Research Article

Effect of Tobacco and Betel Nut on Periodontal Health in Diabetics

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Abstract

A hospital-based cross-sectional study was undertaken on diabetic patients aged between 19-79 years during the period of April 2004 to December 2004 in the Department of Pedodontics (Former Preventive and Children Dentistry) Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka and at Diabetic Clinic at Rajshahi district of Bangladesh. The study was conducted to evaluate how tobacco and betel nut along with other study parameters affect periodontal health in diabetics in the context of Bangladesh. The study population included 34 males and 47 females. Based on study results all study subjects brushed their teeth regularly and mostly with paste and brush. However, consistently the periodontal health in the middle sextants displayed better condition than the posterior sextants. From this view it can be presumed that in the middle sextants the pocket formation is not usually common may be because the anterior region (middle sextants) is easy to clean and have more opportunity to catch extra exposure to oxygen in comparison to posterior sextants. The present study also showed an interesting and controversial connection between periodontitis and tobacco and betel nut chewing among targeted diabetic patients. Though little is known about the effects of tobacco and betel nut among diabetics, it is almost well established that tobacco and betel nut are detrimental to oral health even if the individual is not diabetic. Nevertheless, a diabetic individual who use tobacco or chew betel nut or both is at much greater/higher risk factor for the edentulous mouth or in the mouth where less than two or three teeth are present but this study gives a contrast result regarding periodontal health. Present study detected that gum bleeding is totally absent among both the betel nut chewers as well as tobacco users and also they are not insulin dependent whereas most participants of this study who were neither tobacco users nor betel nut chewers were insulin dependent. In this regard, data of the current study indicate that tobacco and betel nut might be potentially helpful to control blood sugar among the diabetic cohort. It is perceived that the betel nut has an antibacterial property and so it can suppress the salivary organisms for prolonged betel nut users. In the ancients period, for treating bleeding gums in Indian medicine betel nut was also used. It might be possible that because of using tobacco blood circulation of gum may be hampered that eventually results in less or no gum bleeding. Therefore, it requires detecting the association between the higher periodontal index with the tobacco using and betel nut chewing habits. Since the sample size in this study was relatively small (81) and not representative, data have to be interpreted with care. Therefore, in order to validate these findings a longitudinal study could be a good option to elucidate this perception more concretely.

Introduction

Nowadays Diabetes Mellitus (DM) is one of the major health problems worldwide the number of which is increasing in every country including Bangladesh. DM is a chronic systemic disease as well as complex metabolic disorder. Since the year 2000, the International Diabetic Federation (IDF) has been assessing the prevalence of diabetes nationally, regionally as well as globally. According to IDF (2017) globally DM affect more than 451 million individuals and the number will rise to 642 million by 2040 [1,2]. So from this viewpoint DM has now touched epidemic status [1,2]. As said by IDF diabetes arises if the pancreas does not produce enough insulin, or the body cannot utilize the insulin properly. Research results published in WHO bulletin in 2013, Bangladesh has more than 10 million of the adult population are diabetics which could be increased to 13.6 million in 2040. In Bangladesh almost half of the population with diabetes (51.2%) remains undiagnosed [3].

It is well established that if diabetes is accompanied for a long-term, various complications will develop especially when it is uncontrolled or unstable. Thus, diabetes not only affects the quality of life also cuts the length of life. Previously it was assumed that there were five "classic" complications, such as Diabetic Retinopathy, Diabetic Neuropathy, Diabetic Nephropathy, Atherosclerosis (such as microangiopathy, microvascular disease) and Delayed or impaired wound healing. Later on, in 1993, Loe H has been stated that Periodontitis (PD) is the 'sixth' major complication of diabetes [4].

Periodontitis is an inflammation of periodontal ligaments in which tissues and bone structure around the teeth are affected. It frequently

happens due to improper oral hygiene practices. Periodontitis can be very painful and destructive if it is not diagnosed & treated [5]. Diabetes Mellitus shows noticeable susceptibility to infection. The oral cavity is one of the most infection-prone areas and in a diabetic person, infection occurs more than a non-diabetic person. This is again more appropriate and significant for the periodontal tissue because of its nonstop exposure to the food material. The food particles deposited as a film of dental plaque around the tooth and inhabited by the bacteria. The gingival reactions against bacterial plaques are exaggerated more in diabetics. In due course, the periodontal disease tends to develop with increased severity even at an earlier age than in the non-diabetic patient. Therefore, it has been well established that chronic periodontitis can be developed as a secondary disease to diabetes, both type 1 and 2 and vice-versa. As diabetes influences multiple host defense as well as repair mechanisms, the integrity of periodontal tissues is changed by altering the collagen metabolism and phagocytic cell function [6]. As collagen metabolism is defective in diabetics and the periodontal ligament is composed mostly of collagen tissue, the periodontal tissue is more vulnerable to destruction especially when diabetes is not well controlled [7].

Since periodontitis is caused by bacteria in the sub-gingival biofilm previously it was thought that PD is a localized infection (except in the case of some syndromes and untreated odontogenic abscess). But as in severe stages of PD due to the breakdown of the periodontal apparatus, a unique opportunity is created for these oral causative pathogens and their products to get entree to the systemic circulation. So PD extends beyond the local stage and produces systemic effects. Periodontitis is, therefore, more than just a localized oral infection [8-10]. Again in response to periodontal bacteria and bacterial products, serum concentrations of pro-inflammatory biomarkers become higher which in turns results generation of cytokines locally. Due to the production of inflammatory cytokines, systemic inflammation takes place by the influence of the inflamed periodontal tissue. Likewise, the presence of any infection, especially the periodontitis may exaggerate the diabetic symptoms as it contributes to the difficulty in insulin regulation by worsening insulin resistance syndrome (similar to that detected in diabetes) [5,7,11,]. Then start damaging of pancreatic beta-cells and promote diabetes. Recent abundant scientific epidemiological evidence points to a vicious cycle of diabetes and periodontitis deteriorating each other [10,12,13]. Therefore, Diabetes and Periodontitis have a bidirectional relationship.

In Bangladesh, plaque-induced periodontitis is the most common oral health problem due to improper maintenance of oral hygiene which even worse in diabetics. So, periodontitis inflicts an enormous load in preventable measures and has a huge financial implication. It is thus reasonable to an emphasis on preventive dental hygiene program which is especially vital for the patient with diabetes mellitus to promote the needful message to the appropriate individual timely [11].

To do this successfully, it is important to find out the factors that have confounding effects on the development of periodontitis among diabetics especially in the context of Bangladesh in terms of food habits, lifestyle and so on.

The current study provided the opportunity to re-assess the role of tobacco, betel nuts, educational status, socioeconomic status, family history, and blood sugar maintenance method among diabetics. To carry out the study efficiently, it is important to know the strength of the association between the periodontal health status of diabetics with different study parameters using as variables in the study. The main aim of the study was to reform and set up new hygienic services upon identification of the risk factors in Bangladesh perspective.

The objectives of the study were to assess the association between periodontitis and tobacco users as well as betel nut chewers in presence of several social factors, lifestyle and clinical reasons among diabetic cohorts. Assessment of the effect of tobacco, betel nut, blood sugar maintenance, education, socio-economic status responsible for the development of periodontitis, was performed. To achieve the target of the study the investigator needs to comprehend the vital role of variables (using in this study) efficiently. Thus, the findings of the study might be helpful in shaping as well as setting a suitable health education policies and program. So that it might be possible to prevent and control of periodontitis amongst diabetics by providing an integrated approach that could be cost-effective in addition to combat the patient's sufferings.

Thus, the study would help to promote and ensure better periodontal health care for those living with diabetes through advocacy, awareness creation and education considering the contributory factors.

Materials and Methods
A cross-sectional analytical study was conducted from April 2004 to December 2004 amongst 81 diabetic patients visited the outpatient departments of the two public hospitals for seeking treatment of periodontitis. The study was conducted in the Preventive and Children Dentistry Department, Faculty of Dentistry of BSMMU and at Diabetic Clinic at Rajshahi district. A total of 81 patients who attended the clinics during the study period were included in the study.

Sampling Procedure: Purposive
A total of 81 individuals were selected according to the availability who attended the selected clinics (study sites) during the study period and fulfill the purposes of the study.

Inclusion Criteria
Ages above 18 years who have at least 6 natural teeth in their mouth excluding third molars were included in the study. 9 patients were excluded from the study for not meeting the study criteria.

Exclusion Criteria
The patient below the age of 19 years were excluded from the study because of the possibility of false pocket. All third molars were also excluded from the study for the same reason.

Data Collection Procedure: Interview
All subjects were interviewed using a standard self-administered semi-structured questionnaire to obtain socio-demographic information as well as to collect information regarding diabetes treatment status, betel nut and tobacco consumption habits in the study sample. The questionnaires were answered in the same appointment day with the clinical examination.

Data Collection: Clinical Examination Technique
The clinical examinations were carried out by 2 trained and skilled

examiners, in the two spots: Preventive and Children Dentistry Department, BSMMU, Dhaka, Bangladesh and Diabetic clinic, Rajshahi, Bangladesh.

Clinical Examination
The assessment of the periodontal status was carried out using the plain mouth mirror, sterile gloves and masks and periodontal probe (CPITN-probe) designed by World Health Organization (WHO) according to the Community Periodontal Index Treatment Need (CPITN index). CPITN-probe is like a tiny ruler with a black band between 3.5 and 5.5 mm with a 0.5 mm diameter rounded tip. All clinical examination was performed maintaining the usual infection control protocol. The probe was gently (not more than 20 G-force) inserted into pockets around teeth that determine the severity of disease [8]. Deeper the pocket indicates severe the disease.

All clinical parameters were documented with calibration at regular intervals, using standardized criteria and techniques. Thus the whole methodology follows the WHO criteria where 81 patients were examined.

Validity and Reliability
Randomly 10% of the intra-examiner and inter-examiner reliability were assessed by repeating the clinical examinations after every 2 weeks consistently through the study period.

CPITN Examination System
According to the CPITN system, the mouth was divided into 6 divisions, each division is called sextant:
1. Upper right posterior
2. Upper anterior or middle
3. Upper left posterior
4. Lower left posterior
5. Lower anterior or middle and
6. Lower right posterior

Coding System
The codes were arranged in sequence from 0 to score 5 where they represent: 0 = healthy, 1 = gum bleeding on gentle probing, 2 = Calculus and plaque retentive factors, 3 = 4-5mm pocket, 4 = 6mm or deeper pocket and 5 = a sextant with less than two teeth (indicating tooth loss in dentate persons).

The highest score of every sextant was recorded as the score for that particular sextant. If in one sextant the highest score was detected in one tooth then no need to examine the remaining teeth, just can be recorded the highest score [8].

Data Analyses
The collected data were entered and processed using SPSS version 16 statistical program.

Results
Table 1: Distribution of sex among participants (n=81)

Sex	The Frequency	Percent	Cumulative Percent
Male	34	42.0	42.0
Female	47	58.0	100.0
Total	81	100.0	

Table 1 shows the total number of participants were 81 where 34 (42%) were male and 47 (58%) were female. The age ranges were from 19 to 79, where the mean age was 48.62 years, the mode was 50 years and the median age was also 50.

Table 2: Literacy among the participants (n=81)

Reading Status		
	Frequency	Percent
Yes	67	82.7
No	14	17.3
Total	81	100

Table 2 shows: 82.7% (62) were literate and the rest 17.3% (14) were illiterate.

Among all study population, most people 57% (46) were clean their teeth by toothbrush and paste which was highest in graduate (14%) population and lowest in primary school level people (3%). 17.3% (14) use coal which surprisingly constituted the 2nd highest position. Among the illiterate group, 33% were using the brush and 11% used coal. In every sextant, the graduate group showed the best oral health and the people of 11 and 12-grade level showed the worst oral health.

According to the patient's statement the study findings express that all participants clean their teeth regularly though there is a possibility of over-reporting. To get more valid data regarding regular tooth cleaning participant observation could do which was not done in this study. However, all are not clean their mouth before going to bed at night.

Table 3: Bedtime tooth cleaning among study population (n=81)

Bedtime Cleaning Practice (n=81)					
Sex	Frequency of 'Yes'	Percentage of 'Yes' (%)	Frequency of 'No'	Percentage of 'No' (%)	Total
Male	17	50	17	50	34
Female	27	57.4	20	42.6	47
Total	44	54.3	37	44.7	81

Table 4: Bedtime tooth cleaning by literacy

Cleaning before bed			Reading status		Total
			Yes	No	
Yes	Sex	Male	15	2	17
		Female	24	3	27
	Total		39 (60%)	5(31.3)	44 (54.3%)
No	Sex	Male	14	3	17
		Female	12	8	20
	Total		26 (40%)	11(68.7%)	37 (45.7%)
	Total		65 (100%)	16 (100%)	81 (100)

Table 4 shows that amongst all participants 54.3% clean their teeth at bedtime. Again among the literate persons more than 60% clean their mouth at bedtime and the rest (40%) were not but it is noticeable that among the illiterate persons only 31.3% participants cleaned their mouth at bedtime and 68.7% were not. So obviously education has some positive impact on hygiene maintenance.
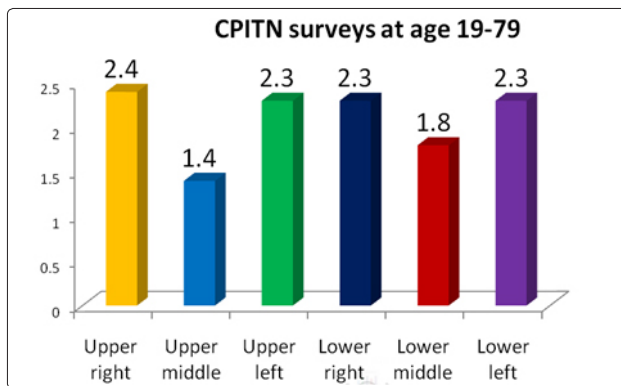

Figure 1: Mean number of scores in different sextants

The mean numbers of the score by sextants are presented in figure 1. Among the six sextants, the middle sextants (both upper = 1.4, lower = 1.8) had better condition than all other sextants. And between the two middle sextants, the upper middle region was better than the lower one.

The reason behind this score maybe it is more difficult for the individual to clean the mouth in the posterior sextants (both right and left region) in comparison to the middle sextant. Again upper middle sextant is easier to clean than the lower middle sextant.
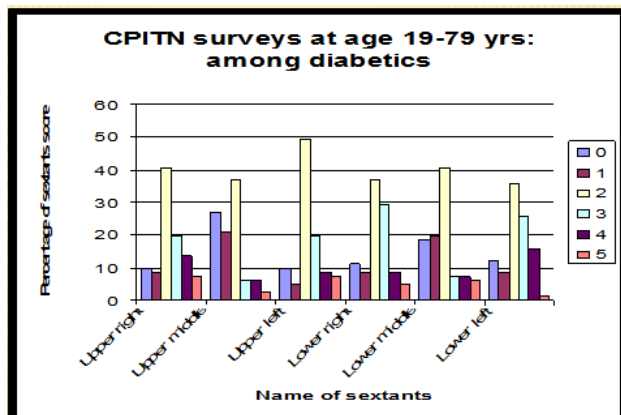

Figure 2: Percentage of different scores in different sextants

The mean number of scores in each sextant representing: healthy (0 = healthy = blue) according to CPITN criteria, which were very low in this surveys (Figure 2). Calculus was a noticeable feature found in this study which shows the highest score (2 = calculus = cream color) consistently in all sextants and missing teeth jaw was the least score (5 = pink = missing teeth).
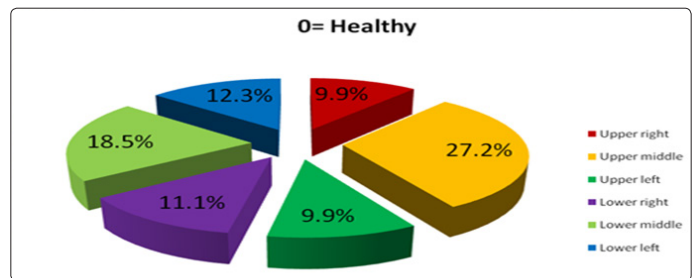

Figure 3: CPITN surveys at age 19-79 years: percentage of healthy gingivae in different sextants

Figure 3 shows what percentage of healthy gingivae where the healthiest gingiva was found in the upper middle sextant (27.2%). Lower middle sextant (18.5%) was also displaying the next better condition than that of other sextants.

In healthy periodontium, the depth of the periodontal pockets measure less than 3 millimeters and on x-rays, no bone loss appears, (though this study did not take any radiograph). Gums are sharply attached against the teeth with pink tips.
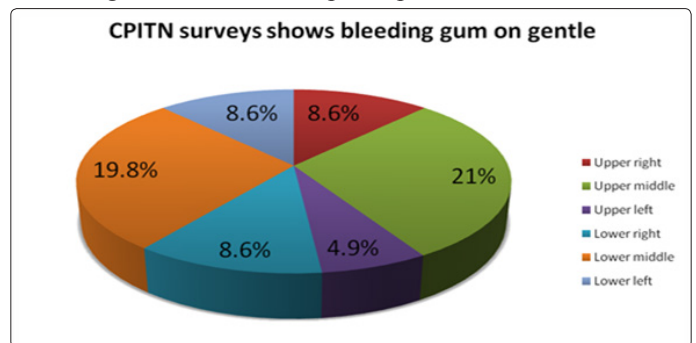

Figure 4: Percentage of sextants in terms of gum bleeding

Figure 4 viewing the score of bleeding gum on gentle probing which was higher both in upper (21%) and lower (19.8) middle sextants.
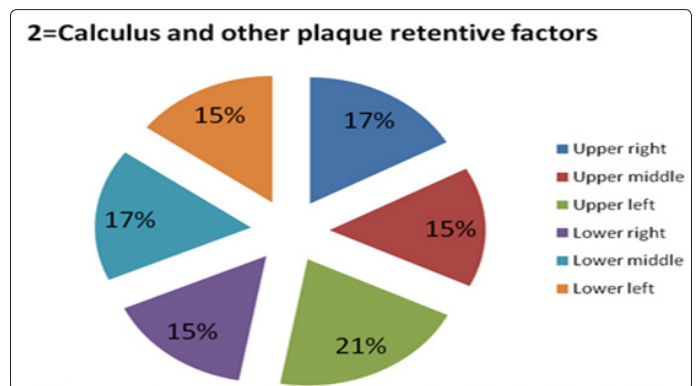

Figure 5: Observed calculus condition measured by CPITN at age 19-79 years

It is visible that calculus deposition is more or less common in all the sextants but gum bleeding was more common in both upper and lower middle sextants.
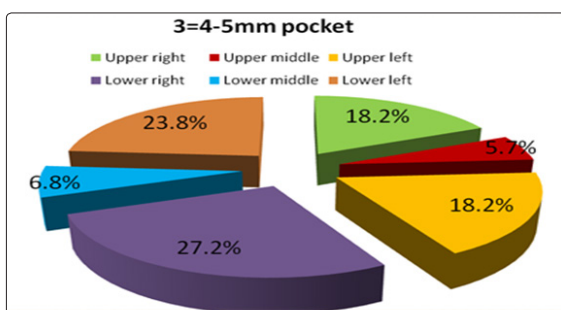
Figure 6: Shows 4-5mm pocket in different sextants by CPITN index

Figure 6 presenting 4-5 mm pocket, which was highest in the lower posterior sextants (almost both in right = 27.2% and left = 23.8%), whereas in the middle sextants both in the upper (5.7%) and lower (6.8%) regions were found lowest scores.

The depth of Gingival pocket is the indicator of gum disease status. If the pocket measures more than 3 millimeters to 5 millimeters it designates the sign of disease.

Here, both in right and left lower posterior sextants represents the worse situation. The reason might be like the lower jaw is a dependent part of the mouth due to gravitation more foods accumulation occurs than the upper sextant. Anterior or middle sextants are consistently showing the better condition - may be as these sextants are more exposed to oxygen and also easy to clean both naturally as well as manually.
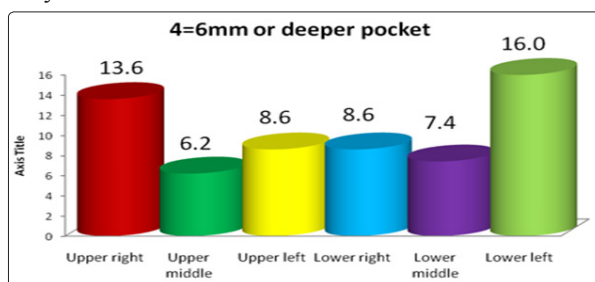

Figure 7: The worse condition of periodontium (6mm or deeper)

Figure 7 viewing 6 mm or deeper pocket of different sextants that indicate a serious condition.

In this figure, the upper right and lower left posterior sextants displaying the worst state than any other sextant. Again it has been apparent that the upper middle sextant consistently shows the best health state in relation to lower middle one as well as the other else.
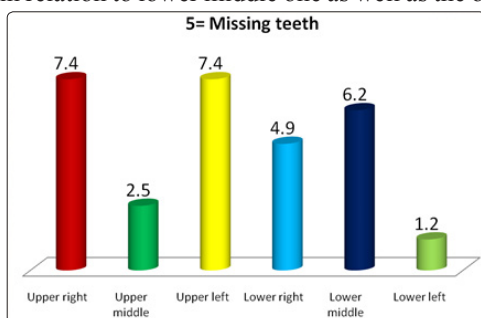

Figure 8: Frequency of missing teeth in different sextants
Figure 8 indicates a sextant contain less than 2 teeth in the jaw.

According to the figure 8, the least number of teeth were present in both upper right (7.4) and in upper left (7.4) sextants and the next least number of teeth were present in lower middle sextant (6.4). While in lower left sextant (1.2) the highest numbers of teeth were present. It can be presumed that as in the upper posterior regions as well as in the lower anterior region the salivary ducts open so it might be possible in those areas calculus deposition is more in comparison to other sextants. As we know that in this study all the individuals were diabetics and so more vulnerable to develop periodontitis in comparison to non-diabetics.

Table 5: Distribution of betel nut chewers and tobacco users (n=81)

		Betel Nut Chewer		
		Yes	No	Total
Tobacco User	Yes	10(12.3%)	10(12.3%)	20(25%)
	No	18(22.3%)	43(53.1%)	61(75%)
	Total	28(34.6%)	53(65.4%)	81

Table 5 shows the distribution of betel nut chewers (34.6%) and tobacco users (25%) among the diabetic cohort. In this study sample the numbers of betel nut chewers were more than the number of tobacco consumers. Among the study population 34.6% (28) participants were betel nut chewers 65.4% (53) were not betel nut chewer. 25% (20) are tobacco users and 75% (61) were not. Again, among all participants 12.3% (10) were both tobacco and betel nut users and 53.1% (43) neither tobacco and nor betel nut chewers. 10 (12.3%) were only tobacco users and 18 (22.3%) were only betel nut chewer. Among all 25% (20) tobacco users including smokeless tobacco 9 were male and 11 were female.

Table 6: Status of diabetes by gender (n=81)

	Gender		
Control Diabetes	Male	Female	Total
Yes	29(36%)	38(47%)	67(83%)
No	5	9	14(17%)
Total	34	47	81(100%)

Table 6 shows that approximately 83% (67) of participants were concerned about controlling their diabetes (36% were male and 47% were female) while 17% participants were not serious to control their diabetes.

Table 7: Different ways of blood sugar maintenance (n=81)

Blood Sugar Maintenance Status	Frequency	Percent (%)
0= Nothing	2	2.5
1= Insulin	15	18.5
2= Tablet	21	25.9
3= Diet	2	2.5
4= Exercise	1	1.2
5= Combination	40	49.4
Total	81	100.0

According to table 7 to control blood sugar level, the most study participants 49.4% (40) used the combination therapy (tablet +diet +exercise). The percentage of insulin users were 18.5% (15).

Table 8: Distribution of betel nut chewers among insulin users

Betel nut chewers (n=28)				
		Yes	**No**	**Total**
Insulin Users	Yes	4(14%)	11	15(19%)
	No	24(86%)	42	66
		28(35%)	53	81

Among the betel nut chewers, 14% participants were insulin users whereas a large percentage of betel nut chewers (86%) were not insulin users. And among the study sample 35% were betel nut chewer and 19% were insulin users.

Table 9: Distribution of tobacco consumers among insulin users

Tobacco Consumers (20)				
		Yes	No	Total
Insulin Users	Yes	1(5%)	14	15(19%)
	No	19(95%)	47	66
		20(25%)	61	81

Among the study sample, 25% were tobacco users and 19% were insulin users. Among the tobacco consumers, 5% participants were insulin users while 95% were not insulin users.

Table 10: Distribution of different categories CPITN scores among the betel nut chewers and non-chewers

n=81			
	Betel nut chewers	Betel nut non-chewers	Total
Gum Bleeding	0 (0%)	7(9%)	7(9%)
Calculus	7(9%)	28(35%)	35(43.2%)
Pocket (Moderate to severe)	8(10%)	13(16%)	21(25%)
Less Teeth	13(16%)	5(6%)	18(22.2%)
Total	28(35%)	53(65%)	81(100%)

Among the betel nut consumers according to the CPITN score 0% participants had no gum bleeding whereas 9% had calculus, 10% had the pocket from moderate to severe depth and 16% showed fewer number of teeth in the mouth. Here, it is noticeable that all betel chewers scored far fewer than the scores of the non-betel nut chewers except in case of fewer number teeth present in the mouth where the percentage of betel nut chewers were higher (16%) in comparison to non-betel nut chewers (6%). So betel nut chewers showing better score in all stages of the periodontal condition.

Discussion

Though little is known about the effects of tobacco and betel nut especially betel nut among diabetics, it is almost well established that tobacco and betel nut are harmful to oral health even for people without diabetes. However, a person with diabetes who use tobacco or who is a betel nut chewer or both, are at much greater risk for periodontal disease than a person without diabetes.

According to WHO, at present smoking is the major avoidable cause of premature death worldwide causing numerous life-threatening systemic diseases and also appearance of the various oral-dental diseases especially periodontitis. Even though abundant previous evidence supported the role of tobacco and betel nut as a potent risk factor for the periodontal health but this study gives a contrast result regarding the role of betel nut and tobacco on periodontal health. Present study detected that gum bleeding was totally absent among both the betel nut as well as tobacco consumers. Again, calculus score was remarkably higher among the non-betel nut and non-tobacco consumers than those of betel nut chewers and tobacco users. As it can be assumed that among the diabetics whose blood sugar level is higher require insulin to control blood sugar in this study it was also visible that the persons who were tobacco users as well as betel nut chewers except only very few they were not insulin-users. Does this result indicate that betel nut and the tobacco has any association to reduce blood sugar! Moreover, from the traditional idea some groups of people believe that betel nut has an antibacterial property and it can suppress the salivary organisms for prolonged betel nut users. In ancient period, for treating bleeding gum in Indian medicine betel nut was also used [14]. However, according to data of the current study, it can be assumed that tobacco and betel nut might have any helpful roles in controlling blood sugar level but as the study sample was so small it could not be said so concretely. Further study could be conducted by using a power sample. Inflammation is beneficial to defense the host against the bacterial contest, but persistent and/or abundant inflammation causes tissue destruction. At present periodontal disease is measured as a non-resolving chronic inflammation, originated and extended by the sub-gingival bacteria, ultimately terminated to the tissue damage that can be diagnosed as periodontitis. The present study results reflect that betel nut and tobacco might have an anti-inflammatory property because in this study in CPITN score no gum bleeding was found among both betel nut and tobacco consumers. From this context, we can generate a new hypothesis although the present study used a convenient sample which could provide a different picture from the real scenario.

Conclusion

Since periodontitis makes an enormous burden in preventable actions that lead to a huge financial consequence, a new hypothesis regarding this topic could be invited focusing mainly on preventive measures as well as cost-effectiveness. As the sample size in this study was relatively small (81) and not representative, data have to be interpreted with care. Therefore, in order to validate these findings a longitudinal study could be a good option to illuminate the acquired study outcomes more concretely [15-19].

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