

Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

NLM ID: 101716117

Journal home page: www.jamdsr.com

doi: 10.21276/jamdsr

Indian Citation Index (ICI)

Index Copernicus value = 100

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Review Article

Oral Mucosal Changes Due to Smokeless Tobacco, Betel Quid and Areca Nut: A Review of Risks and Pathology

¹Mahendrakumar Achlaram Chaudhari, ²Mansi Panchal, ³Nidhi Singh, ⁴Tejashri Fegade, ⁵Lalbahadur Laxmandas Sadhu

¹Research Scientist (MD, MS in Clinical Research), Department of Medicine, Rheumatology, Chobanian & Avedisian School of Medicine, Boston University, USA;

²Department of Health and Human Services, Southern Connecticut State University, New Haven, CT, USA;

³Consultant Oral Physician and Oral Radiologist, Ahmedabad, India;

⁴Consultant Endodontist and Conservative Dentist, Bhusawal, Jalgaon, Maharashtra, India;

⁵Senior Lecturer, Department of Oral and Maxillofacial Pathology, Ahmedabad Dental College and Hospital Bhadaj, Ahmedabad, India

ABSTRACT:

The effects of betel, areca nut and tobacco consumption on the oral mucosa have been extensively reviewed, highlighting their association with oral cancer and various precancerous lesions. The term "quid" refers to a substance or mixture of substances placed in the mouth, chewed, and kept in contact with the mucosa, typically containing tobacco and areca nut. A betel quid specifically includes any quid wrapped in a betel leaf. Quid-related lesions can be classified into two main categories: those with a diffuse outline and those localized to the area where the quid is habitually placed. Expanded criteria and guidelines have been introduced to identify and describe conditions such as chewer's mucosa, areca nut chewer's lesion, oral submucous fibrosis and other quid-related abnormalities. Additionally, a newly recognized clinical condition, betel-quid lichenoid lesion, has been proposed to describe an oral lichen planus-like lesion associated with betel quid use. As an early indication of oral mucosal damage, individuals who chew betel quid, with or without tobacco, frequently develop visible white (leukoplakia) or red (erythroplakia) lesions, along with stiffening of the oral mucosa and the development of oral submucous fibrosis (OSF).

Received: 24 February, 2025

Accepted: 28 March, 2025

Corresponding author: Mahendrakumar Achlaram Chaudhari, Research Scientist (MD, MS in Clinical Research), Department of Medicine, Rheumatology, Chobanian & Avedisian School of Medicine, Boston University, USA

This article may be cited as: Chaudhari MA, Panchal M, Singh N, Fegade T, Sadhu LL. Oral Mucosal Changes Due to Smokeless Tobacco, Betel Quid and Areca Nut: A Review of Risks and Pathology. J Adv Med Dent Scie Res 2025; 13(4):19-22.

INTRODUCTION

The oral cavity is lined by two types of mucosa: keratinized and nonkeratinized. Keratinized mucosa, found in areas like the gingiva and hard palate, contains keratin, providing resistance to mechanical stress and protecting underlying tissues from damage. Nonkeratinized mucosa, found in areas like the lips, cheeks, and floor of the mouth, lacks keratin, making it more pliable and sensitive. It helps with lubrication, speech, swallowing, and forming the oral seal.

Together, these mucosal linings protect against physical, chemical, and microbial threats while supporting sensory functions and initiating digestion. However, habits like chewing and smoking can

damage the oral mucosa, leading to increased epithelial thickness and keratinization.¹

Quid, a substance chewed or sucked in the mouth, often contains tobacco, areca nut, or both, staying in contact with the oral mucosa for long periods. It is classified into three types: (1) betel quid (pan) with areca nut but no tobacco, (2) tobacco products without areca nut and (3) gutkha, which combines both. The composition varies by region and preference.²

Betel quid consists of areca nut, catechu, slaked lime, and spices wrapped in betel leaf.³

Chewed for hours, slaked lime releases alkaloids, creating a euphoric effect. Variants include sweetened versions marketed to children and forms containing

tobacco, such as gutkha.⁴ In India chewing tobacco is a common form of tobacco use. It can increase the chances of developing cancers in areas like the throat and lead to conditions such as keratosis, erythroplakia, leukoplakia and oral submucous fibrosis (OSMF) which can be severe.^{5,6}

The increasing use of gutkha and pan masala, particularly among young individuals, is contributing to a rise in oral cancer. While smoking remains socially unacceptable for many women and children, smokeless tobacco products are more widely accepted, posing significant health risks.⁷ Smokeless tobacco, applied orally, includes dip, plug, chew, and snuff, available in three main types: loose-leaf chewing tobacco, moist snuff, and dry snuff. Previously used by a small segment of the population, its popularity has now expanded to both urban and rural areas.⁸

Carcinogens in gutkha and pan masala originate from areca nut, lime, catechu, and tobacco.⁹ These products contain harmful nitrosamines such as TSNA, NNN, NNK, and NAB, which have been detected in the saliva of betel quid users. Other toxic substances found in smokeless tobacco include nicotine, polycyclic aromatic hydrocarbons (PAHs), aldehydes, and metals. TSNA develops during tobacco processing, and habitual snuff users typically consume 10–15 grams per day, keeping it in their mouth for extended periods.¹⁰

Quid-related lesions fall into two categories: diffusely outlined and localized at habitual quid placement sites. These lesions include chewer's mucosa (thickened oral tissues), areca nut chewer's lesion (tissue changes from areca nut), and oral submucous fibrosis (OSMF) (progressive fibrosis leading to restricted mouth opening and cancer risk).²

A newly identified condition, betel-quid lichenoid lesion, mimics oral lichen planus, presenting as white lace-like or inflamed red patches. Early signs of mucosal damage in quid users include leukoplakia (white patches) and erythroplakia (red patches), both with malignant potential. OSMF can lead to severe oral stiffness, impairing eating and speech.

Early detection and quitting quid use are crucial in preventing oral cancer. Regular check-ups and awareness can help identify and manage these lesions before they progress.

Here we reviewed these mucosal lesions and conditions.

ORAL SUBMUCOUS FIBROSIS

Oral Submucous Fibrosis (OSMF) is a potentially malignant condition characterized by progressive fibrosis (scarring) and inflammation of the connective tissue beneath the oral mucosa. This condition is most commonly associated with the habit of chewing betel quid, areca nut, or smokeless tobacco, although it can also occur due to other factors like chronic irritation from sharp teeth or ill-fitting dental appliances.¹¹

The initial stage of OSMF involves inflammation near

the epithelium, which leads to the thickening and fibrosing of the submucosal tissues. Over time, this scarring affects the normal architecture of the oral cavity, making the tissue less flexible and more rigid. As the condition progresses, it results in thinning of the overlying epithelium (the outer layer of the mucosa), which compromises its protective function and makes it more vulnerable to irritation and infection.¹²

One of the hallmark symptoms of OSMF is trismus or difficulty in opening the mouth, which can significantly impair the ability to eat, speak, and maintain proper oral hygiene. The stiffness and reduced mobility of the oral tissues make it hard for individuals to open their mouths wide enough to chew food properly or perform oral hygiene tasks, increasing the risk of plaque buildup, tooth decay, and gum disease. In advanced stages, speech difficulties may also arise, further affecting the individual's quality of life.¹³

The pathophysiology of OSMF involves the deposition of excess collagen and fibroblasts in the submucosal tissues, which causes a reduction in the elasticity of the affected areas. This leads to progressive loss of oral cavity mobility. The fibrotic changes in OSMF also predispose the individual to oral cancers due to the ongoing cellular changes and the chronic irritation associated with these habits. The combination of chronic inflammation, tissue damage, and the presence of carcinogens in substances like areca nut and tobacco significantly increases the risk of developing oral squamous cell carcinoma (OSCC).¹¹

Recognizing the signs and symptoms of OSMF early is vital for preventing disease progression. Common early signs include a burning sensation in the mouth, difficulty swallowing, and changes in the appearance of the mucosa, such as pale or leathery patches. As the condition advances, the fibrotic bands become more pronounced, and the mouth may become severely restricted in its movement.¹³

LEUKOPLAKIA

Leukoplakia is a potentially precancerous lesion of the oral cavity, strongly associated with smokeless tobacco use, particularly among young adults and adolescents. It presents as a persistent white or yellow patch on the oral mucosa, often in areas subject to chronic irritation. The lesion may vary in texture, ranging from smooth to rough or raised, and cannot be scraped off, distinguishing it from conditions like oral thrush.¹⁴ It is keratotic, meaning it involves abnormal thickening of the keratin layer, which can make the surface appear rough.

The rate of transformation annually varies across regions globally likely influenced by differences in tobacco and dietary practices. Epithelial dysplasia serves as an indicator, for predicting progression.¹⁵ Lesions in high-risk areas like the tongue, floor of the mouth, or soft palate are more likely to become

cancerous. Diagnosis is confirmed through clinical examination and biopsy to assess dysplasia or malignancy.¹⁶

ERYTHROPLAKIA

Erythroplakia is a red patch on the oral mucosa, often found on the floor of the mouth. It is a diagnosis of exclusion, meaning it cannot be identified as any other condition. Similar to leukoplakia (white patches), erythroplakia is defined as a fiery red or velvety plaque with a high risk of malignant transformation. Unlike leukoplakia, which can sometimes be benign, erythroplakia often shows severe epithelial dysplasia or early cancer upon biopsy. Its exact cause is unclear but is strongly linked to tobacco, alcohol, betel quid, and chronic irritation.

Due to its high cancer potential, erythroplakia requires immediate biopsy and may need surgical removal. Eliminating risk factors, regular monitoring, and early intervention are key to preventing its progression.²

ORAL SQUAMOUS CELL CARCINOMA

Oral squamous cell carcinoma (OSCC) accounts for more than 90% of all cancers occurring in the mouth. The terms oral cancer (OC) and OSCC are often used interchangeably.¹⁷ OSCC ranks as the eighth most prevalent cancer globally and originates from the epithelial cells lining the oral cavity. It is strongly associated with risk factors such as tobacco use—both smoking and smokeless forms—as well as excessive alcohol consumption. A key precursor to OSCC is the presence of potentially malignant disorders (PMDs), which include a range of oral lesions that exhibit cellular alterations, increasing the likelihood of malignant transformation.^{18,19} Since dentists and other oral health professionals regularly examine the oral cavity, they should be well-versed in recognizing the characteristics of oral cancer. While diagnosing advanced OC is usually straightforward, detecting early signs of malignancy can be challenging, as they may be subtle and easily overlooked during routine evaluations.²⁰⁻²³

TOBACCO POUCH KERATOSIS

Tobacco pouch keratosis is a white keratotic lesion in the oral mucosa due to prolonged smokeless tobacco use. It commonly affects the anterior mandibular and posterior vestibules, where tobacco is placed. Lesions appear white, wrinkled, or leathery and develop over 1 to 5 years, depending on usage frequency and type. Histologically, the epithelium is thickened and hyperkeratinized, sometimes showing parakeratotic chevrons and increased vascularity.

While epithelial dysplasia is rare, regular monitoring is essential to prevent cancer risk.²

QUID-INDUCED LICHENOID LESION

A quid-induced lichenoid lesion is a condition that occurs exclusively in betel quid users, resembling oral lichen planus but with distinct features. It appears as

fine, white, wavy, parallel lines that do not overlap, intersect, or become raised.²⁴ In some cases, these lines radiate from a central red area, forming a characteristic pattern. Unlike classic oral lichen planus, this lesion is directly linked to quid use and typically develops at the site of quid placement in the mouth.

The severity and persistence of the lesion depend on the frequency, duration, and location of quid placement. A key feature of this lesion is its ability to regress. If quid use is reduced in frequency or duration or if the placement site is changed, the lesion may show signs of healing. In many cases, complete regression is observed when quid chewing is entirely stopped.²⁵ Early detection and quitting the habit are essential in preventing long-term complications and reducing the risk of malignant transformation. Regular oral check-ups can help track changes and allow for timely intervention if necessary.

CONCLUSION

The detrimental impact of smokeless tobacco, betel quid, and areca nut on oral health is undeniable, with strong links to precancerous lesions and oral cancer. Chronic exposure to these substances triggers progressive epithelial changes, increasing the risk of malignant transformation. While some conditions may regress with habit cessation, others like OSMF and leukoplakia, can persist and lead to oral squamous cell carcinoma (OSCC) if not addressed promptly.

Given the rising prevalence of gutkha and pan masala use, particularly among youth, urgent action is needed. Public awareness, strict regulations, routine oral screenings, and cessation programs are key to reducing the incidence of quid-induced lesions and malignancies.

Encouraging regular dental check-ups, lifestyle changes, and early interventions can further minimize the health burden. Ultimately, the fight against oral precancer and cancer hinges on education, healthcare policies, and community-driven initiatives. Through early diagnosis, preventive strategies, and continuous monitoring, the progression of quid-related oral diseases can be curbed, fostering better oral and overall well-being.

REFERENCE

1. Ramasamy J, Sivapathasundharam B. A study on oral mucosal changes among tobacco users. *J Oral Maxillofac Pathol.* 2021; 25(3): 470-477.
2. Sahitha R. Effects of smokeless tobacco, betel quid and areca nut on oral mucosa. *IOSR J Dent Med Sci.* 2014;13(2):8-11.
3. Farrand P, Rowe RM, Johnston A, Murdoch H. Prevalence, age of onset and demographic relationships of different areca nut habits amongst children in Tower Hamlets, London. *Br Dent J* 2001;190(3):150-4.
4. Neville BW, Damm DD, Allen CM, Bouquot JE. *Oral and maxillofacial pathology.* 2nd ed. Philadelphia: W.B. Saunders Company;2002. p. 349-50.
5. Preeti S, Raut DK. Prevalence and Pattern of Tobacco Consumption in India. *Int Res J Soc Sci.* 2012:1-8.

6. Tarsariya VM, Mehta DN, Raval N, Patadiya HH, Vachhrajani K, Ashem A. Evaluation of serum immunoglobulin (IgG, IgM, IgA) in potentially malignant disorders of oral cavity–A case control study. *Journal of Oral Biology and Craniofacial Research*. 2020 Oct 1;10(4):665-9.
7. Majumder P, Thomas PA, Motghare V, Manek PV, Nazneen L, Basak S, Acharya S. Effectiveness of Structured Teaching Program on Adolescent's Knowledge of Tobacco Consumption: A Randomized Control Trial. *J Pharm Bioallied Sci*. 2024 Dec;16(Suppl 4):S3464-S3466.
8. Jagriti Gupta, Krishna kumar Gupta, Fajad mansoor samadi, Arpita Kabiraj. Smokeless tobacco and oral cancer- A review. Year 2012; volume3; issue2; page 74-78.
9. International Agency for Research on Cancer. IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans. Tobacco habits other than smoking; betel-quid and areca-nut chewing; and some related nitrosamines. Vol. 37. 291 pp. Lyon, France: IARC, 1985.
10. Hoffmann, D., Brunnemann, K.D., Prokopczyk, B. and Djordjevic, M.V. (1994) Tobacco-specific N-nitrosamines and areca-derived N-nitrosamines: chemistry, biochemistry, carcinogenicity and relevance to humans. *J. Toxicol. Environ. Health*, 41, 1±52.
11. Chandrashekhara S. C-reactive protein: An inflammatory marker with specific role in physiology, pathology, and diagnosis. *Internet J rheumatol clin immunology*. 2014; 2(S1).
12. Sargaiyan V, Singh S, Shukla R, Tanwar AS, Mehta T, Manek PV, Patel BJ, Patel KJ. Hematological profile of OSMF patients with increasing severity. *Bioinformation*. 2024 Apr 30;20(4):353-357.
13. Khan S, Mehta DN, Jain P, Somani S, Pathan MA, Thakkar H, Agrawal S. A Study to Assess the Role of Psychological Stress in the Severity of Oral Lichen Planus, OSMF, and Leukoplakia and its Correlation with Serum Cortisol Levels. *Journal of Pharmacy and Bioallied Sciences*. 2024 Jul 1;16(Suppl 3):S2021-3.
14. Angadi PV, Rekha KP. Oral submucous fibrosis: a clinicopathologic review of 205 cases in Indians. *Oral Maxillofac Surg*. 2011; 15(1): 15-9.
15. Mehta D, Singh N, Agrawal K, Patel M, Shah V, Oza D. Evaluation of Serum C-reactive Protein Levels in Patients with Oral Submucous Fibrosis and Control Group: A Comparative Study. *Advances in Human Biology*. 2025;10-4103.
16. Ankit K, Khan Y, Jaiswal A, Rana D, Qurishi AA, Pandey S, Manek PV. Prevalence and Patterns of Oral Mucosal Lesions Among Geriatric Patients in India: A Retrospective Study. *J Pharm Bioallied Sci*. 2024 Jul;16(Suppl 3):S2303-S2305.
17. Van der Waal I, Schepman KP, van der Meij EH, Smeele LE. Oral leukoplakia: a clinicopathological review. *Oral Oncol*. 1997; 33(5): 291-301.
18. Van Zyl A, Bunn BK. Clinical features of oral cancer. *SADJ*. 2012 ;67(10): 566-9.
19. Katria V, Dhaka P, Parihar J, Chaudhari MA, Soni J, Bhardwaj MD. Oral Cancer, Oral Health And Potentially Malignant Disorders A Review . *J Adv Med Dent Scie Res* 2025; 13(2) : 25- 30.
20. Mehta DN. Lycopene: Structure, pharmacokinetics and role in oral cancer precancerous lesions. *J Res Adv Dent*. 2012;1:44-9.
21. Patadiya HH, Meher K, Nanda S, Panigrahi R, Bhardwaj U, S R, et al. Exploring the Role of Genetic Testing in Personalized Oncology Treatment and Patient Prognosis. *Seminars in Medical Writing and Education* [Internet]. 2024 Dec. 31 [cited 2025 Apr. 1];3:534. Available from: <https://mw.ageditor.ar/index.php/mw/article/view/534>
22. Patadiya H H. Proliferative Verrucous Leukoplakia: A Persistent and High-risk Oral Disorder. *International Journal of Food and Nutritional Sciences*. 2020; 9(3):519-530.
23. Satya Prakash Gupta Soumya Allurkar, Hiren Hansraj Patadiya, Himani Marmat, Debapriya Kundu, Satinder Pal Singh Tuls. Survival outcomes and response rates among patients with recurrent or metastatic head and neck squamous cell carcinoma. *Bioinformation* 2025;21(1) : 44-47.
24. Raval N, Mehta D, Modi C, Vachhrajani K, Nimavat A. Oral Lichen Planus: An Update on Etiology, Pathogenesis and Management-A Review of Literature. *Advances in Human Biology*. 2013 Sep 1;3(3):14-9.
25. Kashyap P, Mehta T, Raval C, Manek PV, Kewalia K, Guruprasad Y, Arya S. Clinical Correlation of Types and Forms of Smokeless Forms of Quid (Tobacco and Arecanut) and Occurrence of Oro Mucosal Lesions: A Cross-Sectional Study. *J Pharm Bioallied Sci*. 2024 Jul; 16(Suppl 3):S2182-S2184.