



Consequences of Smokeless Tobacco on Oral Health – A Review

Manju.J¹, Krithika.C^{2*}, ³Sridhar.C

¹Reader, Thai Moogambigai Dental College and Hospital, Dr.M.G.R Educational and Research Institute, Chennai.

²Professor Of Oral Medicine and Radiology, Meenakshi Academy of Higher Education and Research, Chennai.

³Sridhar.C, Academic Advisor, Professor of Internal Medicine, Meenakshi Academy of Higher Education and Research, Chennai.

*Corresponding Author: Krithika .C

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ABSTRACT:

Smokeless tobacco use is a prevalent and concerning global issue, profoundly impacting both general and oral health. This comprehensive review article delves into the multifaceted consequences of smokeless tobacco, covering its types, composition, and its effects on general health and oral tissues. The key findings include the elevated risks of cardiovascular diseases, various types of cancer, and addiction associated with smokeless tobacco use. Additionally, it explores the detrimental effects on oral health, such as dental diseases, periodontal conditions, and the development of oral cancer.

Introduction

Smokeless tobacco, often referred to as "spit" or "chew" tobacco, is a type of tobacco product that is consumed by placing it in the mouth between the cheek and gum, or it can be sniffed or inhaled through nose.¹ Unlike smoking, which involves inhaling the tobacco's fumes, smokeless tobacco is used orally, where the nicotine and other chemical compounds are absorbed through the mucous membranes in the mouth. Smokeless tobacco is a broad category encompassing various products such as chewing tobacco, dry snuff, moist snuff, Swedish-style snus, betel quid, gutkha, zarda, toombak, and others. These products are typically composed of a mixture that includes tobacco, nicotine, sweetening agents, abrasives, salts, and various chemicals. They contain over 4,000 different chemicals, with more than 30 of these identified as carcinogenic substances. When compared to smoked tobacco, smokeless tobacco delivers nicotine at a significantly higher rate, around 3 to 4 times more.² Consuming 8 to 10 chews or dips of smokeless tobacco daily is equivalent to the nicotine intake from smoking 30 to 40 cigarettes a day. The choice of smokeless tobacco products used is closely linked to regional preferences, and products like betel quid, khaini, and gutka are among the most commonly consumed.³ These products

may exhibit different usage patterns among men and women in different regions. Additionally, socioeconomic factors, such as household wealth and education, play a significant role in influencing the prevalence of smokeless tobacco use.⁴

Types of Smokeless Tobacco

Smokeless tobacco products encompass a wide range of items, including chewing tobacco, snuff, snus, and dissolvable tobacco. Chewing tobacco can be found as loose leaves, braided leaves, or compressed leaves, often with added flavours. It goes by various names like chew, spitting tobacco, or spit. Snuff is finely ground tobacco, available in dry or moist forms, and is sometimes flavoured. Dry snuff can also be snorted. Snus, a type of moist snuff, is primarily used in Sweden and Norway. Dissolvable tobacco products come in powdered forms pressed into shapes like tablets, sticks, or strips, often resembling candy. Some contain sweeteners and flavors, and they dissolve in the mouth. These are distinct from nicotine lozenges used for smoking cessation. These products mainly employ *Nicotianatabacum* and sometimes *N. rustica*, with regional variations in processing and preparation. Different products, like betel quid with tobacco, khaini, gutka, and others, are widely used in various regions,



often in combination with areca nut and other ingredients. Zarda is a smokeless tobacco product composed of a blend of tobacco, lime, spices, and natural coloring agents. The production process involves breaking up tobacco leaves, boiling them with lime and spices until they become dry, and then adding vegetable dyes to give it its characteristic color. Zarda is typically consumed by chewing, often mixed with finely chopped areca nuts and additional spices. It is also frequently incorporated as an ingredient in betel quid preparations. Nasal use of smokeless tobacco is less common but exists in some regions. Dry snuff, primarily in Europe, is inhaled into the nostrils. Liquid snuff has been reported in the past among specific communities like the Nandi tribe in East Africa. The diversity of smokeless tobacco products and their consumption methods reflects regional and cultural preferences, with varying health implications.⁵

Composition of Smokeless Tobacco

The composition of smokeless tobacco is a multifaceted subject influenced by various factors, primarily the type of tobacco employed. Different curing methods and specific tobacco varieties, including air-cured, flue-cured, fire-cured, Burley, Wisconsin, Pennsylvania air-cured, dark fire-cured, and Virginia flue-cured, contribute to its chemical makeup. The entire production process, encompassing curing and fermentation, introduces significant variations in composition. Smokeless tobacco is a complex blend of numerous chemical compounds, with 3,044 identified as far back as 1988.⁶ Among these, tobacco-specific N-nitrosamines (TSNA), recognized as carcinogens, are of particular concern. TSNA can exist in non-volatile and volatile forms, along with N-nitrosamino acids, and their levels differ significantly among various smokeless tobacco products. The pH and concentration of nicotine, the bio available form, play a pivotal role in determining these carcinogen levels. Moreover, factors beyond the choice of tobacco, such as genetic makeup and environmental conditions during cultivation, significantly impact the composition. Storage conditions are also influential, with higher temperatures leading to increased carcinogen levels, particularly TSNA, over time. In addition to TSNA, smokeless tobacco contains other carcinogenic compounds, including polycyclic aromatic hydrocarbons (PAHs), formaldehyde, acetaldehyde,

crotonaldehyde, and even radioactive elements like polonium-210 and uranium-235. Understanding of smokeless tobacco's chemical composition is vital for both public health awareness and furthering scientific research. In India, the composition includes parameters such as a pH level around 5.21, affecting the release of bioavailable nicotine and other chemical compounds during consumption. Furthermore, Indian smokeless tobacco products typically contain around 4.04 µg/g of ammonia, influencing both flavor and potential health risks. The total carbonate content, measuring approximately 140 µg/g, contributes to the product's overall chemical profile and pH level. Nicotine, found at a concentration of 1.24 mg/g, is a central component and underpins the addictive nature of smokeless tobacco. Notably, N-Nitrosornicotine (NNN) and 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), two well-known tobacco-specific N-nitrosamines (TSNA), are often reported as "ND" in Indian smokeless tobacco, indicating non-detectable or levels below quantification limits. Furthermore, Indian smokeless tobacco contains low levels of the highly carcinogenic polycyclic aromatic hydrocarbon, Benzo[a]pyrene, typically less than 0.0001 µg/g. Cadmium, an environmental contaminant, is present at approximately 0.03 µg/g, while arsenic is found at around 0.07 µg/g, both with potential health implications. Given that nitrate levels can vary, it is essential to consider them in Indian smokeless tobacco due to their role in the formation of harmful compounds during curing and fermentation. The composition of Indian smokeless tobacco is influenced by a blend of factors, including tobacco type, curing methods, and regional agricultural and manufacturing practices.⁷

Harmful Effects of Smokeless Tobacco on Oral Tissues

Smokeless or chewing tobacco use can lead to a range of oral mucosal lesions and health risks. Placing smokeless tobacco in the oral cavity, particularly in the buccal mucosa and gingival sulcus, initially leads to keratotic or hyperkeratotic changes termed "tobacco pouch keratosis." Over time, this area can evolve into oral potentially malignant disorders such as leukoplakia, erythroplakia, and oral submucous fibrosis. Oral Submucous Fibrosis (OSMF) is mainly caused by areca nut rather than smokeless tobacco itself, results in a progressive limitation of mouth opening. Areca nut is



often present in gutka products, contributing to the prevalence of this condition. especially among gutka users. OSMF is a chronic and insidious condition that affects the submucosa of the oral cavity. It has become a concerning epidemic among young people in India. Studies have reported significant odds ratios for the association between gutka use and oral submucous fibrosis.⁸ Leukoplakias, typically diagnosed after the age of 40 and more common in males and smokeless tobacco users, are classified into homogeneous and non-homogeneous types. Non-homogeneous leukoplakias can be speckled, nodular, or verrucous, each with distinct characteristics. Most leukoplakias are asymptomatic, but the presence of erythroleukoplakia indicates possible colonization by candida organisms and an increased risk for dysplasia and malignancy. Proliferative verrucousleukoplakia is a rare entity that carries a higher risk of malignant transformation. Erythroplakia appears as a red patch and may indicate underlying malignancy.⁹ Smokeless tobacco is linked to an increased risk of Oral Squamous Cell Carcinoma (SCC) and verrucous carcinoma. SCCs appear as granular areas or exophytic-ulcerative-infiltrative growths, often with distinct rolled borders and induration. Buccal and tongue sites are particularly susceptible to these cancers. Verrucous carcinoma, accounting for a significant portion of oral cancers, typically presents as a slow-growing tumor with leukoplakic patches, and it has a high potential for local recurrence but a lower risk of nodal metastasis.^{10,11} Chewing tobacco and using smokeless tobacco (SLT) products have severe repercussions for oral health, with specific adverse effects on both dental and periodontal aspects. One of the most prevalent consequences is tooth discoloration. The abrasive nature of tobacco products, especially when consistently chewed, can lead to tooth abrasion, contributing to the deterioration of the tooth's structure. Consequently, individuals who use tobacco products face a 67 percent greater risk of experiencing tooth loss compared to non-users. This can give rise to a host of oral health problems and a reduced overall quality of life. Furthermore, smokeless tobacco users are more prone to gingival recession.¹² This condition leads to the exposure of tooth root surfaces, which, in turn, heightens the likelihood of developing periodontal problems. These include the formation of periodontal pockets, the accumulation of plaque and calculus, all of which are contributing factors to the

onset of periodontitis, an advanced form of gum disease. The detrimental effects of tobacco use on oral health are compounded by the presence of sweetening and flavoring agents in tobacco products. These additives further promote tooth decay, adding to the oral health challenges faced by tobacco users. Extensive research has provided evidence of significant odds ratios for various periodontal issues among tobacco chewers, encompassing conditions such as gingivitis, gingival recession, and periodontal pocketing.¹³

Conclusion

The various forms of smokeless tobacco with different chemicals which vary in composition and preparation, leading to different methods of consumption and potential health risks. One notable trend is the shift in smokeless tobacco use towards younger individuals and initiation at an earlier age. This highlights the urgency of early intervention and educational efforts to prevent the initiation of smokeless tobacco use and its consequences on oral health.

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