and periodontal pockets [17].
- 3) Clinical PLAQUE INDEX evaluated the level and rate of plaque formation on tooth surfaces [18].

OPENEPI online software is used for calculating the sample size, the proportion of systemic diseases in the periodontitis patients was 8.6% (39), a sample size of 189 achieves, the margin of error of 4%, power of 80% with a significance level (alpha) of 0.05. As a lower limit is 189 we choose sample size of 400. Among them 10 questionnaires were omitted due to technical errors.

Validity:

Content validity was utilized to establish the validity of the questionnaire of the study. Researchers and colleagues who already had done similar studies and hold a professional degree related to it were approached for this type of validity.

Inclusion & Exclusion criteria:

Patients within the age range of 25-75, male/female, dentate patients, Tobacco consumers, Diabetic patients, Hypertensive patients, Cardiovascular patients, and individuals specifically visiting DIDC OPD were included in our study. Patients with systemic conditions (renal, hepatic, etc.), children, lactating mothers & pregnant women were excluded.

Data Analysis:

The data is analyzed on an (IBM-compatible microcomputer using the SPSS statistical software (25). T Test was used to compare systemic diseases and tobacco with oral health. Sample size is 400 participants. Sample size was calculated after noting sample size of similar study and

noting population size in dental OPD for the duration of the study. Entering these values in online OPENEPI software.

Variables:

Our variables include dependent variables and independent variables. The dependent variables for smoking are duration and frequency. The dependent variables for diabetes mellitus are types of diabetes, when it was diagnosed and last known fasting glucose reading. The dependent variable for hypertension when it was diagnosed and last known reading. The dependent variable for cardiovascular disease when it was diagnosed. Independent variables include age, gender, and ethnicity.

Limitations:

Sample size is limited to patients come in Dow International Dental College OPD Channesar Campus.

RESULTS: The results of the study are tabulated below

Participants oral health associated with tobacco consumption

TABLE 1				Caries present	Caries absent	Total
P= 0.001						
Do you consume Tobacco	Gingival examination		Total			
	Gingival diseases	Healthy Gums				
No	81	220	301	282	19	301
Yes	37	52	89	81	8	89
Total	118	272	390	360	27	390

Table 1 demonstrates absence and presence of gingival disease and caries among participants.

Out of 390 participants those that consume tobacco, 37 had gingival disease and 81 had caries.

Majority of participants having health gums (220) and no caries (282) were those that do not consumed tobacco.

Participants oral health associated with sugar consumption

TABLE 2						
P=0.000						
Numberr of times participants consume sugar	Gingival examination		Total	Caries present	Caries absent	Total
	Gingival diseases	None				
Once daily	56	129	185	174	11	185
Twice daily	34	33	67	63	4	67
Multiple times in a day	4	34	38	34	4	38
2-4 times weekly	13	49	62	57	5	62
5-7 times monthly	11	27	38	35	3	38
Total	118	272	390	363	27	390

Table 2 demonstrates presence and absence of caries and gingival diseases among participants that consumed sugar on daily, weekly and monthly basis. It was observed that Majority of caries was present among those that consumed sugar on daily basis at least once (174) and same group also had most gingival diseases observed (56), although majority of participants had healthy gums (129) also from the same group.

Participant's oral health associated with systemic diseases

TABLE 3						
P=0.001						
Do you have any medical history	Gingival examination		Total	Caries present	Caries absent	Total
	Gingival diseases	None				
Hypertension	19	40	59	53	6	59
Cardiovascular disorders	9	0	9	9	0	9
Diabetes Mellitus Type I controlled	9	13	22	20	2	22
Diabetes Mellitus Type I Uncontrolled	6	0	6	3	3	6
Diabetes Mellitus Type II controlled	10	26	36	34	2	36
Diabetes Mellitus Type II Uncontrolled	10	3	13	13	0	13
None	55	190	245	231	14	245
Total	118	272	390	363	27	390

Table 3 demonstrate caries and gingival disease among patients with systemic illness. It was observed that hypertensive patients had most caries (53) followed by those that have diabetes mellitus type II controlled (34). Although those with no systemic illness contributed to highest number of caries (231) and healthy gums (190)

DISCUSSION:

The study reported many interesting findings. Participants that consumed tobacco most have gingival bleeding issues and pocketing both on the anterior and posterior dentition. Arti Charokar et al in her study stated that tobacco is one of the major causes of periodontal diseases. Gram-negative Bacteria accumulation at the level of subgingival plaque results in gingivitis and pocket formation among tobacco consumers (24). Rumeysa et al in her study further support our results by stating that consumption of tobacco affects the host immune response with respect to gingivitis. Her study reported a drastic increase in GCF levels among tobacco consumers as a result of the inflammatory response (25). Our study also reported posterior teeth to be more affected by periodontal disease. The larger surface area along with ideal conditions for harboring bacteria can contribute to this outcome plus posterior dentition can also have hard-to-reach areas when brushing teeth. Among participants having systemic problems hypertensive and patients with diabetes reported gingival issues including pocket problems as opposed to those that had cardiovascular disease. Our findings are in line with Swetha Ilangovan et al whose study reported diabetes and hypertension as the most common risk factors for gingivitis and other periodontal problems (31). Pathogenicity of microorganisms with an increase in cytokines and mediators of inflammation are responsible for the host-mediated periodontitis (32),(33). Diabetes and periodontitis have a mutual relationship that can affect the outcome of each other. Hyperglycemia causes leukocytes apoptosis and chemotaxis that retains them within the periodontal tissues, hence destroying them. When periodontal collagen is exposed to increase the level of glucose then it results in oxidation and non-enzymatic glycation that alters the physical properties and reduction in solubility of collagen and also causes degradation of connective tissue. (34,35,36,37). Many researchers have reported hypertension patients having increased susceptibility to periodontal problems (38,39). A study states that inflammatory response in periodontal tissues adversely affects the control

and regulation of blood pressure giving us an indication that inflammation can be a common link between hypertension and periodontal diseases (40). The current study reports the number of teeth involved in caries is less among participants that consume sugar once a day. Excessive sugar is known to cause dental caries. N Alosaimi et al states in

their study that the amount of added sugars intake was more consistently and strongly associated with dental caries than the frequency of added sugars intake (41). Thus, the majority of results in the current study have reported outcomes in line with previous research. One thing to note is a reduced number of carious patients in our study can be accounted for due to the majority of the social class that undertook the study. The majority were from low socioeconomic backgrounds and in Pakistan sugar from natural sources such as fruits and vegetables is widely consumed by this class as compared to the middle and higher classes that have increased intake of processed food and sugars such as chocolates that are known to be high-risk factors for dental caries.

CONCLUSION:

The present study has narrowed the gap between periodontal diseases and caries risk factors and association among the local population majorly due to social class and sugar consumption. Further work is still needed to clarify these attributes on a much larger scale and wide social classes including the upper middle class.

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