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ORIGINAL RESEARCH

Clinical Evaluation of Gutkha chewing and Pattern of Bone Loss in Periodontitis

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ABSTRACT

Introduction: Tobacco in the form of Gutkha is commonly used in India. The present study was done to analyze the extent and pattern of alveolar bone loss (ABL) among gutkha chewers who were having chronic periodontitis.

Materials and methods: A total of 55 habitual gutkha chewers within the age range of 18 to 35 years with chronic periodontitis, who were otherwise healthy were recruited for the study. Fourteen full mouth intraoral periapical (IOPA) radiographs were taken for each individual (a total of 770 radiographs) with the help of radiovisiography. Kodak dental software was used to analyze and measure the alveolar bone loss at each proximal site and data were computed as percentage alveolar bone loss.

Results: Almost all the subjects had poor oral hygiene status. Clinical parameters of periodontal examination represented by clinical attachment level, probing depth, gingival bleeding index had positive correlation with frequency and duration of gutkha chewing. The study population had a mean alveolar bone loss of 17%. Mean bone loss was more severe in mandible 18.3% ± 2.6, when compared with maxillary arch 15.7% ± 3.7.

Conclusion: Maximum bone loss was observed with molars and incisors. Alveolar bone loss was more frequently found in mandibular arch as compared to maxillary arch.

Keywords: Digital radiography, Oral hygiene, Tobacco.

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INTRODUCTION

Tobacco is smoked in the form of cigarettes, cigar, pipe or hookah. It is also used in smokeless form, such as pan masala, mava, moist snuff and gutkha. Though, the primary cause of periodontitis is cumulative effect of interaction between bacterial challenge and the immune and inflammatory system of the host, there is substantial epidemiological and clinical evidence that tobacco smokers are more likely to develop periodontitis.[1,2] The effects of tobacco smoking on periodontal health have been extensively documented,[3-5] but the effect of smokeless tobacco on periodontal health has not received much attention.

The habit of smokeless tobacco is widespread in south-east Asia, south pacific and among people of Indian origin migrated to rest of the world. 'Gutkha' is a form of smokeless tobacco which has its origin in India. It is a mixture of areca nut (areca catechu), catechu (acacia catechu), lime, cardamom (*Elettaria cardamomum*), tobacco and unspecified flavoring agents.[6-8] Being nonperishable and easily available in sachets, commercial products of gutkha are popular among men and women of rural population in certain regions of India.

Areca nut and tobacco which are constituents of gutkha are addictive. Gutkha chewers experience temporary euphoria, giddiness and sensation of heat in body. These pharmacological activities are usually interpreted as cholinergic effect of arecoline.[6,8]

Smokeless tobacco use has been associated with several manifestations localized at the site of quid placement. These manifestations include: hyperplastic, dysplastic and malignant oral lesions,[9] oral submucous fibrosis,[10] dentinal hypersensitivity.[7] Previous studies on the effect of smokeless tobacco on periodontal health have been limited to attachment loss manifested as gingival recession at the usual site of tobacco placement.[11,12] Other effects of smokeless tobacco on periodontium like an increase in gingival inflammation, changes in gingival blood flow and interproximal periodontal attachment loss are documented.[5] Some studies, however, have reported no association between use of smokeless tobacco and interproximal attachment loss.[13,14]

Smokeless tobacco may be an important risk factor for severe active periodontal diseases.[3,11] Because of repeated and long-term exposure to arecoline, betel quid chewers could be more susceptible to periodontal damage and less responsive to reattachment procedure.[8,15,16] Regulation of death pathways in neutrophils by areca nut may be one

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of the mechanisms by which periodontal health of quid chewers is compromised.[17]

Previous studies have analyzed the effect of smokeless tobacco on oral mucosa and systemic health. In all aspects, this habit proved to be deteriorating to health. Hence, in the present study, attempts are made to understand the effect of gutkha on periodontium, especially the extent and distribution of alveolar bone destruction in subjects with chronic periodontitis.

MATERIALS AND METHODS

A total of 55 patients visiting the Outpatient Department of Periodontics, PMNM Dental College, Bagalkot, who were habitual gutkha chewers were recruited for the study. The patients selected, were in the age range of 18 to 35 years with a history of gutkha chewing habit for at least 2 years and a frequency of minimum of two sachets per day. Clinically, diagnosed chronic periodontitis patients, who had shown radiographic interproximal bone loss in one or more teeth, were included in study. They had a minimum of 24 teeth excluding 3rd molars. The ethical approval was obtained from the institutional review board and Rajiv Gandhi University of Health Sciences, Karnataka, India. All procedures were explained to the subjects prior to the study and informed consent was obtained from all subjects.

Smokers, patients who did not undergo any periodontal therapy for past 1 year and those with a history of systemic diseases influencing bone loss, such as osteoporosis and pregnant women were excluded from the study. Teeth in severe malocclusion as well as proximally restored teeth were excluded. Older age group which has significantly higher level of periodontal disease was excluded by keeping upper age limit of 35 years.[3]

Each patient was evaluated for probing depth (PD), clinical attachment loss (CAL), gingival index (GI)[18] and oral hygiene index simplified. Full mouth intraoral periapical (IOPA) (14 IOPA) was taken from each subject, thus a total of 770 radiographs were obtained by '(Kodak RVG 5000/6000) Digital Radiography System'.

Each IOPA was observed for three points: CEJ on proximal surface, alveolar bone crest (ABC) and root apex (AP). The alveolar bone loss (ABL) was considered to be radiographically imaged at the most cervical level along the proximal root surface, where periodontal ligament started to be of equal width. If there were more than one image of ABC then most apical one was selected.[19]

Distance between CEJ and ABC, and between CEJ and AP was measured along the root surface, to define alveolar bone loss in relation to root length. All these measurements were carried out with inbuilt measuring scale in the software (Fig. 1).

Fig. 1: The measurement of interproximal bone loss by scale inbuilt in software

The following formula[20] was used to calculate percentage ABL on each proximal surface:

$$[(CEJ - ABC) - 2\ mm]/[(CEJ - AP) - 2\ mm] \times 100$$

Subtraction of 2 mm from the CEJ to ABC or CEJ to AP distances was adopted as a criterion in the formula used, based on histological studies on periodontally healthy teeth showing that the distance from the top of alveolar bone crest to the bottom of gingival sulcus also called as biological width, is approximately 2 mm.[20,21]

Based on the duration of gutkha chewing habit and frequency of sachet usage, patients were grouped as follows:

Number of sachets per day: 2-5, 6-9, 10-13, 14-17 and more than 17.

Duration of chewing in years: 2-4, 5-7, 8-10, 11-13 and more than 13.

These groups were used to determine whether duration and frequency of gutkha chewing had any role in influencing percentage of ABL.

STATISTICAL ANALYSIS

The calculated percentage of ABL and the clinical parameters recorded were analyzed and correlated using analysis of variance (ANOVA), Mann-Whitney U-test, and Karl Pearson's correlation coefficient method. Level of significance was set at $p < 0.05$.

RESULTS

Table 1 shows the comparison between duration of gutkha chewing and clinical parameters in patients. We observed that patients who had gutkha chewing habit for more than 13 years had higher CAL, PD and GI score as compared to individuals who had the habit for lesser duration.

Table 1: Comparison of duration of chewing with respect to different parameters by Kruskal-Wallis one-way analysis of variance test

Duration of chewing	*CAL*		*PD*		*GI*		*OHI-S*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
2-4 years	5.1818	0.6524	4.6818	0.6691	1.9000	0.1549	3.5818	0.6258
5-7 years	5.5650	0.7271	4.9500	0.5835	1.9250	0.1070	3.4550	0.7067
8-10 years	5.9722	0.6720	5.1889	0.6416	2.0056	0.0998	3.9000	0.7004
11-13 years	6.1000	0	5.3000	0	2.0000	0	3.6000	0
>13 years	6.7600	0.8264	5.8600	0.7829	2.1000	0.1414	4.1800	0.7918
h-value	13.6339		9.9775		11.179		6.6323	
p-value	0.0086*		0.0408*		0.0246*		0.1567	

*Significant at 5% level of significance ($p < 0.05$); SD: Standard deviation

Table 2 shows comparison between frequency of gutkha chewing and clinical parameters. It was seen that CAL had significant correlation with frequency of gutkha chewing. probing depth, GI and OHI-S had no significant correlation with frequency of gutkha chewing.

Mean percentage of ABL is compared with frequency of gutkha chewing (Table 3) and with duration of habit (Table 4). There was a positive correlation between the duration of gutkha chewing habit and mean percentage of ABL. Also, it was seen that there was an increase in the bone loss with an increase in frequency of gutkha chewing habit.

All the parameters in the study which included: ABL, PD, GI, OHI-S, duration of habit and number of sachets per day were correlated among each other using Karl Pearson's correlation coefficient method. There was significant correlation among each variable recorded in the study.

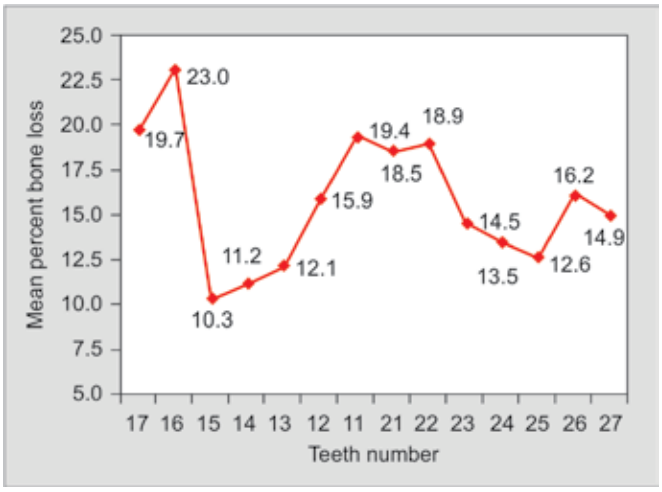
Pattern of Bone Loss

The mean value of percentage ABL in subjects studied was 17%. Maxillary first molar showed the highest percentage of ABL among all teeth. Bone loss was more severe in mandibular arch, where the mean percentage ABL was 18.3 (SD—2.9), compared with 15.7 (SD—3.7) in the maxillary arch (Graphs 1 and 2). Bone loss was more pronounced in first molars and incisors in both maxilla and mandible. Canines and premolars had comparatively lesser bone loss in both the arches. Distal surfaces of teeth showed more mean percentage ABL 17.26 (± 3.99) than on mesial surfaces 16.83 (±3.42) but the difference was not statistically significant.

Table 2: Comparison of number of sachets with respect to mean percent of bone loss by analysis of variance test

No. of sachets	*Mean*	*SD*
2-5	15.27	5.43
6-9	15.32	4.61
10-13	17.45	6.44
14-17	20.32	8.72
>17	19.77	7.39

p-value: 0.2951; SD: Standard deviation



Graph 1: The mean percent bone loss in maxillary arch

Table 3: Comparison of number of sachets with respect to different parameter by Kruskal-Wallis one-way analysis of variance test (nonparametric)

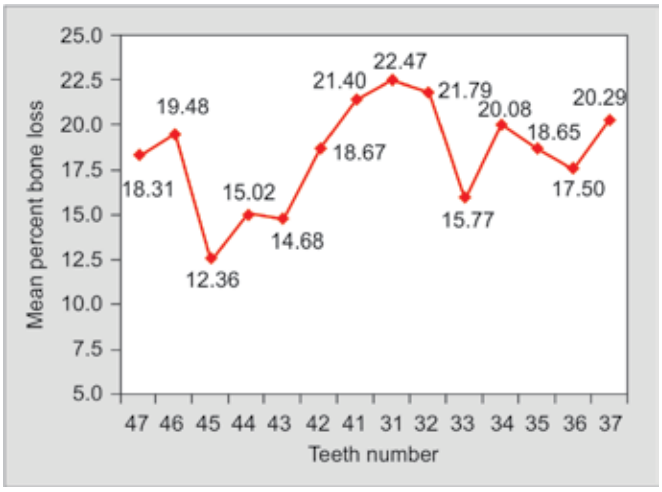
No. of sachets	*CAL*		*PD*		*GI*		*OHI-S*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
2-5 sachets	5.4706	0.6989	4.8882	0.6451	1.9529	0.1125	3.7471	0.6453
6-9 sachets	5.5765	0.7934	5.0118	0.6688	1.9059	0.1478	3.4588	0.6520
10-13 sachets	5.8083	0.8436	5.1083	0.6986	2.0083	0.1084	3.9000	0.9648
14-17 sachets	6.7800	0.5891	5.7000	0.8093	2.0000	0.0707	3.6000	0.6325
>17 sachets	6.0750	0.3403	5.1000	0.6683	2.0750	0.1500	3.9750	0.3304
h-value	10.673		4.9502		6.9147		4.1717	
p-value	0.0305*		0.2925		0.1405		0.3833	

*Significant at 5% level of significance ($p < 0.05$); SD: Standard deviation

Table 4: Comparison of duration of chewing with respect to mean percent of bone loss by analysis of variance test

Duration of chewing (Years)	*Mean*	*SD*
2-4	13.89	3.90
5-7	14.86	4.96
8-10	16.94	4.84
11-13	16.58	0
>13	27.69	5.79

p-value: 0.0000; 5% level of significance ($p < 0.05$); SD: Standard deviation



Graph 2: The mean percent bone loss in mandibular arch

DISCUSSION

Composition as well as manner of smokeless tobacco use can alter the disease process. It was controversial; whether mechanical forces or products of smokeless tobacco caused gingival recession till Offenbacher[22] concluded that solubilized tobacco compounds may interact with the bacterial plaque, perhaps substrate or cofactor, to enhance the recession effect. Clinical attachment loss and radiographic ABL when compared between relatively stable disease and an active disease shows that attachment loss precedes radiographic evidence of crestal ABL during period of periodontal disease activity.[23]

We used full mouth IOPA radiographs instead of panoramic view, because periapical radiography has shown to be more accurate in osseous destruction assessment than panoramic radiography, regardless of the location of the dental surfaces and the degree of osseous destruction.[19,24,25]

Unlike indirect digitization of radiographic films, standardized direct digital radiography used in the study had the advantage of eliminating processing errors, gray level adjustment of image and higher sensitivity with reduced radiation dose.[26,27] Moreover, the inbuilt measuring scale assured accurate measurement of the distance between CEJ and AP and also between ABC and AP. In previous studies, Schei[27] and Bjorn[28] rulers have been used to assess intraoral radiographic films for measurement of alveolar bone destruction. We assessed the alveolar bone destruction over the monitor screen using software as it is less time consuming and it provided greater precision[29] compared to the above mentioned techniques.

When archwise comparison of bone loss was assessed, it was seen that gutkha chewers had more bone loss in the mandibular arch. But in a study done by Brian,[30] on aggressive periodontitis patients who were smokers, bone loss was more severe in the upper arch. When individual teeth were assessed, molars and incisors showed maximum bone loss; maxillary first molars showed the highest amount. Minimum bone loss was seen in canines and premolars.

Study population was categorized under five different groups for duration of habit and frequency of habit of chewing gutkha; to find out whether pattern of habit has any influence of severity on periodontal disease. Chronic use of gutkha was found to be associated with deeper probing depth, more clinical attachment loss and more gingival index score than recent gutkha chewers. This study showed that oral hygiene status was not dependent on duration of habit. But duration of habit had significant influence on ABL. Hence, there must be some factors other than plaque which were responsible for additive or complementary effect to etiologic factor of periodontitis. Constant association of irritating products of gutkha may be considered as promoting factor for early episode of periodontal tissue destruction. Here, it was observed that the habit rather than the disease chronic periodontitis had influence on the pattern of bone loss. Our results strongly support the findings of earlier study conducted by Parmar;[6] that chewing gutkha has potentially causative role in deteriorating periodontal status.

To the best of our knowledge, this is the first time a study was being conducted to analyze the periodontal status and pattern of bone loss among gutkha chewers. This study was done considering the fact that smokeless tobacco is the more common form of tobacco usage in India especially in rural India.

The drawback of the study was relatively small sample size. A similar investigation in large population needs to be carried out to have widely accepted results. Further studies are needed to understand exact mechanism of gutkha action on bone loss in chronic periodontitis patients.

CONCLUSION

Tobacco chewing in the form of gutkha is deteriorating to periodontal tissue. Gutkha chewers neglect their oral hygiene, it may be because of lack of education. The

results of the current study suggest that young adults with chronic periodontitis have severe periodontal destruction with respect to incisors and molars while canines and premolars are minimally involved.

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