Effect of tobacco on periodontal health of adult population of Lucknow city

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Abstract

Introduction: The use of tobacco is a significant global cause of death and a risk factor for human health that can be reduced. In adults all over the world, periodontal disease is quite prevalent, especially in its mild and moderate forms, and it has a number of detrimental health repercussions. Tobacco is a major risk factor affecting the periodontium. Hence this study was undertaken to assess the effect of tobacco either in smoking, chewing form or a combination on periodontal disease parameters of adults in Lucknow. **Materials and methods:** A cross sectional study was conducted on 600 subjects, 200 smoking tobacco users, 200 chewing tobacco users and 200 combinations. Informed consent of all participants was obtained after explaining the purpose of the study. A single examiner conducted the examination, who was priorly calibrated for recording of all indices and bone loss measurements. Clinical parameters to evaluate severity of periodontal disease included Oral hygiene Index - simplified, Gingival Index, Community periodontal Index of treatment needs and Clinical Attachment loss. One-way analysis of variance (ANOVA), and Tukey's *post hoc* analysis was run to find significant differences between smokers, chewers and combination users for all parameters evaluated. **Results:** Cigarette was the most commonly smoked tobacco while Khaini the most commonly chewed tobacco. Gingival index was noted majorly in combination group (1.8925 $\pm$ .12354), followed by chewers and smokers which was statistically significant at p=0.000. The highest mean score for CPI was noted in the combination group with a mean of 2.6150 $\pm$ 1.12834. Smokers had a mean CAL of 1.3150 $\pm$ .59797, chewers had 1.4300 $\pm$ .64590 and combination habit users had 1.4800 $\pm$ .67964 . Periodontitis was noted in 24.5% of the smokers, 39.5% of chewing tobacco users and 50.5% in combination group Thus, it can be noted in combination group. An overall prevalence of 41.5% was observed for periodontitis. **Conclusion:** Tobacco consumption is associated with periodontal disease parameters. The authors strongly recommend a prospective cohort study of tobacco habits and its relation with periodontal disease in future research.

Keywords: smoking, chewing tobacco, gingival index, periodontal index, loss of attachment, periodontium.

Introduction:

The epidemic of tobacco use is one of the largest threats to global health right now. Smoking directly causes almost five million deaths worldwide each year, making it the biggest preventable cause of mortality. With a percentage of deaths attributable to tobacco reaching 12% for men and 1% for women, India has a mortality rate from tobacco use of 206 per 100,000 males and 13 per 100,000 women over the age of 30.[1]

Tobacco is the only product that may be eaten, smoked, sucked, or sniffed and is dangerous to the general public when used as intended. Smoking, chewing smokeless tobacco, and combining tobacco with betel nuts are just a few oral tobacco usage options. The prevalence of smoking among men ranges from 15% to over 50%, according to the limited reports on tobacco use in different population groups.[2] The majority of tobacco smokers reside in cities, but smokeless tobacco is more common in rural and some suburban areas. The region with the highest use of smokeless tobacco is South East Asia.

One of the most common reasons for tooth loss, particularly in older people, is periodontal disease. Even while local, genetic, systemic, and environmental factors have a significant influence in defining an individual's vulnerability to periodontal illnesses, dental plaque-associated microbes are the principal causative agents of periodontal diseases. One of the most significant environmental risk factors for periodontal disorders is tobacco use.

One of the most significant environmental risk factors for periodontal disorders is tobacco use. Unlike smoking, the role of oral smokeless tobacco (SLT) in the etiology of periodontal disease has received considerably less attention. Although traditionally, oral SLT consumption has been associated with oral malignant and potentially malignant lesions, emerging data suggest that these habits may be associated with poor periodontal health also. Besides some case reports mentioning periodontal changes associated with oral SLT habits [7], initial studies conducted in the US have shown that oral SLT habits are associated with increased incidence of gingival recession.[3]

Tobacco consumption has a significant impact on the immune system's defensive reaction, and the neutrophil is a crucial part of the host response. It is crucial for both oxidative and nonoxidative killing processes as well as chemotaxis and phagocytosis. Neutrophils taken from smokers' mouths or those exposed to nicotine in a lab setting have demonstrated to exhibit functional changes in chemotaxis, phagocytosis, and oxidative burst. By preventing neutrophils from releasing reactive oxygen species (ROS), which causes oxidative stress-mediated tissue damage, nicotine hinders the removal of periodontal infections.

Though several studies exist about the relationship of smoking and chewing tobacco to periodontal disease separately, literature on correlation between the two tobacco habits is scarce. Hence the present study was undertaken to answer the research question " What is the effect of smoking and chewing tobacco on periodontal health of adult population residing in Lucknow city?"

Materials and methods:

A cross sectional study was conducted on individuals with tobacco habits. The study was approved by the Institutional Ethical Committee of Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow and Informed Consent was obtained from all the participants as per the guidelines of World Medical Association declaration of Helsinki.

A written voluntary informed consent was then obtained from the subjects in a separate consent form prepared in English and Hindi. The study was conducted in the

area marked under the jurisdiction of Lucknow city.

Based on the prevalence obtained from the study of Vaishnavi Devi. B and L. Leelavathi et al.[4] who reported 15% of smokers and 12% of smokeless tobacco users with severe gingivitis, the sample used in the present study was 195.84 for smokers rounded off to 196 and 162.2 rounded off to 162 in the chewing tobacco users. Sample size formula used is,

$$N = \frac{Z^2 P (1- P)}{d^2}$$

But considering 10% of the population loss because of incomplete information, another 10% was added to this making the final sample size to be (196+19) + (162+16) = 393, which was for convenience rounded off to 400. A third group, constituted of a combination of those with both smoking and smokeless tobacco habit was also recruited. Three groups were assessed. Group A (n=200): Subjects with smoking tobacco habit; Group B (n=200): Subjects with smokeless or chewing tobacco habit and Group C (n=200): Subjects with a combination of both smoking and chewing tobacco habit. "Multistage cluster sampling" was employed to arrive the sample size of 400.

Inclusion criteria for the study was patients aged between 20 to 70 years, of both gender, presence of at least 20 sound teeth, teeth remaining were periodontally untreated and subjects free of any systemic illness. Chronically alcoholic patients, individuals reporting any systemic illness, presence of any periodontal abscess, necrotizing ulcerative gingivitis, patients who had any previous periodontal treatment, subjects on medications such as anti-inflammatory and antibiotics were excluded.

Data collection was done in two parts . A structured proforma was filled out to include details of demographic information and Tobacco usage after a standardised interview. Tobacco usage was determined by the form in which it was used, frequency of usage, daily consumption (packets used daily) and how many years they have been using tobacco. Clinical examination for Periodontal disease was evaluated based on Gingival Index, Oral hygiene index – simplified, Community periodontal Index and Loss of attachment.

Measurement of Periodontitis: Patients with periodontal pockets in two or more interproximal sites with a clinical attachment level of ≥3 mm, in two or more interproximal sites with a PD ≥4 mm (for different teeth), or in one site with a PD ≥5 mm were diagnosed as having periodontitis.

Statistical Package for the Social Sciences was used to statistically analyse the collected data (SPSS Version 25; Chicago Inc., IL, USA). To ascertain whether the data were normally distributed, Shapiro Wilk tests were run. The mean values, numbers, percentages, and standard deviation were used to compare the variables. To determine the difference in CPI between groups, the chi square test was utilised. The ANOVA test was used to compare the means for various readings for the groups for the gingival index and the simplified oral hygiene index. P value of

0.05 or less was regarded as statistically significant.

Results:

A total of 600 subjects with the habit of tobacco consumption was evaluated for the presence and severity of periodontitis. 200 sample each in smoking tobacco, chewing tobacco and a combination of both were included.

Subjects were divided into five groups. 28.6% were in 20 – 30 years, 39.6% in 31 – 40 years, 20.6% in 41 – 50 years, 6.3% in 51 -60 years and 5.3% above 60 years. A clear male predominance was noted in all three groups , but was more pronounced with 89.0% in smokers, 62% in chewing tobacco users and combination habit addicts with 83.0%. Chewing tobacco was more prevalent in the females as compared to the other two groups. Cigarette was the most predominantly smoked in both smokers (67.5 %) and combination (70.5%) group. Bidis were consumed in 31.5% of smokers and 29.5% of combination users. Khaini was the most commonly used chewing tobacco among chewers with 41% and 45% among combination users. Paan was the next prevalent smokeless tobacco habit. Table 1 shows the duration of habits among the respondents.

Table 1: Duration of the habit among study population

Group N (%)	**Smokers N(%)**	**Chewers N(%)**	**Combination N(%)**
0 – 5 years	55 (27.5)	63 (31.5)	59 (29.5)
6 – 10 years	67 (33.5)	48 (24.0)	57 (28.5)
11 – 15 years	46 (23.0)	32 (16.0)	46 (23.0)
16 – 20 years	18 (9.0)	21 (10.5)	19 (9.5)
>20 years	14 (7.0)	36 (18.0)	19 (9.5)

Table 2: Distribution of OHI- S among study population

Group	**N**	**Mean**	**S.D**	**Std. Error**
Smokers	200	3.6116	.32269	.02282
Chewers	200	2.9834	.11026	.00780
Combination	200	4.1239	.33953	.02401
ANOVA statistic	845.412			
df	2			
P value	0.000*			

*=Significant; NS=Not Significant Combination group (Smokers + Chewers) exhibited the highest mean scores of 4.1239 + .33953 suggesting poor oral hygiene index status, followed by smokers with a mean of 3.6116 ± .32269 and chewing tobacco users with a mean of 2.9834 + .11026, which was statistically significant at p=0.000. (Table 2)

Table 3: Distribution of Gingival Index among study population

Group	N	Mean	S.D	Std. Error
Smokers	200	1.4744	.06921	.00489
Chewers	200	1.7110	.08130	.00575
Combination	200	1.8925	.12354	.00874
ANOVA statistic	988.874			
df	2			
P value	0.000*			

*=Significant; NS=Not Significant

The mean Gingival Index of Smokers was 1.4744 ± .06921, chewers was 1.7110 ± .08130 and combination users was 1.8925 ± .12354. All three groups had moderate level of gingivitis. The highest was noted in combination group, followed by chewers and smokers which was statistically significant at p=0.000. (Table 3)

Table 4: Distribution of Community Periodontal Index among study population

Group	N	Mean	S.D	Std. Error
Smokers	200	2.0900	.99844	.07060
Chewers	200	2.1750	1.13172	.08002
Combination	200	2.6150	1.12834	.07979
ANOVA statistic	13.418			
Df	2			
P value	0.000*			

*=Significant; NS=Not Significant

Community Periodontal Index among study population is summarised in Table 4. The highest mean score was noted in the combination group with a mean of 2.6150 ± 1.12834, followed by chewing tobacco users at 2.1750 ± 1.13172 and smokers at 2.0900 ± .99844, which was statistically significant at p =0.000.

Prevalence of Periodontitis:

Based on criteria set, periodontitis was noted in 24.5% of the smokers, 39.5% of chewing tobacco users and 50.5% in combination group (Combining CPI codes of Code 3 and Code 4 together). Thus, it can be noted that combination group demonstrated greater prevalence followed by chewing tobacco and smokers.

Discussion:

The current study was conducted to analyse the periodontal parameters among 600 tobacco users. Clinical parameters such as the gingival index, plaque index, oral hygiene index simplified and community periodontal index, loss of attachment were assessed for both smokers and smokeless tobacco users. Unknown is the exact method by which tobacco use affects the periodontal tissues. In order to promote higher bone resorption and tissue destruction, tobacco components can induce the production of proinflammatory cytokines such interleukin (IL)-1, IL-6, IL-8, tumour necrosis factor, and transforming growth factor.

In the current study, men clearly dominated, accounting for 89.0% of smokers, 62.0% of chewers, and 83.0% of combination smokers. This result is consistent with those of other research where males were more likely to smoke. The concentration of economic power in the hands of men, as well as their propensity for stress circumstances and the belief that tobacco smoking makes them more resilient to stress, have all been linked to the higher incidence of use among men.

The present study findings reported majority (39.6%) in the age range of 31 – 40 years followed by 20 – 30 years, suggesting the younger generation addiction to tobacco. Age has been found to be an important determinant of tobacco use in earlier studies such as Singh and Ladusingh[5] and Jha et al[6]. The study of Vaishnavi B et al[4] and Li et al[7] showed a higher preference among the age group of 36 to 50 years in smokers and smokeless tobacco users.

Cigarette was the most commonly used smoking tobacco in 67.5% of the smoking population followed by bidis in 31.5% and chutta in 1.0%. This was in concordance with the study of Vaishanavi B et al who reported smoking tobacco preferred by the smokers were cigarette in 68% beedi in 24% and chutta in 8%. This finding is similar to the one reported in a study in Delhi.[8]

Smokeless tobacco users reported a higher usage of khaini in 41.0%. The study differed slightly with the research of Vaishnavi B et al who reported an usage of pan in 44% of their study population followed by Gutkha in 36%. Similarly the usage of paan was higher among the reported smokeless tobacco users which is in accordance with few previous studies.[8]

Gingival Index in the smoking exclusively population was 1.4744 $\pm$ .06921, chewers was 1.7110 $\pm$ .08130 and combination users was 1.8925 $\pm$ .12354, which was statistically significant at p=0.000, suggesting that bleeding was lesser in the smokers. This can be attributed to the fact that tobacco users have decreased blood flow to the tissues of periodontium, which may manifest clinically as reduced bleeding on probing.[9] Smoking tobacco users have reduced bleeding when compared to the general population. This can be attributed to the fact that tobacco users have decreased

blood flow to the tissues of periodontium, which may manifest clinically as reduced bleeding on probing. Smoking also causes immuno-inflammatory imbalances resulting in increased oxidative stress in the body. The latter hastens the inflammation process, which increases the susceptibility to infections and dental caries. Though smoking alters the vascular function, neutrophil, monocytes count, cytokines and inflammatory mediators, the gingival inflammation can be reduced with plaque removal. It also destroys the surrounding microflora leading to decreased human immune response causing dental caries and alveolar bone damage thereby affecting periodontium.

Oral hygiene was measured using Oral hygiene index- simplified as given by John C Greene and Jack R Vermillion. Combination group (Smokers + Chewers) exhibited the highest mean scores of 4.1239 + .33953 suggesting poor oral hygiene, followed by smokers with a mean of 3.6116 $\pm$ .32269 and chewing tobacco users with a mean of 2.9834 + .11026, which was statistically significant at p=0.000.The study of Abdul Ahad et al also reported similar findings with combination group having a mean of 4.0±13.4 followed by smokers with a score of 3.37 $\pm$ 0.91 and least in chewers. This findings were contradictory to the study findings of Katuri K K etal [10] who reported OHI-S scores were almost similar in all the groups, though smokers had higher scores of 3-4, than combined users and smokeless tobacco users; the difference between the groups was not statistically significant. Gingival Index scores was higher in the chewers with 1.7110 $\pm$ .08130 as compared to the mean of smokers with 1.4744 $\pm$ .0692.

Clinical attachment loss in smokers demonstrated a mean of 1.3150 $\pm$ .59797, chewers had 1.4300 $\pm$ .64590 and combination habit users had 1.4800 $\pm$ .67964, which was statistically significant at p=0.032. This was in accordance with the study of Katuri.KK et al who also reported higher CPI scores in combination group. According to Haffajee AD and Socransky SS11, increased amount of clinical attachment loss was observed in current smokers at maxillary lingual sites and lower anterior teeth than past and never smokers. No efforts were made in this study to differentiate CAL based on different locations / sites in the oral cavity. In contrast to the present findings, the use of Swedish moist snuff is shown to cause less attachment loss and bone loss, this is due to presence of fermentable carbohydrates, high pH, low levels of tobacco-related nitrosamines.[12]

The rate at which plaque develops varies between individuals, and it may be deduced that the rate of development of gingival inflammation also will show variation.[13] The reasons why such differences occur has not yet been fully explained, but several factors may act indirectly and it is possible that one of these might be tobacco usage. Also, it is stated that it has a stronger potential of leading to addiction compared to chewing tobacco because of its higher nicotine concentration and prolonged mean usage time. This clearly states that using tobacco in any form affects the oral and systemic health. The results of the study have provided valuable data by comparing the gingival and periodontal health of

smokers and smokeless tobacco users. This information would be useful for the oral health planners to create awareness among the general population regarding its adverse effects. The dental clinicians can provide proper diagnosis and management setup with these details before any specialised procedure.

Periodontitis was observed in 24.5% of the smokers, 39.5% of chewing tobacco users and 50.5% in combination group (Combining CPI codes of Code 3 and Code 4 together). Thus, it can be noted that combination group demonstrated greater prevalence followed by chewing tobacco and smokers. Overall prevalence was 41.5%. The occurrence in the present study was slightly lesser than the study of Goel K et al[14] who reported an overall prevalence of periodontitis to be 71.6%. This difference in prevalence could be attributed to the case-based definition used for periodontitis varying from study to study, and identifying the true prevalence of periodontitis continues to be a challenge. Confounding factors such as poor oral hygiene, presence of plaque along with tobacco consumption, gender, geography and economic status could also play a role. Despite this, the prevalence of periodontitis is high in the surveyed population.

Limitations: The cross-sectional nature of the study prevents us from making any temporal association between periodontal parameters and tobacco use. Heterogeneity was also noted in the type of smoking and smokeless tobacco products used, which could have affected our results. Hence, longitudinal studies with a larger sample size are suggested to be carried out to ascertain these results. Another limitation that needs to be considered while assessing the strength of association between tobacco products (smoking, chewing or combination) and periodontal disease is the fact that the tobacco products used in Asian countries, contains a wide variety of ingredients besides tobacco, especially in chewing tobacco such as betel quid, areca nut, slaked lime, catechu, spices, etc. Moreover, the methods of preparation of these products also vary, which may contribute to alteration of toxicity of these ingredients. Hence, it may be difficult to identify the specific effects of tobacco on the periodontal tissues. Furthermore, the effects of these different commercial products on the periodontal tissues may also be different on account of their different chemical composition. Hence, we recommend product-specific researches to be undertaken to further assess the effect of tobacco on periodontal health.

Despite the limitations arising from the collected data and the cross-sectional study design, the results of present study might be an important guide to direct future research on the link between smokeless tobacco and periodontal disease. The results obtained in this study can be used by clinicians to highlight the detrimental effect of smokeless tobacco and to dispel the growing belief amongst patients that smokeless tobacco is safer to use than tobacco.

Conclusion:

The study demonstrates the harmful effects of tobacco use on periodontal health and also establishes that tobacco chewers destroy more clinical attachment levels than smokers do. These findings warn the dental fraternity to get more actively involved in tobacco cessation counselling and directly participate in health promotion, in general, and oral health promotion, in particular,

given the established link between periodontal disease and a person's systemic health. In toto, smoking is linked to periodontal disease. Combination behaviours are far more harmful than just smoking or chewing tobacco. To further understand the association between the temporal course of tobacco-induced periodontal disorders and their onset, longitudinal studies with long-term follow-up should be done.

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