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Tobacco-related Oral Mucosal Lesions and Dental Diseases

In contrast to its effects on other parts of the body, the health impacts of tobacco on the mouth such as oral precancerous lesions/conditions and periodontal diseases receive relatively little attention and are not widely known among the general public.¹⁵² Tobacco in any form, either smoked or smokeless, can cause a wide spectrum of oral mucosal alterations or lesions. The type and location of the alteration/lesion varies with the type of tobacco used, the way it is used, and the frequency and duration of use. These lesions are classified as (i) premalignant (precancerous) lesions, (ii) premalignant conditions, and (iii) other tobacco-related lesions. A premalignant lesion is a localized tissue alteration, while a premalignant condition is more generalized and widespread with significant systemic involvement.¹⁵³ Precancerous lesions include leucoplakia, erythroplakia and palatal changes among reverse smokers, and precancerous conditions include oral submucous fibrosis and oral lichen planus. The pathogenesis of premalignant lesions has been discussed in Box 4.6. Evidence shows that premalignant lesions are direct precursors of invasive lesions. The most common oral precancerous lesion is leucoplakia, which manifests as a white plaque.¹⁵⁴

Box 4.6 Pathogenetic pathways¹⁵⁵

Oral and pharyngeal tissues come into direct contact with carcinogens present in smokeless tobacco products and tobacco smoke. In addition, tobacco-specific nitrosamines (TSNAs) can be formed in the mouth through the process of nitrosation.

Global evidence

Globally, several studies have confirmed the association between tobacco and oral precancerous lesions such as leucoplakia and erythroplakia.^{152–161} Several cross-sectional and longitudinal studies have shown that tobacco smokers and chewers experience an increased prevalence and worsening of periodontal diseases with subsequent tooth loss.¹⁵² In South Asia too, tobacco use is found to be associated with periodontal disease.^{162–163}

Indian evidence

In India, a vast majority of oral cancers are preceded by precancerous lesions and conditions caused by the use of tobacco in some form. These can be more easily seen because of their peculiar oral location, making oral cancers particularly amenable to prevention.¹⁵³ This section profiles several oral lesions, for which an association with tobacco has been observed.

Premalignant lesions**Leucoplakia**

Leucoplakia is the most common precancerous lesion associated with smoking and/or chewing tobacco. Tobacco smoking and chewing are the most important aetiological factors for leucoplakia. Globally, it occurs 6 times more frequently in smokers than in non-smokers.¹⁶⁴ In India, leucoplakia has only rarely been reported among individuals who do not use tobacco in some form. The prevalence of leucoplakia in India varies from 0.2% to 5.2%.^{165–168} Leucoplakia may be persistent, regress spontaneously, recur or progress to cancer. Regression occurs more significantly in lesions associated with the chewing of tobacco or betel quid than in those associated with smoking.^{169,170} Worldwide, 3.6% of leucoplakia shows malignant transformation.¹⁷¹ Malignant transformation rates in leucoplakia varied from 0.13% to 10% in various Indian studies.^{169,170,172,173}

Among the subclinical types, at least 20% and up to 46% of nodular leucoplakia progress to cancer as compared to 0.5%–1.7% of homogeneous leucoplakia, and 1% or less of ulcerated leucoplakia, depending on the follow up period.^{169,170,174} It has been reported that on biopsy, nodular leucoplakia is more likely than the other types to show dysplasia or carcinoma, and that lesions with significant histological alteration carry a greater risk than those with a normal histology.¹⁷⁴

Erythroplakia

Erythroplakia has been associated with tobacco smoking and alcohol use. A prevalence rate of 0.09% is reported in the USA and 0.02% in Indian villagers.¹⁷⁵ Erythroplakia represents the most severe oral premalignant lesion and carries a much greater risk of cancer than leucoplakia.^{175,176}

Palatal changes among reverse smokers

Reverse smoking has detrimental effects on the palatal mucosa, which is clinically characterized by the presence of palatal keratosis, excrescence, patches, red areas, ulceration and pigmentation.¹⁶⁹ One component may change into another over time, reflecting a single pathogenetic mechanism. In a 6-year follow up study of about 10,000 individuals in Srikakulam, in the state of Andhra Pradesh, the incidence rates of palatal changes observed were 24.9 per 1000 men and 39.6 per 1000 women per year; almost all the lesions occurred among smokers.¹⁶⁹

Palatal changes among reverse smokers exhibit a varied clinical course. In 6 years of follow-up in Srikakulam district, 0.2% of palatal changes progressed to oral cancer, 74.5% remained stationary, 14.3% regressed completely and in 11% the clinical behaviour was not clear.¹⁶⁹ In Visakhapatnam district, where reverse *chutta* smoking is widely prevalent, the frequency of palatal cancer in the hospital was reportedly high—about 38%–48% of all oral cancers.¹⁷⁷

Premalignant conditions

Oral submucous fibrosis

Oral submucous fibrosis (OSMF or OSF) is a premalignant condition characterized by slowly progressive chronic fibrotic disease of the oral cavity and oropharynx, in which the oral mucosa loses its elasticity and develops fibrous bands, which ultimately lead to difficulty in opening the mouth. Several aetiological factors are suggested but it is now accepted that OSMF is clearly caused by areca nut chewing.¹⁷⁸

From an uncommon disease found mainly among old persons in India, OSMF is emerging as a new epidemic mainly among the youth (persons below 35 years), as shown by the increase in prevalence from 0.16 to 3.2 in Bhavnagar, Gujarat from the late 1960s to the late 1990s (Table 4.13).^{166,178} This dramatic increase in OSMF among young people in India has been attributed to *gutka* and *paan masala* chewing.^{178,179} The prevalence of OSMF in various Indian studies ranges from 0.03% to 3.2% (Table 4.13).^{165–168,180,181}

OSMF is a high-risk precancerous condition. From 4.5% to 7.6% of OSMF lesions progress to become oral cancer.^{182,183} The relative risk of malignant transformation among individuals with OSMF compared to individuals who do not have any oral precancerous condition was 397.3 (stratified for tobacco use).¹⁷⁴ The increased malignant potential is due to generalized epithelial atrophy. In India, a higher occurrence of leucoplakia and carcinoma is reported in patients with OSMF. It is believed to be an important factor responsible for the increasing incidence of oral cancer in lower age groups (below 35 years).^{178,184}

Oral lichen planus

Oral lichen planus (OLP) is a chronic mucocutaneous condition categorized as precancerous. The aetiology of OLP remains unclear; however, tobacco practices are reported to be

Table 4.13 Prevalence of oral submucous fibrosis (OSMF) in different areas

Place	Persons examined (n)	Persons with OSMF (n)	Prevalence (%)	Tobacco users (n)	Non-users of tobacco (n)	Type of population
Lucknow ¹⁶⁵	10,000	51	0.5	49	2	Urban
Bangalore ¹⁸⁰	10,000	18	0.18	–	–	Urban
Trivandrum ¹⁸¹	5000	61	1.2	–	–	Urban
Ernakulam ¹⁶⁶	10,287	36	0.4	–	–	Rural
Srikakulam ¹⁶⁶	10,169	4	0.04	–	–	Rural
Bhavnagar ¹⁶⁶	10,071	16	0.16	–	16	Rural
Bhavnagar ¹⁷⁸	5018	164	3.2	160	–	Rural
Agra ¹⁶⁷	7286	44	0.6	44	–	Rural
Pune ¹⁶⁸	101,761	33	0.03	30	3	Rural

an aetiological factor.¹⁸⁵ Malignant transformation was reported in 0.3% of cases in Ernakulam district, Kerala.¹⁶⁹ In India, a longitudinal study demonstrated an association between tobacco-chewing practices and OLP.¹⁸⁶

In India, the prevalence of OLP among 35,000 dental patients in four urban centres ranged from 0.02% to 0.4%.^{165,181,187} In a house-to-house study of random samples of 7639 Indian villagers, the prevalence varied from 0.1% to 1.5%.¹⁸⁵ The incidence rate of OLP in Ernakulam, Kerala was 2.1 per 1000 men and 2.5 per 1000 women per year among 34,039 persons, whereas in Bhavnagar, Gujarat, it was 0.1 per 1000 men and 0.03 per 1000 women per year in 32,841 persons.¹⁶⁷

Other tobacco-related oral mucosal lesions

Other common oral mucosal lesions reported from India include smokers' palate, leucoedema,

tobacco–lime users' lesion, OLP-like lesion, central papillary atrophy of the tongue, palatal erythema, palatal erythema with papillary hyperplasia and periodontal disease. The epidemiology of these lesions has been extensively studied and reported. The common thread among all of them is a strong association with tobacco use in any form. These lesions have not shown any significant excess malignant potential.^{162,165,169,188–190}

Effect of interventions on tobacco-related oral mucosal lesions

In India, the effects of primary intervention on tobacco-related oral mucosal lesions were studied in the rural populations of three districts: Ernakulam (Kerala), Bhavnagar (Gujarat) and Srikakulam (Andhra Pradesh).^{191,192} Table 4.14 shows the relationship between the regression rate of leucoplakia and changes in tobacco use in Ernakulam and Bhavnagar one year after the intervention. The regression rate

Table 4.14 Regression of leucoplakia according to change in tobacco use at the first follow up examination (n=11,388 subjects), one year after intervention in Ernakulam and Bhavnagar districts⁹³

Level of tobacco use	No. of leucoplakia lesions	No. of regressed leucoplakia lesions	Regression rate (%)
Ernakulam			
Unchanged/increased	263	3	1.1
Reduced/stopped	76	4	5.3*
Total	339	7	2.3
Bhavnagar			
Unchanged/increased	520	67	12.9
Reduced/stopped	9	5	55.6†
Total	529	72	13.6

*p<0.05; †p<0.01

Table 4.15 Comparison of 5-year age-adjusted incidence rate for leucoplakia in the intervention and control cohort in Ernakulam district, Kerala¹⁹¹

	Intervention cohort		Control cohort		Rate ratio
	Leucoplakia (n)	Incidence per 1000	Leucoplakia (n)	Incidence per 1000	
<i>Smoking</i>					
Men	15	8.0	34	24.5	0.33
<i>Chewing</i>					
Men	15	22.6	34	44.6	0.51
Women	21	6.2	67	33.5	0.19
<i>Mixed</i>					
Men	36	18.1	66	90.9	0.20
Women	1	9.4	2	49.0	0.19
<i>Total</i>					
Men	87	11.4	134	47.8	0.24
Women	22	5.8	69	33.0	0.18

of leucoplakia among those discontinuing or reducing their level of tobacco use was more than four times higher than among those who continued their practices.¹⁹³ In Srikakulam, a regression rate of palatal changes of 2.8%, 10.1% and 20.7% was observed among subjects who did not change, reduced and quit tobacco practices, respectively, after one year. At the end of a 5-year intervention in Ernakulam district, the age-adjusted incidence rate of leucoplakia per 1000 men was 47.8 in the control cohort versus 11.4 in the intervention cohort and, among

women, it was 33 versus 5.8 per 1000 (Table 4.15).¹⁹¹ In Srikakulam, the 5-year age-adjusted incidence rate for palatal changes per 1000 in the intervention cohort was 59.8 among men and 289.5 among women, while in the control cohort it was 260.8 among men and 489.5 among women.¹⁹¹ The intervention continued for 10 years and there was strong evidence for a decreased incidence of leucoplakia in Ernakulam and of palatal changes in Srikakulam, which represented a potential decrease in the risk of oral cancer.¹⁹⁴

4.7 TOBACCO-RELATED ORAL MUCOSAL LESIONS AND DENTAL DISEASES

KEY MESSAGES

- Tobacco use in any form has marked effects upon the soft tissues of the oral cavity.
- Tobacco use is associated with oral precancerous lesions such as leucoplakia and erythroplakia, and other oral mucosal lesions.
- Leucoplakia is the most common precancerous lesion associated with smoking and/or chewing tobacco.
- Oral submucous fibrosis (OSMF) is emerging as a new epidemic, especially among the youth. The dramatic increase in OSMF among young people in India has been attributed to chewing *gutka* and *paan masala*.
- Primary intervention has been found to be useful in reducing tobacco use and consequently the incidence of precancerous lesions.