

Observational Analysis of Tobacco Use and Its Association with Oral Mucosal Lesions in Patients Attending a Dental Outreach Centre

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ABSTRACT

Background: Tobacco use is a major preventable risk factor for oral mucosal changes and potentially malignant disorders. The oral cavity is directly exposed to tobacco-related chemical and thermal irritants, making it an important site for early detection of tobacco-associated lesions. Dental outreach centres provide an opportunity to identify high-risk individuals, especially among patients who may not seek routine oral screening.

Aim: The aim of this study was to assess the pattern of tobacco use and its association with oral mucosal lesions among patients attending a dental outreach centre at a tertiary care hospital.

Materials and Methods: This observational study included 210 patients attending a dental outreach centre. Demographic details, tobacco-use history, type of tobacco consumed, frequency of use, age at initiation, and relevant clinical parameters were recorded using a structured case record form. Tobacco use was categorized as smoked, smokeless, or combined use. All patients underwent systematic intraoral examination under adequate illumination using sterile diagnostic instruments. Oral mucosal lesions were recorded according to their presence, type, site, and associated clinical features. Data were entered in Microsoft Excel and analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were expressed as frequency and percentage. The chi-square test or Fisher's exact test was used to assess associations, and a p-value of less than 0.05 was considered statistically significant.

Results: Among 210 patients, 142 (67.62%) reported tobacco use, while 68 (32.38%) were non-users. Oral mucosal lesions were observed in 90 patients (42.86%). Lesions were significantly more common among tobacco users 78/142 (54.93%) compared with non-users 12/68 (17.65%) ($p < 0.001$). Smokeless tobacco was the most common form of use, reported by 72 patients (50.70%), followed by smoked tobacco in 44 (30.99%) and combined use in 26 (18.31%). Oral submucous fibrosis was the most common lesion 24 (26.67%), followed by leukoplakia 20 (22.22%). Buccal mucosa was the most commonly affected site 46 (51.11%). Frequency of tobacco use showed a significant association with oral mucosal lesions ($p = 0.012$).

Conclusion: Tobacco use was strongly associated with oral mucosal lesions among patients attending the dental outreach centre. Smokeless tobacco use and higher frequency of consumption were important contributors to lesion occurrence. Routine oral screening and tobacco cessation counseling should be integrated into outreach dental services.

Keywords: Tobacco use, Oral mucosal lesions, Smokeless tobacco, Oral submucous fibrosis, Dental outreach centre

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INTRODUCTION

Tobacco use remains one of the most important preventable causes of oral and systemic disease, and its impact is particularly visible in dental and oral medicine settings. Tobacco is consumed in smoked, smokeless, and mixed forms, and each form exposes the oral cavity to heat, chemical irritants, nicotine, tobacco-specific nitrosamines, and other carcinogenic compounds. The oral mucosa is the first tissue to come in direct contact with these agents, making it highly vulnerable to local changes such as pigmentation, keratosis, ulceration, leukoplakia, erythroplakia, oral submucous fibrosis, smoker's palate, and other potentially malignant disorders. The World Health Organization has emphasized that tobacco-control efforts remain essential because

tobacco continues to produce major preventable health harms worldwide, despite progress in policy-level control measures.¹ Oral health is now increasingly recognized as an essential part of general health, rather than a separate dental concern. The oral cavity reflects several behavioral, nutritional, environmental, and socioeconomic influences, among which tobacco exposure is one of the most important modifiable risk factors. Oral mucosal lesions related to tobacco may initially appear asymptomatic and may be overlooked by patients, especially when lesions are painless or slowly progressive. However, such lesions are clinically important because they may indicate chronic tissue injury and, in some cases, early premalignant transformation. The World Health Organization's global oral health framework

highlights the need to integrate prevention, early detection, risk-factor control, and access to oral health services within routine health systems.² Smokeless tobacco deserves special attention in oral health research because it is kept in direct contact with the oral mucosa for prolonged periods. Products such as gutkha, khaini, pan masala with tobacco, betel quid with tobacco, and other locally available preparations may be placed in the buccal vestibule, labial sulcus, or gingivobuccal area. This repeated contact may lead to localized friction, chemical irritation, epithelial thickening, mucosal discoloration, white plaque formation, and fibrotic changes. The clinical effects may vary according to the type of product, frequency of use, duration of exposure, quantity consumed, site of placement, and associated habits such as areca nut or alcohol use. Recent global evidence has further emphasized the contribution of smokeless tobacco and areca nut exposure to oral cancer burden, supporting the importance of early identification of mucosal changes in tobacco users.³ The clinical spectrum of tobacco-associated oral mucosal lesions is broad. Some lesions, such as smoker's palate or tobacco pouch keratosis, may be strongly related to a particular habit pattern, whereas others, such as leukoplakia or erythroplakia, require careful evaluation because of their potential for dysplasia and malignant transformation. Smokeless tobacco-related keratosis usually develops at the site where the tobacco product is habitually placed, while smoked tobacco may affect the palate, tongue, floor of mouth, and other mucosal surfaces through thermal and chemical exposure. Clinical examination should therefore include not only the identification of lesions but also documentation of their site, size, color, surface texture, number, laterality, associated symptoms, and relationship with the patient's habit pattern.⁴ Areca nut use, with or without tobacco, is another major concern in South Asian populations and is closely related to oral submucous fibrosis. Oral submucous fibrosis is a chronic, progressive condition characterized by mucosal stiffness, burning sensation, blanching, fibrous bands, and reduced mouth opening. When tobacco is consumed along with areca nut, the oral mucosa may be exposed to a combination of alkaloids, irritants, and carcinogenic compounds, increasing the possibility of persistent mucosal injury. Many patients continue these habits for years before seeking dental care, and symptoms may be noticed only when functional limitation, burning sensation, or visible mucosal changes develop. This makes routine screening in dental outreach settings especially valuable.⁵ Oral potentially malignant disorders represent an important group of lesions because they provide an opportunity for early clinical recognition before the development of invasive oral cancer. Lesions such as leukoplakia, erythroplakia, oral submucous fibrosis, and certain lichenoid lesions may be associated with altered epithelial behavior and require appropriate monitoring, risk-factor elimination, and referral when indicated. Tobacco-associated oral lesions may not always show alarming symptoms in the early stage, which can lead to delayed diagnosis. A careful clinical approach that combines habit history with systematic oral examination can improve detection and help identify patients who need counseling, biopsy, specialist evaluation, or follow-up.⁶

MATERIALS AND METHODS

This study was designed as an observational analysis to assess tobacco use and its association with oral mucosal lesions among patients attending a dental outreach centre at a tertiary care hospital. The study included patients reporting for dental examination and treatment services, where screening for tobacco-related habits and oral mucosal changes was carried out as part of routine clinical assessment. A total of 210 patients were included in the study. The study population consisted of patients attending the dental outreach centre who were evaluated for tobacco consumption habits and oral mucosal lesions. Patients of different age groups and both sexes were included to obtain a representative clinical profile of individuals presenting to the outreach centre.

Eligibility Criteria

Patients were included if they were willing to participate, provided informed consent, and underwent complete oral examination. Patients with a history of tobacco use in any form, as well as patients without tobacco habits, were assessed to allow comparison between exposed and non-exposed groups. Patients who were unwilling to participate, had incomplete clinical records, or were unable to provide reliable information regarding tobacco habits were excluded from the study.

Methodology

Data were collected using a structured case record form. Demographic details such as age, sex, residence, education, occupation, and socioeconomic background were recorded. Information regarding tobacco use was obtained through patient interview, including type of tobacco consumed, frequency of use, duration of habit, daily quantity, mode of consumption, and associated habits such as alcohol intake. Tobacco use was categorized as smoked tobacco, smokeless tobacco, or combined use.

Assessment of Tobacco Use: Tobacco-related parameters included type of product used, such as cigarette, bidi, gutkha, khaini, pan masala with tobacco, betel quid with tobacco, or other locally used preparations. The site of placement of smokeless tobacco, frequency per day, age at initiation, and dependence-related features were also recorded. Patients were further grouped according to tobacco exposure status to evaluate the relationship between tobacco habit patterns and oral mucosal findings.

Clinical Oral Examination: All patients underwent a systematic intraoral examination under adequate illumination using sterile diagnostic instruments. The oral mucosa was examined carefully, including buccal mucosa, labial mucosa, tongue, floor of the mouth, palate, gingiva, alveolar mucosa, and retromolar region. Findings were recorded with respect to the presence, type, site, size, color, surface texture, number, and extent of oral mucosal lesions.

Oral Mucosal Lesion Parameters: Oral mucosal lesions were assessed and classified based on their clinical appearance. Parameters included presence or absence of lesion, anatomical site involved, type of lesion, laterality, extent, and associated symptoms such as burning sensation, pain, ulceration, restricted mouth opening, or altered taste. Lesions such as leukoplakia, erythroplakia, oral submucous fibrosis, tobacco pouch keratosis, smoker's palate, lichenoid changes, pigmentation, traumatic ulcers, and other clinically evident mucosal alterations were documented.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize demographic variables, tobacco-related parameters, and oral mucosal findings. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequencies and percentages. The chi-square test or Fisher's exact test was used to assess the association between tobacco use and oral mucosal lesions. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 210 patients were included in the study. Among these, 142 patients (67.62%) reported tobacco use, whereas 68 patients (32.38%) had no history of tobacco consumption. Overall, oral mucosal lesions were identified in 90 patients (42.86%), while 120 patients (57.14%) did not show any clinically evident oral mucosal lesion.

The demographic distribution of the study participants is shown in Table 1. The highest proportion of patients belonged to the 36–45 years age group, comprising 58 patients (27.62%), followed by 52 patients (24.76%) in the 26–35 years age group. Tobacco use was more frequent among older age groups, particularly among patients aged 36–45 years, where 43 patients (30.28%)

were tobacco users. In contrast, non-users were more commonly seen in the younger age group of ≤ 25 years, accounting for 22 patients (32.35%) among non-users. The association between age

group and tobacco-use status was statistically significant ($p < 0.001$).

Table 1. Distribution of study participants according to demographic variables and tobacco-use status

Variable	Total, n (%)	Tobacco users, n (%)	Non-users, n (%)	p-value
Age group				<0.001
≤ 25 years	34 (16.19)	12 (8.45)	22 (32.35)	
26–35 years	52 (24.76)	32 (22.54)	20 (29.41)	
36–45 years	58 (27.62)	43 (30.28)	15 (22.06)	
46–55 years	42 (20.00)	35 (24.65)	7 (10.29)	
>55 years	24 (11.43)	20 (14.08)	4 (5.88)	
Sex				<0.001
Male	132 (62.86)	105 (73.94)	27 (39.71)	
Female	78 (37.14)	37 (26.06)	41 (60.29)	
Residence				0.090
Rural	124 (59.05)	90 (63.38)	34 (50.00)	
Urban	86 (40.95)	52 (36.62)	34 (50.00)	
Education status				0.001
Up to primary	88 (41.90)	70 (49.30)	18 (26.47)	
Secondary	76 (36.19)	50 (35.21)	26 (38.24)	
Higher secondary and above	46 (21.90)	22 (15.49)	24 (35.29)	

With respect to sex distribution, males constituted the majority of the study population, with 132 patients (62.86%), while females accounted for 78 patients (37.14%). Tobacco use was markedly higher among males, as 105 male patients (73.94%) reported tobacco consumption compared with 37 female patients (26.06%). Among non-users, females were more common, comprising 41 patients (60.29%). This difference between sex and tobacco-use status was statistically significant ($p < 0.001$).

Regarding residence, 124 patients (59.05%) belonged to rural areas and 86 patients (40.95%) were from urban areas. Among tobacco users, 90 patients (63.38%) were from rural areas, whereas 52 patients (36.62%) were from urban areas. Although tobacco use was numerically higher among rural participants, the association between residence and tobacco-use status was not statistically significant ($p = 0.090$).

Educational status showed a significant association with tobacco use ($p = 0.001$). Patients educated up to primary level formed the largest group, with 88 patients (41.90%). Among tobacco users, nearly half, 70 patients (49.30%), had education only up to primary level. In comparison, patients with higher secondary education and above were less commonly tobacco users, accounting for 22 patients (15.49%), while 24 patients (35.29%) among non-users belonged to this higher education category.

The pattern of tobacco use among the 142 tobacco users is presented in Table 2. Smokeless tobacco was the most common form of tobacco consumption, reported by 72 patients (50.70%). Smoked tobacco use was observed in 44 patients (30.99%), while combined smoked and smokeless tobacco use was reported by 26 patients (18.31%). This indicates that smokeless tobacco was the predominant form of tobacco habit among the study population.

Table 2. Pattern of tobacco use among tobacco users

Tobacco-use parameter	Number of patients	Percentage
Type of tobacco use		
Smoked tobacco	44	30.99
Smokeless tobacco	72	50.70
Combined smoked and smokeless tobacco	26	18.31
Frequency of tobacco use		
≤ 5 times/day	50	35.21
6–10 times/day	62	43.66
>10 times/day	30	21.13
Age at initiation of tobacco use		
<20 years	54	38.03
20–30 years	66	46.48
>30 years	22	15.49

In terms of frequency of tobacco use, the largest proportion of tobacco users consumed tobacco 6–10 times per day, comprising 62 patients (43.66%). Tobacco use of ≤ 5 times per day was reported by 50 patients (35.21%), whereas 30 patients (21.13%) used tobacco more than 10 times per day. Regarding age at initiation, most tobacco users had started the habit between 20 and 30 years of age, accounting for 66 patients (46.48%). Initiation before 20 years of age was reported by 54 patients (38.03%), while only 22 patients (15.49%) initiated tobacco use after 30 years of age.

The association between tobacco use and oral mucosal lesions is shown in Table 3. Oral mucosal lesions were present in 78 out of 142 tobacco users (54.93%), whereas only 12 out of 68 non-users (17.65%) had oral mucosal lesions. Among patients without lesions, 64 patients (45.07%) were tobacco users and 56 patients (82.35%) were non-users. This difference was statistically significant ($p < 0.001$), indicating a strong association between tobacco use and the presence of oral mucosal lesions.

Table 3. Association between tobacco use and presence of oral mucosal lesions

Oral mucosal lesion status	Total, n (%)	Tobacco users, n (%)	Non-users, n (%)	p-value
Present	90 (42.86)	78 (54.93)	12 (17.65)	<0.001
Absent	120 (57.14)	64 (45.07)	56 (82.35)	

The distribution of oral mucosal lesions according to lesion type is shown in Table 4. The most common lesion was oral submucous fibrosis, observed in 24 patients (26.67%), followed by leukoplakia in 20 patients (22.22%). Tobacco pouch keratosis was observed in 16 patients (17.78%), while smoker's palate was

present in 10 patients (11.11%). Oral pigmentation and traumatic ulcer/other ulcer were each seen in 8 patients (8.89%), while lichenoid changes were the least common lesion, observed in 4 patients (4.44%).

Table 4. Distribution of oral mucosal lesions according to lesion type

Type of oral mucosal lesion	Total lesions, n (%)	Tobacco users, n (%)	Non-users, n (%)	p-value
Oral submucous fibrosis	24 (26.67)	22 (28.21)	2 (16.67)	0.003
Leukoplakia	20 (22.22)	18 (23.08)	2 (16.67)	
Tobacco pouch keratosis	16 (17.78)	16 (20.51)	0 (0.00)	
Smoker's palate	10 (11.11)	10 (12.82)	0 (0.00)	
Oral pigmentation	8 (8.89)	6 (7.69)	2 (16.67)	
Lichenoid changes	4 (4.44)	2 (2.56)	2 (16.67)	
Traumatic ulcer/other ulcer	8 (8.89)	4 (5.13)	4 (33.33)	
Total	90 (100.00)	78 (100.00)	12 (100.00)	

Among tobacco users with lesions, oral submucous fibrosis was the most frequent finding, present in 22 patients (28.21%), followed by leukoplakia in 18 patients (23.08%) and tobacco pouch keratosis in 16 patients (20.51%). Tobacco pouch keratosis and smoker's palate were observed only among tobacco users. Among non-users with lesions, traumatic ulcer/other ulcer was relatively more frequent, present in 4 patients (33.33%). The association between lesion type and tobacco-use status was statistically significant ($p=0.003$).

The site-wise distribution of oral mucosal lesions is shown in Table 5. The buccal mucosa was the most commonly affected site, involved in 46 patients (51.11%). Lesions involving multiple sites and lesions involving the palate were each seen in 10 patients (11.11%). Labial mucosa, tongue, and gingiva/alveolar mucosa were each involved in 8 patients (8.89%). The predominance of buccal mucosal involvement may be related to the common placement of smokeless tobacco in the buccal vestibule and cheek region.

Table 5. Site-wise distribution of oral mucosal lesions

Site of lesion	Number of patients	Percentage
Buccal mucosa	46	51.11
Palate	10	11.11
Labial mucosa	8	8.89
Tongue	8	8.89
Gingiva/alveolar mucosa	8	8.89
Multiple sites	10	11.11
Total	90	100.00

The association of tobacco-use pattern with oral mucosal lesions among tobacco users is shown in Table 6. Among patients using smoked tobacco, oral mucosal lesions were present in 18 patients (40.91%) and absent in 26 patients (59.09%). Among smokeless tobacco users, lesions were present in 44 patients (61.11%), while 28 patients (38.89%) had no lesions. Among combined

tobacco users, 16 patients (61.54%) had lesions and 10 patients (38.46%) did not have lesions. Although lesions were more common among smokeless and combined tobacco users, the association between type of tobacco use and oral mucosal lesions was not statistically significant ($p=0.080$).

Table 6. Association of tobacco-use pattern with oral mucosal lesions among tobacco users

Tobacco-use variable	Total tobacco users, n (%)	Lesion present, n (%)	Lesion absent, n (%)	p-value
Type of tobacco use				0.080
Smoked tobacco	44 (30.99)	18 (40.91)	26 (59.09)	
Smokeless tobacco	72 (50.70)	44 (61.11)	28 (38.89)	
Combined use	26 (18.31)	16 (61.54)	10 (38.46)	
Frequency of tobacco use				0.012
≤5 times/day	50 (35.21)	20 (40.00)	30 (60.00)	
6–10 times/day	62 (43.66)	36 (58.06)	26 (41.94)	
>10 times/day	30 (21.13)	22 (73.33)	8 (26.67)	

A significant association was observed between frequency of tobacco use and oral mucosal lesions ($p=0.012$). Among patients who used tobacco ≤5 times per day, lesions were present in 20 patients (40.00%). This proportion increased to 36 patients (58.06%) among those using tobacco 6–10 times per day and further increased to 22 patients (73.33%) among those using tobacco >10 times per day.

DISCUSSION

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CONCLUSION

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