

# SMOKELESS TOBACCO AND ITS ADVERSE EFFECTS ON ORAL CAVITY- AN OVERVIEW

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## Abstract

Smokeless tobacco is used without burning the product and can be used orally/nasally. The prevalence of smokeless tobacco use is more common in the Asian countries, especially in India. Smokeless tobacco use is more prevalent among young people and females, because of its ease of use without getting noticed. They are used in various forms like khaini, mawa, pan masala, snuff, mishri etc. More than 28 proven chemical carcinogens present in smokeless tobacco. The nicotine present causes addiction and cardio vascular diseases; on oral cavity it causes premalignant lesions like leukoplakia, erythroplakia and also oral cancer. Smokeless tobacco has deleterious effects on periodontium like increased gingival recession and attachment loss. On teeth, tobacco use increases the susceptibility to caries mainly due to the high sugar content of smokeless tobacco. This article aims to give a brief overview about the smokeless tobacco forms and effects on oral cavity, provides guidelines to counsel the patient and various nicotine replacement therapy that can be used safely in patients, who wish to quit the use of smokeless tobacco products.

**Key Words:** - Carcinogens, Khaini, Leukoplakia, Snuff, Tobacco Cessation

## Introduction

Smokeless tobacco products have been in existence for thousands of years among populations in South America and Southeast Asia. Over time, these products have gained popularity throughout the world. Oral smokeless tobacco products are placed in the mouth, cheek or lip and sucked (dipped) or chewed. Tobacco pastes or powders are used in a similar manner and placed on the gums or teeth.<sup>1</sup>

The World Health Organization predicts that during the first two decades of the 21st century, India will experience the fastest rate of rise in deaths attributable to tobacco worldwide. Given a population of over one billion people, this exponential increase in tobacco-related mortality from 1.4% of all deaths in India in 1990 to 13.3% in 2020 will result in tremendous social and economic burdens for this country.<sup>2</sup> In general, cigarettes account for only 20% of all tobacco consumed, while gutkha (chewing tobacco) each account for about 40% of tobacco consumption.<sup>3</sup>

Tobacco use is more common among males when compared with females.<sup>4, 5</sup> However, in female's use of smokeless tobacco is more common than any other form of tobacco.<sup>4</sup> Several studies of smokeless tobacco use by pregnant women in India demonstrate adverse reproductive outcomes, especially low birth weight.<sup>6,7,8,9</sup> Youth are especially vulnerable to initiating smokeless tobacco use. In many cultures, particularly in India, smokeless tobacco use is more socially acceptable than smoking,<sup>10</sup> and it is usually easy to practice without detection. There is also evidence that some advertising of smokeless tobacco products targets children.<sup>11</sup> Tobacco manufacturers sell "starter" products that are milder or sweeter for initiating users.<sup>12</sup> Smokeless tobacco products are usually cheaper than cigarettes. At present smokeless tobacco use is common among youth globally.<sup>13</sup>

Tobacco use among youth in India seems to be becoming more of a problem, especially in urban areas. Anecdotal

evidence suggests that the age of initiation of tobacco use is declining, with reports of children beginning to use tobacco as early at the age of 10.<sup>14</sup> There is also empirical evidence to suggest the use of tobacco is increasing among young people, in places like Delhi and Mumbai. In 2001, as part of the Global Youth Tobacco Survey (GYTS), 4.5% and 4.0% of students in grades 8–10 in these cities reported regular use of any tobacco.<sup>15</sup> In 2004, in a survey funded by the Indian Cancer Society, 8% of students in grades 7–10 in these cities reported the same indicating that tobacco use had almost doubled among youth in Delhi and Mumbai in less than three years.<sup>16</sup> In all surveys, smokeless forms of tobacco use (for example, gutkha) were more popular than smoked forms (for example, cigarettes, bidis). In another study it was found that most of the children usually began use of tobacco in 7th or 8th standard and the mean age group of acquiring this habit was 11.9 years.<sup>17</sup> Tobacco manufacturers encourage the use of smokeless tobacco products by smokers on occasions when they are not permitted to smoke and thereby promote individuals to adopt smokeless tobacco use in conjunction with continued smoking.

This paper reviews the forms of smokeless tobacco and its effects in the oral cavity and role of dental practitioner's tobacco cessation.

### Smokeless tobacco products:

Smokeless tobacco exists in two major forms: snuff and chewing tobacco. Other forms like applying over the gums and teeth and sucking is also practiced in India.

The most common methods of smokeless tobacco use in India are betel quid chewing and its variants. Betel quid chewing is an ancient practice—several millennia old. Betel quid is mentioned in ancient religious texts, medicinal treatises, literary works, and old stone inscriptions. Traditionally betel quid consisted of betel leaf, pieces of

areca nut, a few drops of lime (calcium hydroxide), several condiments, sweetening, and flavouring agents, depending on regional practices and individual preferences. After tobacco was introduced in India in the 17th century, it became an ingredient of the betel quid. Currently almost all habitual users of betel quid use it with tobacco. The betel quid chewing habit evolved into several variants<sup>18</sup> such as chewing of *mawa*, *khaini*, *mainpuri* tobacco, and, more recently, various brands of commercially manufactured and marketed *pan masala*.

#### **Khaini**

The tobacco-plus-lime mixture is probably the most common variant of the betel quid. The mixture is known as *khaini* in the northern part of India, and it is popular in other parts as well. To prepare the quid, the user places a small amount of tobacco in the palm; a dash of lime is flicked by a thumb or forefinger, and it is mixed and rubbed vigorously with the tobacco in the hand. The mixture is then ready for use and is placed in the mouth at various sites like canine region, labial groove; and tongue. The most common sites of oral cancers and pre-cancers also vary correspondingly in those regions.

#### **Mawa**

Another variant of betel quid that contains areca nut, tobacco, and lime. By weight, more than 90% of *mawa* is areca nut. It is prepared immediately prior to use and is generally purchased from kiosks that sell betel quid and other tobacco products. The vendor places small pieces of sun-cured areca nut (5.5 g) on a piece of cellophane (10 to 13 cm), adds tobacco flakes (0.4 g), and sprinkles a few drops of a solution of calcium hydroxide. The mixture is then tied as a round ball in the cellophane wrapper and it is typically rubbed in the palm for a couple of minutes, ostensibly to homogenize the *mawa* mixture. (More likely, this action produces greater availability of free nicotine through the action of calcium hydroxide on tobacco.)

#### **Pan Masala**

Generally available in two types—with tobacco and without tobacco—sold under the same brand name. The single name for both choices affords a significant marketing advantage to the manufacturer. Since there are no restrictions on advertising a consumer product that contains no tobacco, *pan masala* without tobacco is vigorously advertised and promoted, without restriction, even on the government-controlled electronic media.

#### **Mishri**

Mishri is a powdered form of roasted tobacco. It is common in Maharashtra and central regions of India, especially among women. People begin using *mishri* as a dentifrice, but it soon turns into an addiction. A typical user applies *mishri* to the teeth and gums several times a day.

#### **Gudakhu**

Tobacco is also used in the form of *gudakhu*, a paste made of tobacco and molasses. This is common in the eastern region.

There are more than 28 proven chemical carcinogens present in the smokeless tobacco<sup>19</sup>. Table 1 lists the carcinogens isolated and identified in smokeless tobacco.

*Table 1 Carcinogenic agent in tobacco.*

Carcinogens in smokeless tobacco	Concentration (ng/g)
Ethylcarbamate	310-375
Nitrosamines	
Nitrosodimethylamine	ND-270
Nitrosopyrrolidene	ND-760
Nitrosopiperidine	ND-110
Nitrosomorpholine	ND-690
Nitrosodiethanolamine	40-6,800
Nitrosoamino Acids	
3-(Methylnitrosamino)-propionic acid	200-65,700
4-(Methylnitrosamino)-butyric acid	ND-9,100
Nitrosoazetadine-2-Carboxylic acid	4-140
Tobacco-specific Nitrosamines	
N-Nitrosomonicotine	400-147,000
4-(Methylnitrosamino)-(3-pyridyl)-1-butanone	ND-18,000

\*ND-not detected

#### **Effects of smokeless tobacco on oral mucosa**

##### *Systemic effects*

The systemic effects of smokeless tobacco include nicotine dependence or addiction, transient increase in blood pressure and increased risk of cardio-vascular diseases. It is also reported that smokeless tobacco may contain high levels of sodium, which may contribute to elevated blood pressure. Chewing tobacco use is associated with an increased risk of death from coronary heart disease and cerebrovascular disease<sup>20</sup>. These systemic effects of smokeless tobacco use may not be of direct concern to dentists. Nonetheless, knowledge of these effects may assist in counseling patients, who have a long history of smokeless tobacco use.

##### *On periodontium*

Smokeless tobacco was strongly associated with severe active periodontal disease and inter-proximal attachment loss.<sup>21</sup> The primary periodontal alteration in smokeless tobacco users is localized gingival recession. In general,

gingival recession occurs in 25-30% of ST users. Most studies reported that recession occurred specifically in the area of tobacco placement<sup>22</sup> Periodontal pathology is most likely related to long-term use of ST and is more typical in adult population

The association of ST and gingival recession might be due to exacerbated inflammatory responses induced by ST, which contributes to accelerated periodontal breakdown and gingival recession at the site of placement.<sup>23</sup> Mechanical trauma resulting from the abrasive nature of the ST being held in close proximity to thin gingival tissues could also be contributory to recession.

### **On teeth**

#### *Dental caries*

Increased caries incidence has been reported in smokeless tobacco users.<sup>24,25</sup> This may be possibly explained by the fact - Smokeless tobacco contains high amounts of caries promoting sugars like sucrose, fructose, which stimulate the growth of cariogenic bacteria.<sup>26</sup> *In-vitro* evidence of stimulated growth of *Streptococcus mutans* and *Streptococcus sanguis* in the presence of smokeless tobacco extracts.<sup>27</sup>

One *in vivo* study found that micro-flora associated with root caries comprised a significantly larger proportion of colony-forming units on the root surface of teeth adjacent to the tobacco placement than on the teeth on the contralateral side of the mouth. The study also found significantly high level of collagenase on the side of the mouth where tobacco was placed. It was speculated that increased collagenase activity might interact with specific bacteria to enhance the development of root caries due to the organic nature of cementum.<sup>26</sup>

Another possible contributing mechanism in the development of root-surface caries among tobacco chewers, there is loss of keratinized gingiva and tooth abrasion, yielding a periodontal problem at the site where tobacco is held. A significant amount of root surface is exposed, reflecting the degree of gingival recession and bone loss. The exposed root surface caused by the loss of cementum and some dentin are at increased risk to develop caries.<sup>28</sup> ST users are also associated with poor oral hygiene and less sophisticated outlook on health care.<sup>29</sup>

Though there is insufficient evidence, to conclude that smokeless tobacco has a direct causal role in either caries formation or inhibition, literature suggests smokeless tobacco do play an important role in caries activity.

#### *Tooth abrasion and staining*

Tooth abrasion and severe staining of teeth are seen in association with ST use. The abrasion can be attributed to the chemical erosion or constant placement of the ST in the same anatomic site. Rare instances of ST-associated melanosis and prosthetic appliance stains have been reported.<sup>24</sup>

Other oral effects include staining of composite restorations and teeth, halitosis, and reduction of taste and smell acuity.<sup>30</sup>

### **Oral mucosa**

#### *Pan chewer's lesion*

Betel chewer's mucosa is a condition of the oral mucosa in which, because of either direct action of the quid or the traumatic effect of chewing (or both). The oral mucosa may desquamate or peel and detached white tags of tissue can also be seen and felt, thus giving a pseudomembranous or wrinkled appearance. The site commonly involved is buccal mucosa and the mandibular groove, corresponding to the site of the quid placement. In addition, the average age of people with chewer's mucosa is usually higher, at least 50 years, whereas cheek-biting typically occurs in younger people, around 20–35 years. This could be scraped off with a piece of gauze and usually these lesions disappear, when the habit is discontinued.<sup>31</sup>

#### *Lichenoid lesion*

A quid-induced lichenoid oral lesion has been reported exclusively among users of betel quid. It resembles oral lichen planus, but there are certain specific differences. This lesion was originally described as a lichen-planus-like lesion, but it is now termed a betel-quid lichenoid lesion.<sup>31</sup> This lesion may regress with decrease in the frequency or duration of quid use or a change in the site of placement of the quid. There may be complete regression if the quid habit is given up.

#### *Oral sub-mucous fibrosis*

Oral sub-mucous fibrosis (OSF) is most commonly developed in patients chewing areca nut. Although it is occasionally preceded by the formation of vesicles, OSF is always associated with a sub-epithelial inflammatory reaction followed by fibro-elastic changes of the lamina propria, accompanied by epithelial atrophy. This process leads to stiffness of the oral mucosa, which results in trismus and inability to eat.

OSF is diagnosed based on clinical criteria, including oral ulceration, paleness of the oral mucosa, a burning sensation (particularly in the presence of spicy foods), hardening of the tissue and presence of characteristic fibrous bands. The condition is associated with gradual onset of inability to open the mouth and protrusion of the tongue, which causes difficulty in eating, swallowing and phonation. It has been recognized that OSF may manifest itself at an early stage without the presence of fibrous bands, and although palpable fibrous bands are not always present, a tough leathery mucosa with all the associated symptomatic, clinical and histo-pathologic characteristics of OSF may be seen.

It is therefore, recommended<sup>31</sup> that the definition of OSF be extended and that this condition be diagnosed based on the presence of one or more of the following characteristics:

- Palpable fibrous bands
- Tough, leathery texture of the mucosa
- Blanching of the mucosa (defined as a persistent, white, marble-like appearance of the oral mucosa, which may be localized, diffuse or reticular),

#### *Oral cancer*

In India, the number of newly diagnosed tobacco-related cancers has been estimated at approximately 250 000 out of 700 000–900 000 new cancers diagnosed each year and this contributes to one-third of all cancers in India.

In an evaluation of epidemiological studies on the carcinogenic risk to humans of smokeless tobacco habits, the IARC Monographs Working Group has concluded that “there is sufficient evidence that smokeless tobacco causes oral cancer and pancreatic cancer in humans” and that smokeless tobacco is “carcinogenic to humans”.

In the studies from India, relative risks of oral cancer for men who were current chewers of pan with tobacco compared to non-chewers varied from 1.8 (95% CI: 1.2–2.7) to 5.8 (95% CI: 3.6–9.5). Relative risks of oral cancer for women who currently chewed pan with tobacco varied from 30.4 (95% CI: 12.6–73.4) to 45.9 (95% CI: 25.0–84.1).<sup>48,49</sup> The odds ratio for men who currently chewed areca nut without tobacco compared to non-chewers was 1.7 in one study.<sup>32</sup>

In a study been chewers of pan with tobacco developing oral cancer was 8.4 times (95% CI: 2.3–30.6) and without tobacco 9.9 times (95% CI: 1.8–55.6) greater than that of never-chewers, after adjustment for oral sub-mucous fibrosis, ever cigarette smoking, alcohol drinking and other chewing habits.<sup>33</sup> Retention of the quid overnight, analysed in another study, showed a 36-fold increased risk.<sup>34</sup>

In one study of oral cancer from India, current users of nasal snuff had a relative risk of 3.9 ( $P < 0.05$ ) for cancer of the gingiva.<sup>35</sup>

#### *Pre-cancer*

Oral mucosal disorders arise at the site where smokeless tobacco is regularly placed. These are mostly white plaques, with a wrinkled surface and are termed ‘leukoplakia’. However, in some cases reddish lesion are also seen, which are termed as “erythroplakia” Smokeless tobacco use is a strong risk factor for oral leukoplakia and length of use is a predictor of the severity of the lesion.

These precancerous lesions can be easily diagnosed and present an important indicator of oral cancer risk. Some studies report 2-12% of these lesions has been reported to turn malignant over several years. The malignant transformation of non-homogeneous lesions involving erythroplakia and nodular leukoplakia is particularly high, reportedly ranging from 15 to 40% depending upon the time period. Almost every tobacco chewing-related oral malignancy is preceded by a clinically distinct premalignant stage at the site of cancer.<sup>36</sup>

#### *Role of dentists*

Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit. It is essential that clinicians and healthcare delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a healthcare setting.

Dentists are in a unique position to respond to this tobacco - as a health problem. Many studies have reported that when dental personnel are actively involved in counselling patients on the harmful effects of smokeless tobacco, a greater proportion of patients stopped using this products.<sup>37</sup> Tobacco dependence treatments are effective across a broad range of populations.

Dentists are currently encouraged to make tailor made cessation strategy for each patient. To be successful the dentist should have attributes like should never give-up, be persistent and supportive.<sup>38</sup> Dentists should also provide the patient with accurate information on the negative factors of smokeless tobacco.

The "5 A's" for brief intervention are used in cases where the adolescent wishes to quit and include: -<sup>39</sup>

- Ask about tobacco use and document tobacco use status for every patient at every visit.
- Advise to quit. In a clear, strong, and personalized manner, urge every tobacco user to quit.
- Assess willingness to make a quit attempt.
- Assist in quit attempt.
- Arrange follow-up.

Anticipatory guidance — the practice of providing counsel regarding potential problems — is a key part of health care for the young, and can be considered an additional and important 'A' of this process. If dentists provide messages about tobacco use that are appropriate to the patient's age and developmental stage, the potential for broad public health impact is great.<sup>40</sup> A congratulatory message positively reinforced can truly enhance the chances of a child desisting from tobacco use in the future.

The five R's is recommended in the event that tobacco quitting is not being contemplated:

#### **Relevance**

Encourage the patient to indicate why quitting is personally relevant, being as specific as possible.

#### **Risks**

Dentist can help the patient to identify potential negative consequences of tobacco use. Suggest and highlight those that seem most relevant to the patient.

#### **Rewards**

Dentist should ask the patient to identify potential benefits of stopping tobacco use.

**Roadblocks**

The clinician should ask the patient to identify barriers or impediments to quitting and note elements of treatment.

**Repetition**

The motivational intervention should be repeated every time an unmotivated patient visits the clinic setting.

*Nicotine replacement therapy*

It is the formulations of nicotine, which deliver steady concentrations of nicotine into the blood, whose effect is to blunt the pleasurable effect of inhaled nicotine and, more importantly, to diminish the intensity of nicotine withdrawal symptoms.

NRT is available over the counter in most countries in various formulations including lozenges, gum, patches, spray, sublingual tablets and inhaler.

Seven first-line medications<sup>41</sup> (5 nicotine and 2 non-nicotine) reliably increase long-term smoking abstinence rates:

- Bupropion SR
- Nicotine gum/ lozenge
- Nicotine inhaler
- Nicotine nasal spray
- Nicotine patch
- Varenicline

**Limitations of NRT:**

- The common side effects of commonly used NRTs like Bupropion and Varenicline are insomnia, headache, dry mouth, convulsions and dizziness.
- The commonly available drugs are expensive, which is not affordable by all the patients.

In a recent meta-analytic review,<sup>42</sup> the authors concluded that Varenicline and behavioural interventions might help ST users to quit.

Counselling and medication are effective when used by themselves for treating tobacco dependence. However, the combination of counselling and medication is more effective than either alone. Thus, dentists should encourage all individuals to make a quit attempt and use both counselling and medication.

Fortunately, research has shown that, if lesions are identified early, the involved mucosa can revert back to normal upon cessation of smokeless tobacco use. Thus revealing the potential benefits achieved from tobacco cessation in dental office.

**Conclusions**

Given the fact, that tobacco use is one of the leading preventable causes of illness/death and also the dental practice setting provides an ideal opportunity to assist tobacco users in achieving tobacco abstinence. It is now in our hand, to take this as a social and moral responsibility to fight against this dreadful yet preventable condition – TOBACCO.

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