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THE IMPACT OF LONG-TERM USE OF SWEDISH SNUS ON THE RISK OF MALIGNANT TRANSFORMATION OF THE ORAL MUCOSA

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ABSTRACT

Objective: Swedish snus is a widely used form of smokeless tobacco, often considered a less harmful alternative to cigarette smoking. The aim of this review is to evaluate the impact of long-term snus use on oral mucosal changes and to assess the risk of malignant transformation associated with these lesions.
Methods: A narrative review of the literature was conducted, focusing on epidemiology, chemical composition, biological effects, and clinical manifestations of long-term snus use. Studies describing oral mucosal lesions, histopathological features, and cancer risk were analyzed.
Results: Long-term use of Swedish snus leads to characteristic oral mucosal changes, most commonly presenting as well-demarcated whitish or yellowish hyperkeratotic lesions at the site of tobacco placement. Histopathological findings include epithelial thickening, hyperkeratosis, and minimal or absent dysplasia. These lesions are typically asymptomatic and often reversible after cessation of snus use. Although snus contains carcinogenic compounds such as tobacco-specific nitrosamines, epidemiological studies indicate a relatively low risk of malignant transformation compared to other forms of smokeless tobacco. No significant increase in oral cancer incidence has been demonstrated among exclusive snus users, although rare cases of malignant transformation have been reported.
Conclusions: Swedish snus is not a harmless product and is associated with distinct oral mucosal changes. Despite the relatively low risk of malignant transformation, these lesions require clinical monitoring. Early detection, cessation of use, and appropriate management significantly reduce potential complications. Preventive strategies, including patient education and regular dental examinations, remain essential.

KEYWORDS

Swedish Snus, Smokeless Tobacco, Oral Mucosa, Leukoplakia, Potentially Malignant Disorders, Oral Cancer, Tobacco-Specific Nitrosamines, Keratosis, Histopathology, Nicotine Dependence, Oral Lesions, Cancer Risk

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Introduction

Swedish snus is a form of moist smokeless tobacco used orally—most commonly as finely ground, pasteurized tobacco packaged either loose or in small portioned pouches. The tradition of snus use dates back to the 17th century in Sweden, which currently has the highest consumption of this product worldwide. Snus is placed under the upper lip in the oral vestibule, where nicotine and other compounds are absorbed through the mucous membrane.

Snus use is particularly widespread among men—approximately 20% of adult men in Sweden use snus regularly, while the proportion among women is significantly lower. In recent decades, its popularity has also increased in other Scandinavian countries, especially among young adults (e.g., in Norway, regular snus use among individuals aged 16–24 reaches ~29% in men and ~12% in women).

Snus is sometimes presented as an alternative to cigarette smoking in tobacco harm-reduction strategies, due to the absence of smoke and lower levels of certain toxins compared to traditional chewing tobacco. Nevertheless, it contains high doses of nicotine, which poses a significant risk of addiction.

Potential Health Risks

Long-term snus use is not free from adverse health effects. Like all tobacco products, snus contains numerous harmful substances and carcinogens. In particular, it includes tobacco-specific nitrosamines (TSNAs)—compounds with proven carcinogenic effects—although their levels in Swedish snus have been reduced due to improvements in production and storage processes.

Studies have shown that concentrations of nitrosamine metabolites (e.g., NNAL) in the urine of snus users reach approximately half the levels observed in smokers. Additionally, snus contains other toxic substances typically found in tobacco (including polycyclic aromatic hydrocarbons, heavy metals, and formaldehyde).

Snus use is associated with several documented health effects: nicotine dependence may affect the cardiovascular system (e.g., increased heart rate and blood pressure), and epidemiological data suggest that long-term use may increase the risk of certain cancers outside the oral cavity. Current reviews indicate that snus likely increases the risk of esophageal and pancreatic cancer, and possibly also gastric and rectal cancer.

Long-term users of snus have also shown slightly higher overall cancer-related mortality compared to non-tobacco users. Although many of these risks appear lower than those associated with cigarette smoking, snus is not a harmless product—it entails significant biological consequences, including exposure to carcinogens and continuous nicotine stimulation.

Importance of Oral Mucosal Changes

One of the most characteristic local effects of long-term snus use is the development of changes in the oral mucosa at the site where the tobacco is placed. Chronic irritation from tobacco and its chemical components leads to the formation of well-demarcated areas with altered color and surface structure.

These changes—often described as keratotic lesions or snus-associated leukoplakia—constitute an important clinical issue. Firstly, their presence indicates chronic tissue damage caused by tobacco, requiring evaluation and intervention. Secondly, such mucosal lesions may represent precancerous conditions, meaning they can potentially develop into malignant tumors (oral cancer).

Both Swedish snus and other forms of oral tobacco (e.g., Sudanese toombak) are known to induce characteristic mucosal changes, although the risk of malignant transformation appears lower in the case of snus. Nevertheless, any persistent white lesion in the oral cavity should raise oncological concern.

From a clinical perspective, early detection, proper diagnosis (including histopathological evaluation), and preventive measures are essential. The following sections present an overview of the morphology, clinical and microscopic features of these lesions, as well as their malignant potential and management strategies.

Oral Mucosal Changes in Snus Users

Clinical Presentation

Chronic placement of snus in a specific area of the oral cavity leads to characteristic local mucosal changes. These lesions most commonly occur on the vestibular side of the upper lip or cheek and are well demarcated from surrounding healthy mucosa.

Clinically, they appear as whitish or yellowish patches, sometimes with a brownish hue due to tobacco staining. The surface is typically thickened, wrinkled, or uneven, often with visible grooves. Lesion margins may be clearly defined, although in some cases they gradually blend into normal mucosa.

A four-grade clinical classification system has been proposed in Scandinavian literature, where lesion severity correlates with duration and intensity of snus use. Importantly, these lesions are usually asymptomatic, which means users may remain unaware of them until detected during routine dental examinations.

Histopathological Characteristics

Snus-induced lesions are classified as keratinization disorders of stratified squamous epithelium with features of potentially malignant disorders (similar to leukoplakia).

Two main histological patterns have been described:

- epithelial thickening (acanthosis) with vacuolization of spinous layer cells,
- “chevron-type” keratinization with alternating thick and thin epithelial layers forming V-shaped patterns.

These features reflect a defensive response of the epithelium to chronic irritation. Additional findings include hyperkeratosis, parakeratosis, connective tissue fibrosis, and signs of chronic inflammation.

Importantly, epithelial dysplasia is usually absent or mild. Compared to other forms of smokeless tobacco, the prevalence of dysplasia in snus users is relatively low.

Crucially, these lesions are reversible upon cessation of snus use—both clinically and histologically.

Risk of Malignant Transformation

The risk of malignant transformation of snus-related lesions has been extensively studied. Overall, evidence suggests that Swedish snus carries a significantly lower cancer risk compared to other smokeless tobacco products such as toombak or gutka.

Large cohort studies in Sweden have not demonstrated a statistically significant increase in oral cancer risk among exclusive snus users. For example:

- Roosaar et al. (2021): HR ~0.93 (no increased risk),
- Luo et al. (2007): HR ~1.0 in never-smokers.

Although some studies suggest a possible increased risk in heavy users, the overall evidence does not support a strong association between snus use and oral cancer incidence.

Cases of oral squamous cell carcinoma arising at snus placement sites have been reported, confirming that malignant transformation is possible but rare. The estimated incidence is approximately 0.5 cases per 100,000 users annually.

Management and Early Intervention

Dental Surveillance

Regular dental check-ups (every 6–12 months) are essential for early detection and monitoring of lesions.

Biopsy and Diagnosis

Persistent or suspicious lesions should undergo biopsy and histopathological evaluation—the gold standard for diagnosis.

Cessation of Snus Use

Stopping snus use is the most important therapeutic intervention. Lesions often regress within weeks to months after cessation.

Treatment

If dysplasia or carcinoma in situ is detected, surgical removal is recommended.

Education and Prevention

Patients should be educated about risks and instructed in self-examination. Preventive strategies include tobacco cessation support and pharmacotherapy (e.g., nicotine replacement therapy, bupropion, varenicline).

Summary

Long-term use of Swedish snus leads to characteristic oral mucosal changes, typically presenting as white hyperkeratotic lesions. These changes are potentially precancerous but carry a relatively low risk of malignant transformation compared to other tobacco products.

Nevertheless, they require careful monitoring. Early detection, cessation of use, and appropriate management usually result in lesion regression and effectively eliminate cancer risk.

Prevention remains key—through patient education, cessation support, and regular oral examinations.

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