

Prevalence of oral mucosal lesions in dental patients with tobacco smoking, chewing, and mixed habits: A cross-sectional study in South India

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ABSTRACT

Background: A variety of oral mucosal lesions and conditions are associated with the habit of smoking and chewing tobacco, and many of these carry a potential risk for the development of cancer. There have been no studies that report the prevalence of habits and associated oral changes in the population in Dharwad region, of Karnataka, south India. **Materials and Methods:** A hospital-based, cross-sectional study was carried out at SDM Dental College (Dharwad, Karnataka). A total of 2400 subjects (1200 subjects with and 1200 subjects without habits) attending the dental hospital were interviewed and examined by trained professionals to assess any oral mucosal changes. **Results:** Oral mucosal lesions were found in 322 (26.8%) subjects who had tobacco smoking and chewing habits as compared to 34 (2.8%) subjects without those habits. Oral leukoplakia (8.2%) and oral submucous fibrosis (OSF) (7.1%) were the prevalent oral mucosal lesions found in subjects who had those habits, while the other lesions (1.7%) namely; oral candidiasis, median rhomboid glossitis, recurrent aphthous ulcer, frictional keratosis, and oral lichen planus (0.9%) were frequently reported among individuals without those habits. The odds of developing oral lesions in subjects with tobacco habits was nearly 11.92 times that of abstainers (odds ratio, OR = 11.92, 95% confidence intervals, CI = 10.61-14.59%). **Conclusion:** The study showed that the risk of the development of oral lesions associated with tobacco smoking, chewing, or both is quite high. Males who had one or more of these habits showed more frequent oral changes than females. The study reinforces the association of OSF with *gutkha* and areca nut chewing, and leukoplakia, erythroplakia, and oral cancer with tobacco smoking, chewing, or mixed habits.

Key words: Betel quid, gutkha, oral cancer, oral lesions, pre-cancer, tobacco

INTRODUCTION

Tobacco use is one of the most important risk factors for the development of oral mucosal lesions including oral pre-cancer and cancer.^[1] In recent years, various commercial preparations known as *pan masala* and *gutkha* have become available in India and in many parts of Asia. Many brands

of these products contain areca nut and tobacco, both of which have been implicated in occurrence of oral cancer. The investigators have also observed that smoking and chewing of tobacco and betel quid act synergistically in oral carcinogenesis and that persons with mixed habits form a substantially high-risk population.^[2]

In comparison to western populations, in which oral cancer represents about 3% of malignancies, it accounts for over 30% of all cancers in India; this difference can be attributed to regional variation in the prevalence and pattern of habits.^[3] However, epidemiological data of the changing trends are lacking. The purpose of this study was to investigate the prevalence of oral mucosal changes in individuals with smoking, chewing, and mixed habits and to assess the relative risk of oral lesions resulting from the habits.

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MATERIALS AND METHODS

The present study was conducted at SDM College of Dental Sciences and Hospital (Dharwad, Karnataka, India). Permission from the ethics committee of the dental hospital was obtained prior to the study. Twelve hundred patients from both suburban and rural areas attending the outpatient department of Oral Medicine, SDM Dental College were randomly selected. The inclusion criteria included patients aged ≥ 15 years who currently smoked, chewed tobacco, consumed alcohol, or had a combination of these habits for a minimum of 12 months. Another 1200 patients aged ≥ 15 years closely matched with the study sample for age, sex, and socioeconomic status with no habits were also interviewed and examined by trained professionals. Informed consent was obtained from all patients prior to the interview and examination.

Details of the habits such as duration in years, frequency, site of placement of quid in the oral cavity, and alcohol consumption were recorded. Individuals were divided into regular alcohol users (those who took alcoholic beverages at least three times a week), occasional users (those who drank alcohol at least once a month), and those who took no alcohol.

The clinical diagnosis of oral mucosal lesions/conditions such as oral carcinoma, leukoplakia, erythroplakia, lichen planus, smoker's palate, leukoedema, and other lesions were based on the pertinent WHO criteria and International seminar on oral leukoplakia and associated lesions related to tobacco habits.^[4-6] Lesions such as frictional white lesion, oral candidiasis, smoker's melanosis, median rhomboid glossitis, and recurrent aphthous ulcer were grouped under other lesions. The clinical diagnosis of chewer's mucosa, oral submucous fibrosis (OSF), and quid-induced lichenoid lesion were based on the criteria provided by Zain *et al.*,^[7]

The data were analyzed using Chi-square test and odds ratio (OR) with 95% confidence interval (CI) to estimate the risk of developing an oral lesion in relation to the risk factors in question.

RESULTS

Of the 1200 study population (with habits), 1067 (88.9%) were males and 133 (11.1%) were females. In the other 1200 group of subjects without habits closely matched for age, sex, and socioeconomic status with the study sample, 951 (79.2%) were males and 249 (20.7%) were females. There was a considerable difference in the prevalence of oral mucosal changes in the subjects with and without the habits; 322 (26.8%) subjects with smoking and or chewing habits had oral mucosal lesions compared to 34 (2.8%)

subjects who had no such habits. This difference was found to be statistically significant ($\chi^2 = 273.6, P < 0.001$).

The estimated odds ratio for developing oral mucosal changes was found to be elevated in subjects with tobacco or other habits (OR = 11.92, 95% CI = 10.61-14.59%) as compared to those who had no such habits. The prevalence of oral mucosal lesions was found to increase with the increasing frequency and duration of the habits.

Prevalence of habits according to gender

As seen from the study findings [Table 1], the difference in the pattern of habits in the two sexes were found to be statistically significant ($P < 0.001$).

Prevalence of oral mucosal lesions in study group (with habits)

In the present study, out of 1200 subjects with smoking/chewing habits, 322 (26.8%) showed oral mucosal changes, out of these, leukoplakia was found in 99 (8.25%), OSF in 85 (7.08%), lichen planus in 30 (2.5%), chewer's mucosa in 26 (2.16%), smoker's palate in 20 (1.66%), lichenoid lesion in 18 (1.5%), leukoedema in 9 (0.75%), erythroplakia in 7 (0.58%), oral carcinoma in 14 (1.16%), and other lesions (6-smoker's melanosis, 3-median rhomboid glossitis, 3-oral candidiasis and 2-frictional keratosis) in 14 (1.16%).

The prevalence of oral mucosal changes in males was 28.7% and females 12% and was thus considerably higher in males with these habits [Table 2]. The difference was found to be statistically significant ($\chi^2 = 66.65, P < 0.001$).

Prevalence of oral mucosal lesions in the study group according to the habits

Leukoplakia was found with increased frequency in subjects with smoking (cigarette and *bidi*) habit and in those who chewed betel quid with tobacco. Oral submucous fibrosis (OSF) was the prevalent oral mucosal change

Table 1: Prevalence of habits by gender

Habit	Males n (%)	Females n (%)	Total n (%)	P value
Gutkha	245 (23)	4 (3)	249 (20.8)	<0.001
Areca nut	13 (1.2)	13 (9.8)	26 (2.2)	
Betel quid	60 (5.6)	44 (33.1)	104 (8.7)	
Tobacco with lime	10 (0.9)	2 (1.5)	12 (1.0)	
Betel quid with tobacco	367 (34.4)	69 (51.9)	436 (36.3)	
Bidi smoking	79 (7.4)	1 (0.7)	80 (6.7)	
Cigarette smoking	98 (9.2)	0	98 (8.2)	
Cigarette plus bidi smoking	10 (1.0)	0	10 (0.8)	
Smoking plus chewing	172 (16.1)	0	172 (14.3)	
Others	13 (1.2)	0	13 (1.0)	
Total	1067 (88.9)	133 (11.1)	1200 (100)	

observed in *gutkha* and areca nut chewers. On the other hand, in subjects with mixed habits (smoking plus chewing), leukoplakia was the prevalent lesion found [Figure 1].

The above results indicate that the prevalence of oral mucosal lesions differed in the subjects according to the types of habits, which was found to be statistically significant ($\chi^2 = 92.24, P < 0.001$).

Prevalence of oral mucosal changes in subjects with habits according to age

Out of 272 subjects aged 15-24 years with these habits, 70 (25.7%) had oral mucosal changes, the most prevalent being oral sub-mucous fibrosis (16.1%). In those aged 25-34 years, 73 (23.3%) subjects had oral mucosal changes with oral sub-mucous fibrosis (8.3%) as the most frequently observed.

In the age group 35-44 years, 53 (25.6%) of the 207 subjects with habits had observable oral mucosal changes. Leukoplakia (12.0%) was the prevalent lesion observed.

Seventy (30.3%) out of 231 subjects aged 45-54 years had oral mucosal changes with leukoplakia (14.3%) as the most prevalent lesion found.

Of the 128 individuals with the habits in subjects aged 55-64 years, 44 (34.3%) subjects had oral mucosal changes. Leukoplakia (14.8%) was the most prevalent lesion.

In the group aged 65-74 years, 11 (27.5%) of the 40 subjects with these habits had oral mucosal changes, again with leukoplakia (12.5%) as the prevalent lesion.

In the last group aged ≥ 75 years, 10 had these habits and only 1 (10%) had oral mucosal change diagnosable as leukoplakia.

We observed a small difference in the frequency of oral mucosal changes among the different age groups. However, the values were not statistically significant ($\chi^2 = 9.56, df = 6, P > 0.05$).

Prevalence of oral mucosal lesions in the control group (without the habits)

Among 1200 subjects without these habits, 34 (2.83%) had oral mucosal changes. Of these, 20 (1.67%) showed other lesions (6 frictional keratosis, 8 recurrent minor aphthous, 4 oral candidiasis, and 2 median rhomboid glossitis). Lichen planus was seen in 11 (0.91%), leukoedema in 2 (0.16%), and OSF in 1 (0.08%) [Table 3].

Frequency of oral mucosal lesions at different locations in the oral cavity

The most frequently involved intra-oral site was the buccal mucosa (40.2%), followed by labial mucosa (12.8%), palate (12.5%), commissures (12.2%), pterygomandibular plica and glossopalatal arch (8.6%), tongue (3.6%), floor of the mouth (3.3%), buccal vestibule (3.3%), gingiva (2.9%), and alveolar mucosa (0.5%) [Table 4].

Table 2: Prevalence of oral mucosal lesions in the study group (with habits)

Lesions	Males n (%)	Females n (%)	Total n (%)	P value
Leukoplakia	97 (9.09)	2 (1.5)	99 (8.25)	<0.001
OSF	77 (7.21)	8 (6.0)	85 (7.08)	
Lichen planus	29 (2.71)	1 (0.7)	30 (2.5)	
Chewer's mucosa	25 (2.34)	1 (0.7)	26 (2.16)	
Smoker's palate	20 (1.9)	0	20 (1.66)	
Lichenoid lesion	15 (1.4)	3 (2.2)	18 (1.5)	
Leukoedema	9 (0.84)	0	9 (0.75)	
Erythroplakia	7 (0.65)	0	7 (0.58)	
Other lesions	14 (1.31)	0	14 (1.16)	
Oral carcinoma	13 (1.21)	1 (0.7)	14 (1.16)	
Total	306 (28.7)	16 (12.0)	322 (26.8)	

OSF: Oral submucous fibrosis

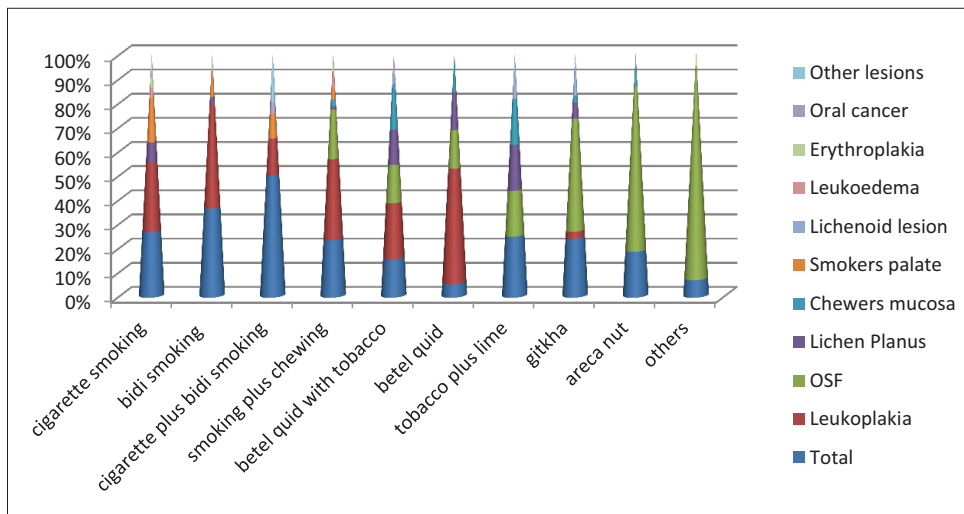


Figure 1: Prevalence of oral mucosal lesions in the study group according to habits

Table 3: Prevalence of oral mucosal lesions in the control group (without habits)

Lesions	Males n (%)	Females n (%)	Total n (%)
Leukoplakia	0	0	0
OSF	0	1 (0.4)	1 (0.08)
Lichen planus	3 (0.3)	8 (3.2)	11 (0.91)
Chewer's mucosa	0	0	0
Smoker's palate	0	0	0
Lichenoid lesion	0	0	0
Leukoedema	2 (0.2)	0	2 (0.16)
Erythroplakia.	0	0	0
Other lesions	14 (1.5)	6 (2.4)	20 (1.67)
Oral carcinoma	0	0	0
Total lesions	19 (2.0)	15 (6.0)	34 (2.83)

OSF: Oral submucous fibrosis

Table 4: Frequency (%) of oral mucosal lesions at different locations in the oral cavity

Site	Percentage
Buccal mucosa	40.20
Labial mucosa	12.80
Palatal mucosa	12.50
Commissures	12.20
Pterygomandibular plica and glossopalatal arch	8.60
Tongue	3.60
Floor of the mouth	3.30
Buccal vestibule	3.30
Gingiva	2.90
Alveolar mucosa	0.50

In the study group, 182 (15.2%) subjects with chewing and/or smoking habits also consumed alcohol; 82 (45.0%) of the 182 subjects had oral mucosal lesions compared to 23.6% oral mucosal changes in those who did not consume alcohol, but had the habit of smoking and/or chewing tobacco.

The study showed an increased consumption of alcohol in men and an increased incidence of oral mucosal changes among alcohol drinkers with some additional habits (smoking and/or chewing) as compared to those with lesions who did not drink alcohol. This was found to be statistically significant ($\chi^2 = 64.3$, $P < 0.001$).

DISCUSSION

In the present study, the most frequent habit reported was the chewing of betel quid with tobacco (36.3%) and the chewing of *gutkha* (20.7%). Bhowate *et al.*,^[8] in their study reported that 66.3% of the population chewed tobacco in the form of betel quid. It is interesting to note sex differences in the pattern of habit ($P < 0.001$). While the predominant habit in men was the chewing of betel quid

with tobacco (34.4%) and *gutkha* (23.0%), followed by cigarette smoking plus chewing (9.5%), the habits that were predominant among women related to chewing (betel quid with tobacco 51.9%, betel quid without tobacco 33.1%, and areca nut chewing 9.8%) [Table 1]. The habits of chewing *gutkha* and smoking among women were minimal. The prevailing habit in the younger age group (15-34 years) was the chewing of *gutkha*. Maher *et al.*,^[9] reported a similar finding in their study.

The 26.8% prevalence of oral mucosal changes in subjects with habits in the present study is higher in comparison to previous studies,^[10-12] while it is lower than the 49.9% prevalence among rural Indians as reported by Bhowate *et al.*,^[8] This difference can be attributed to the variations in the study population surveyed, i.e., a hospital-based study with mixed population and differences in the pattern and duration of habits.

The present study showed a higher frequency of oral carcinoma (1.2%) compared to previous reports.^[13,14] The lesion was more prevalent among males than among females. This difference may be due to the fact that a large number of men are reported to have the habit of smoking and chewing tobacco and with mixed habits. Buccal mucosa and gingiva were the frequent intra-oral location for oral carcinoma.

The overall prevalence of leukoplakia (8.2%) in the present study was more than that reported in a number of epidemiologic studies.^[15-17] This difference can be explained by the difference in the study population and the tobacco habits of Indian and western populations. However, in their study, Bhowate *et al.*,^[8] reported a very high 11.5% prevalence of oral leukoplakia in rural populations in India. Similarly, Campisi and Margiotta^[14] reported one of the highest (13.8%) incidences of leukoplakia in men who drank alcohol and had the habit of smoking. In this study, leukoplakia was more frequently observed in men with smoking and mixed (smoking and chewing) habits than in females. The very small number of women smokers may account for this difference. As in many other studies, our study also supports an association between smoking habits and leukoplakia.^[13-15]

The prevalence of oral lichen planus revealed in the present study was 2.5% in subjects with habits and 0.9% among individuals with none of these habits, a finding which is similar to that in previous studies.^[10-12,16] Axell and Rundquist^[16] pointed out that snuff users showed a slightly higher prevalence of lichen planus than smokers. On the contrary, Mani^[10] observed no relationship of lichen planus to oral tobacco habits. Lichen planus in chewers of tobacco betel should not be ignored, even if the potential of this

lesion for malignant transformation remains somewhat uncertain, since tobacco habits may influence the natural history of oral lichen planus.

The prevalence of erythroplakia was 0.6% in the study population investigated, which is relatively low compared to the 1.95% prevalence reported by Chung *et al.*,^[12] but higher than that previously reported by Lay *et al.*,^[15] All the lesions were reported in men with the habits of smoking, chewing of betel quid with tobacco, and mixed habits. The lesion was found to affect almost exclusively the buccal mucosa and palate.

In comparison with previous studies,^[8,11-13] the prevalence of OSF in the present study is quite high (7.1%). This could be attributed to the prevalent habit in this region of chewing *gutkha* and betel quid. The majority of subjects with OSF were aged between 15 and 34 years, which could be related to the habit prevailing in this age group of chewing *gutkha* and areca nut. Our study further confirms the strong relation reported by various case control studies^[9,17] between areca nut chewing and OSF.

Lichenoid oral lesion is defined as oral mucosal lesion, generally occurring at the site of placement of quid resembling lichen planus, but differing from lichen planus by being characterized by the presence of fine, white, wavy parallel lines that do not overlap or criss-cross, not elevated and which, in some instances, radiate from a central erythematous area.^[6,7] Betel quid chewing is so strongly associated with this lesion that it almost exclusively occurs at the site of the placement of betel quid.^[13]

In the present study, lichenoid oral lesion was observed in 1.5% of subjects with the habit and the lesion was found mostly in *gutkha* chewers ($n = 12$) and subjects who chewed betel quid with tobacco ($n = 5$). All lesions were found at the site identified by the subjects as their primary site of quid placement.

Chewer's mucosa was found in 28 (2.2%) of the subjects with the habits, a finding which is similar to 1.7% reported by Axel *et al.*,^[18] among Malaysian and Thai dental patients, but lower than 13.1% reported by Reichart *et al.*,^[19] Similar to the observation by Axel *et al.*,^[18] chewer's mucosa was noted predominantly in men with chewing habits in this study.

In accord with previous reports,^[11,12,14] our study demonstrates increased consumption of alcohol among men, and an increase in the incidence of oral mucosal changes among alcohol drinkers with some additional habits (smoking and/or chewing) as compared to those who abstained from drinking alcohol, but had these

habits. Since the percentage of subjects with habits who consumed alcohol is low (15.2%), no conclusive evidence can be drawn on alcohol as a risk factor for associated oral lesions. The alcohol habit may perhaps produce discernible oral effects in association with other etiological risk factors such as tobacco smoking or chewing or mixed habits of chewing and smoking.

CONCLUSION

In conclusion, we observed the marked presence of the main risk factors (tobacco smoking, chewing of betel quid with and/or without tobacco, and *gutkha* chewing) not only for oral cancer and precancer but also for many other oral lesions such as lichen planus, chewer's mucosa, leukoedema, lichenoid lesion, smoker's palate, and smoker's melanosis. On aggregate, the available data suggests that the risk of OSF associated with *gutkha* chewing habit, and leukoplakia, erythroplakia, and oral cancer associated with smoking, chewing, or mixed habits is quite high. Therefore, intervention programs to discourage the use of *gutkha* and other risky habits should be a public health priority.

The highly selective character of the sample studied, i.e., hospital-based population with mixed patients presenting from both urban and rural areas and the relatively small population investigated, makes any comparison with other epidemiologic studies unsafe, so the results should be interpreted with great caution.

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