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Original Article

The Effects of Smokeless Tobacco on Oral Health: A Cross-Sectional Study

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ABSTRACT

Background: Smokeless tobacco is widely used in Pakistan, particularly in the form of snuff or naswar, and its direct contact with oral tissues may contribute to dental, periodontal, and mucosal abnormalities. Objective: To assess smokeless tobacco-use patterns, perceptions, oral-hygiene practices, and oral-health findings among smokeless tobacco users attending selected hospitals in Peshawar. Methods: This descriptive cross-sectional study was conducted over five months at Naseer Khan Babar Memorial Hospital, Lady Reading Hospital, and Hayatabad Medical Complex, Peshawar. A total of 193 smokeless tobacco users were selected through non-probability convenience sampling. Data were collected using a self-structured questionnaire and oral examination with tongue depressors. Frequencies and percentages were analyzed using SPSS version 25. Results: Most participants were male, 187 (96.9%), and the largest age group was 26–32 years, 59 (30.6%). Snuff was the most common product, used by 153 participants (79.3%). Duration of use was less than 5 years in 86 participants (44.6%) and 6–15 years in 70 (36.3%). Overall, 180 participants (93.3%) perceived smokeless tobacco as harmful to oral health, yet 174 (90.2%) believed it was safer than cigarette smoking. Placement-site lesions were reported in 141 participants (73.1%), while dental caries was the most frequent dental abnormality, affecting 61 (31.6%). Conclusion: Snuff use predominated among participants, and oral lesions, dental abnormalities, and comparative-risk misconceptions were common. Keywords: Smokeless tobacco; Naswar; Oral health; Dental caries; Gingivitis; Oral lesions.

INTRODUCTION

Smokeless tobacco use remains an important but comparatively under-addressed public health concern because it exposes users to nicotine and multiple toxic compounds without combustion, creating a perception among many users that it is safer than cigarette smoking. Tobacco products are derived from plants of the Nicotiana genus and contain nicotine, an addictive alkaloid that stimulates cholinergic pathways and increases dopaminergic activity in the brain reward system, thereby reinforcing repeated use and dependence (1–4). Although smokeless tobacco does not produce tar, carbon monoxide, and nitrogen oxides in the same way as combustible tobacco, it can still deliver substantial nicotine exposure through the oral mucosa, and blood nicotine concentrations among smokeless tobacco users may remain elevated for prolonged periods (6, 8, 9, 19). This distinction is clinically important because absence of smoke does not mean absence of harm, particularly when the product remains in direct and repeated contact with the oral mucosa.

Smokeless tobacco products vary widely across regions in their composition, mode of preparation, toxicity, and method of use. Commonly used oral forms include moist snuff, dry snuff, loose-leaf chewing tobacco, naswar, gutka, and other locally prepared preparations (10–13). In Pakistan, smokeless tobacco use is culturally embedded in several communities, and naswar is particularly common in Khyber Pakhtunkhwa and adjoining regions. Naswar is typically prepared from dried tobacco leaves mixed with ash, calcium hydroxide paste, flavoring agents, and sometimes coloring substances, and it is usually placed in the oral vestibule for mucosal absorption (13–15). The regional popularity of naswar is especially relevant for Peshawar, where its use has been reported as a dominant form of tobacco consumption among local users (13). These sociocultural and product-specific patterns make locally generated oral-health data important, because risks observed in one population or product type may not be directly generalizable to another.

The oral cavity is the first site of exposure to smokeless tobacco products, and repeated placement of tobacco against the mucosa may contribute to localized irritation, microbial changes, keratotic changes, periodontal tissue damage, tooth discoloration, halitosis, mucosal lesions, and potentially malignant oral disorders (20–25). Smokeless tobacco contains numerous chemical constituents, including tobacco-specific nitrosamines and other carcinogenic or potentially toxic compounds, with concentrations varying by product type and preparation method (8, 18). Previous literature has linked smokeless tobacco use with gingival recession, periodontal pocket formation, plaque and calculus accumulation, dental caries, leukoplakia, erythroplakia, oral submucous fibrosis when used with areca nut, tooth loss, and oral cancer (9, 22–24). Because the product is commonly placed at a specific intraoral site, oral findings may be localized to the area of placement, making direct oral examination and site-specific questioning clinically relevant.

Despite increasing awareness of tobacco-related harm, many users continue to regard smokeless tobacco as a safer alternative to cigarettes, largely because it is not smoked and does not produce visible smoke exposure (16, 17). This perception may reduce motivation to quit and may delay oral-health consultation, especially when early mucosal or periodontal changes are ignored. At the same time, oral-health promotion remains a major priority within public health because preventable oral diseases can impair nutrition, communication, appearance, quality of life, and long-term health (28). In settings where smokeless tobacco is socially acceptable and readily available, oral-health screening among users can provide clinically useful evidence for prevention, counseling, and early detection of tobacco-associated oral changes.

Although previous studies have examined smokeless tobacco use and its oral consequences in different populations, local hospital-based evidence from Peshawar remains important because of the high use of naswar and the distinct cultural context of tobacco consumption in Khyber Pakhtunkhwa. Existing literature supports an association between smokeless tobacco and oral mucosal, periodontal, and dental problems, but the pattern of product use, duration of use, oral-hygiene practices, perceived harm, and reported or observed oral abnormalities among local users require further description. Therefore, the present study aimed to assess patterns of smokeless tobacco use and describe oral-health findings among smokeless tobacco users attending selected hospitals in Peshawar. The study specifically sought to determine the frequency of different smokeless tobacco products, duration of use, perceived oral-health effects, oral lesions at the placement site, halitosis, toothbrushing practices, and common dental abnormalities among the study participants.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted among smokeless tobacco users attending three hospitals in Peshawar, Khyber Pakhtunkhwa, Pakistan: Naseer Khan Babar Memorial Hospital, Lady Reading Hospital, and Hayatabad Medical Complex. The study was carried out over a period of five months. A cross-sectional design was selected because the objective was to describe the pattern of

smokeless tobacco use and the frequency of oral-health findings among current users at a defined point in time rather than to establish temporal or causal relationships. The study population consisted of patients attending the outpatient departments of the selected hospitals during the data-collection period.

The sample size was calculated using the Daniel formula for prevalence-based cross-sectional studies, and a final sample of 193 participants was included. Participants were selected through a non-probability convenience sampling technique from eligible individuals attending the outpatient departments during the study period. Individuals were eligible if they were male or female participants of any age who used smokeless tobacco and were willing to participate after receiving information about the study. Participants who were unwilling or unable to cooperate with the questionnaire and oral examination process were excluded. Before data collection, informed written consent was obtained from each participant.

Data were collected using a self-structured questionnaire and oral examination. The questionnaire recorded sociodemographic characteristics, including gender, age group, and educational status, along with smokeless tobacco-related variables such as type of product used, duration of use, perceived negative effect on oral health, belief regarding comparative safety of smokeless tobacco versus cigarette smoking, experience of halitosis, perceived taste function, and frequency of toothbrushing. The smokeless tobacco products assessed in the questionnaire included chewing tobacco, snuff, and oral nicotine pouches. Duration of use was categorized into predefined intervals of less than 5 years, 6–15 years, 16–25 years, 26–35 years, and more than 36 years. Oral-health-related findings included gingivitis, gum recession, dental caries, lesion at the site of smokeless tobacco placement, halitosis, and perceived disturbance of taste function.

Oral examination was performed using tongue depressors to inspect the oral cavity, with particular attention to the site where smokeless tobacco was usually placed. The examination was used to identify visible oral abnormalities and placement-site lesions, while questionnaire responses were used to document participant-reported symptoms and perceptions. Dental caries, gingivitis, gum recession, and oral lesions were recorded as categorical findings. Halitosis, taste function, and brushing frequency were recorded according to participant response. To improve consistency during data handling, questionnaire responses were coded using predefined categories before entry into the statistical software. Completed questionnaires were reviewed for completeness before analysis.

The main study variables were smokeless tobacco type, duration of use, perceived oral-health effect, belief regarding safety compared with cigarette smoking, dental abnormality, oral lesion at the placement site, halitosis, taste function, toothbrushing frequency, age group, gender, and educational status. The primary descriptive outcomes were the frequencies and percentages of oral-health findings among smokeless tobacco users. The study was not designed to infer causality, and the results were interpreted as descriptive frequencies within the sampled hospital-attending population. Potential sources of bias included convenience sampling, hospital-based recruitment, self-reported behavioral information, and possible underreporting of tobacco use among some participant groups. These limitations were considered during interpretation by avoiding causal language and by presenting findings as descriptive estimates from the study sample.

Data were entered and analyzed using SPSS version 25. Categorical variables were summarized as frequencies and percentages. Sociodemographic characteristics, smokeless tobacco-use patterns, oral-hygiene practices, perceptions regarding harm, and oral-health findings were tabulated using the total sample as the denominator unless otherwise specified. Percentages were calculated from the available responses for each variable. The analysis focused on descriptive statistics because the study objective was to report the distribution of smokeless tobacco-use patterns and oral-health findings among the included participants. Ethical approval was obtained from the relevant institutional authorities of Lady Reading Hospital, Hayatabad Medical Complex, and Naseer Khan Babar Memorial Hospital. The ethical clearance references included Lady Reading Hospital Ref. No. 184/LRH/MTI and Hayatabad Medical

Complex Approval No. 1858. Participant confidentiality was maintained throughout data collection, data entry, and analysis, and the collected information was used only for research purposes.

RESULTS

A total of 193 smokeless tobacco users were included in the study. The sociodemographic characteristics of the participants are presented in Table 1. Most participants were male, accounting for 187 (96.9%) of the sample, while 6 (3.1%) were female. The largest age category was 26–32 years, comprising 59 (30.6%) participants, followed by 19–25 years with 54 (28.0%) participants. Educational status varied across the sample, with secondary education reported by 61 (31.6%) participants, followed by other educational categories in 58 (30.1%) participants and no formal schooling in 32 (16.6%) participants.

Table 1. Sociodemographic Characteristics of the Participants (n = 193)

Variable	Category	n (%)
Gender	Male	187 (96.9)
	Female	6 (3.1)
Age group	<18 years	4 (2.1)
	19–25 years	54 (28.0)
	26–32 years	59 (30.6)
	33–39 years	23 (11.9)
	40–46 years	25 (13.0)
	≥47 years	28 (14.5)
Educational status	Never attended school	32 (16.6)
	Primary	23 (11.9)
	Secondary	61 (31.6)
	Professional education	19 (9.8)
	Other	58 (30.1)

The pattern of smokeless tobacco use and related perceptions is shown in Table 2. Snuff was the most frequently used smokeless tobacco product, reported by 153 (79.3%) participants, followed by oral nicotine pouches in 37 (19.2%) participants and chewing tobacco in 3 (1.6%) participants. Duration of smokeless tobacco use was less than 5 years in 86 (44.6%) participants and 6–15 years in 70 (36.3%) participants. Most participants perceived smokeless tobacco as harmful to oral health, with 88 (45.6%) strongly agreeing and 92 (47.7%) agreeing that it had a negative effect. However, 174 (90.2%) participants also believed that smokeless tobacco was safer than cigarette smoking.

Table 2. Smokeless Tobacco Use Pattern and Perceptions Among Participants (n = 193)

Variable	Category	n (%)
Duration of smokeless tobacco use	<5 years	86 (44.6)
	6–15 years	70 (36.3)
	16–25 years	29 (15.0)
	26–35 years	5 (2.6)
	>36 years	3 (1.6)
Type of smokeless tobacco	Chewing tobacco	3 (1.6)
	Snuff	153 (79.3)
	Oral nicotine pouches	37 (19.2)
Perceived negative effect on oral health	Strongly agree	88 (45.6)
	Agree	92 (47.7)
	Do not agree	13 (6.7)
Belief that smokeless tobacco is safer than cigarette smoking	Yes	174 (90.2)
	No	5 (2.6)
	Not sure	14 (7.3)

Oral-health findings and hygiene-related responses are presented in Table 3. Dental caries was the most frequently reported or observed dental abnormality, present in 61 (31.6%) participants, followed by gum recession in 46 (23.8%) and gingivitis in 37 (19.2%). No dental abnormality was recorded in 49 (25.4%) participants. Lesions at the site of smokeless tobacco placement were reported in 141 (73.1%) participants, while 52 (26.9%) had no such lesion. Halitosis was reported by 80 (41.5%) participants. Most participants, 167 (86.5%), reported normal taste function, whereas 26 (13.5%) reported impaired taste

function. Toothbrushing once daily was reported by 165 (85.5%) participants, while 28 (14.5%) reported brushing twice daily.

Table 3. Oral-Health Findings and Oral-Hygiene Responses Among Participants (n = 193)

Variable	Category	n (%)
Dental abnormality	Gingivitis	37 (19.2)
	Gum recession	46 (23.8)
	Dental caries	61 (31.6)
	No dental abnormality	49 (25.4)
Lesion at site of smokeless tobacco placement	Yes	141 (73.1)
	No	52 (26.9)
Halitosis	Yes	80 (41.5)
	No	113 (58.5)
Taste function	Normal	167 (86.5)
	Impaired	26 (13.5)
Toothbrushing frequency	Once daily	165 (85.5)
	Twice daily	28 (14.5)

Overall, the descriptive findings show that snuff was the dominant smokeless tobacco product in this hospital-based sample, and oral lesions at the placement site were common. Dental caries represented the most frequent dental abnormality, while gum recession and gingivitis were also reported. The coexistence of high perceived oral harm and high belief in comparative safety versus cigarette smoking suggests that many users may recognize oral-health risks but still consider smokeless tobacco a less harmful tobacco product. Because the study used a descriptive cross-sectional design and only aggregated frequencies were available, these findings should be interpreted as patterns within the study sample rather than causal estimates of the effect of smokeless tobacco on oral disease.

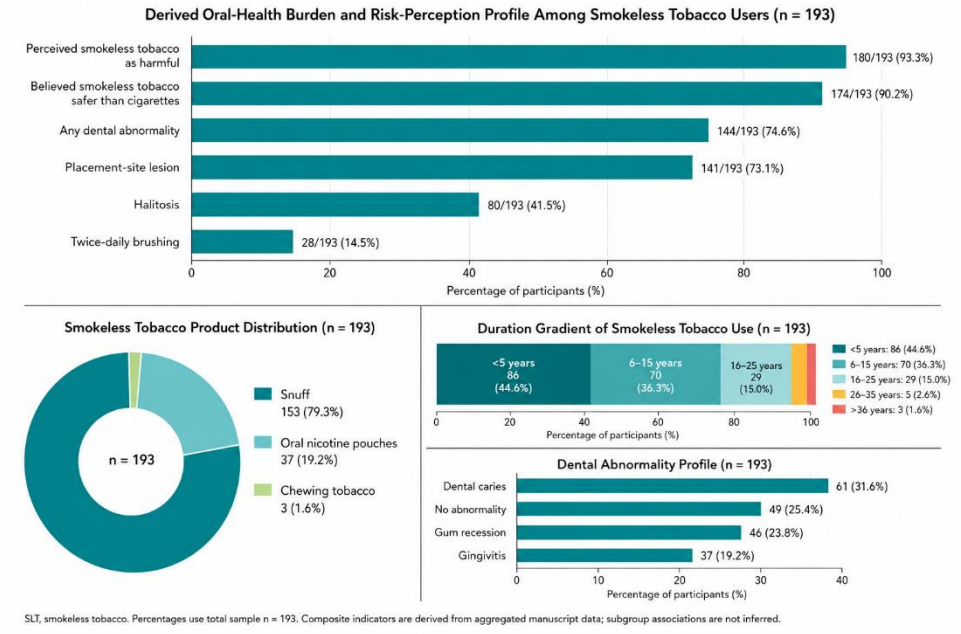

Figure 1. Derived Oral-Health Burden and Risk-Perception Profile Among Smokeless Tobacco Users

The derived descriptive profile shows a high oral-health burden alongside a marked comparative-risk misconception among smokeless tobacco users. Although 180 of 193 participants (93.3%) perceived smokeless tobacco as harmful to oral health, 174 (90.2%) still believed it was safer than cigarette smoking, indicating that recognition of oral harm did not translate into accurate risk appraisal. Oral morbidity was also frequent, with any recorded dental abnormality present in 144 participants (74.6%) and placement-site lesions reported in 141 participants (73.1%). Dental caries was the most common dental abnormality, affecting 61 participants (31.6%), followed by gum recession in 46 (23.8%) and gingivitis in 37 (19.2%), while 49 participants (25.4%) had no recorded dental abnormality. Snuff was the dominant smokeless tobacco product, used by 153 participants (79.3%), and most users had a duration

of use below 15 years, including 86 participants (44.6%) with less than 5 years of use and 70 (36.3%) with 6–15 years of use. These patterns suggest that oral lesions and dental abnormalities were already common in a predominantly snuff-using population, even though the available aggregated data do not permit causal inference or subgroup association testing.

DISCUSSION

The present hospital-based descriptive cross-sectional study assessed smokeless tobacco-use patterns, perceptions, oral-hygiene practices, and oral-health findings among 193 smokeless tobacco users attending selected hospitals in Peshawar. The findings indicate that snuff was the dominant smokeless tobacco product, used by 153 participants (79.3%), while oral nicotine pouches were reported by 37 participants (19.2%) and chewing tobacco by only 3 participants (1.6%). This pattern is consistent with the regional context of Khyber Pakhtunkhwa, where naswar is culturally familiar, inexpensive, readily accessible, and commonly used as a form of oral tobacco. The dominance of snuff in the present sample supports previous evidence that naswar is a major smokeless tobacco product among Pashtun populations in Pakistan and adjoining regions, particularly in and around Peshawar (13). Similar concerns have been raised in Pakistani studies describing naswar consumption as a relevant public health issue because of its potential relationship with oxidative stress, lipid-profile alteration, and broader systemic risk markers among users (15). Although the present study focused on oral-health findings rather than biochemical outcomes, the high frequency of snuff use reinforces the need to treat naswar as a major local exposure in oral-health screening and tobacco-control counseling.

The sample was predominantly male, with 187 males (96.9%) and 6 females (3.1%). This distribution should be interpreted cautiously because the study used convenience sampling from hospital outpatient departments and therefore does not estimate the true population prevalence of smokeless tobacco use by gender. However, the marked male predominance is broadly consistent with studies from South Asian and regional settings where smokeless tobacco use has often been reported more frequently among males than females (35). Sociocultural factors may influence both actual use and willingness to disclose tobacco habits, particularly among women; therefore, the low number of female participants in the present study may reflect a combination of lower reported use, underreporting, recruitment setting, and social desirability bias. Future community-based studies using confidential data-collection methods may provide a more accurate understanding of smokeless tobacco exposure among women.

Dental caries was the most frequent recorded dental abnormality, affecting 61 participants (31.6%), followed by gum recession in 46 participants (23.8%) and gingivitis in 37 participants (19.2%), while 49 participants (25.4%) had no recorded dental abnormality. These findings are clinically relevant because smokeless tobacco is retained in close contact with teeth, gingiva, and oral mucosa, allowing repeated chemical and mechanical exposure at localized sites. Previous literature has described higher levels of gingival recession, periodontal pocket formation, plaque accumulation, calculus deposition, and periodontal tissue damage among smokeless tobacco users (24). Studies from other settings have similarly reported dental caries, gingivitis, periodontal findings, and mucosal lesions among smokeless tobacco users, supporting the biological plausibility of oral tissue involvement in this population (29–31). However, the present findings should not be interpreted as causal estimates because the study did not include a non-user comparison group, longitudinal follow-up, or adjusted analysis for oral hygiene, diet, socioeconomic factors, dental-care access, or frequency and duration of tobacco exposure.

A particularly important finding was the high frequency of lesions at the site of smokeless tobacco placement, reported in 141 participants (73.1%). This finding is consistent with the known local irritant effect of smokeless tobacco products, especially when tobacco is repeatedly placed at the same intraoral site. Chronic placement of tobacco against the mucosa may contribute to keratotic or inflammatory changes, and previous evidence has linked smokeless tobacco use with oral mucosal disorders, including smokeless tobacco keratosis, leukoplakia, erythroplakia, and other potentially harmful oral changes (22–

25). The present study did not histologically classify lesions or grade mucosal abnormalities; therefore, the lesion findings should be interpreted as clinically observed or reported placement-site abnormalities rather than definitive diagnoses of premalignant disease. Nonetheless, the high frequency of placement-site lesions highlights the importance of routine oral examination among smokeless tobacco users and suggests that dental and medical outpatient settings may be useful points for early identification and referral.

The perception-related findings show an important contradiction. Most participants recognized harm, as 88 participants (45.6%) strongly agreed and 92 participants (47.7%) agreed that smokeless tobacco negatively affects oral health, giving a combined 180 participants (93.3%) who perceived oral-health harm. At the same time, 174 participants (90.2%) believed that smokeless tobacco was safer than cigarette smoking. This apparent contradiction suggests that many users may understand that smokeless tobacco can damage oral health but still underestimate its broader risk profile when compared with cigarettes. Such comparative-risk misconceptions have been described in previous literature, where smokeless tobacco is often perceived as less harmful because it does not involve smoke inhalation or visible combustion (17). This belief may reduce cessation motivation and may encourage continued use despite symptoms such as lesions, halitosis, or dental abnormalities. Public health messages should therefore avoid focusing only on the absence of smoke and should clearly communicate that smokeless tobacco can still deliver addictive nicotine and expose oral tissues to toxic and carcinogenic substances.

Halitosis was reported by 80 participants (41.5%), while impaired taste function was reported by 26 participants (13.5%). These symptoms may affect social interaction, oral comfort, eating behavior, and quality of life, although the present study did not measure these outcomes directly. Toothbrushing once daily was reported by 165 participants (85.5%), whereas only 28 participants (14.5%) reported brushing twice daily. Oral hygiene practices may modify oral-health outcomes among smokeless tobacco users, but the present aggregated data do not allow assessment of whether brushing frequency differed across those with and without lesions, dental caries, gingivitis, gum recession, or halitosis. Future studies should include cross-tabulated and adjusted analyses to determine whether oral-hygiene behavior, duration of use, type of smokeless tobacco, and placement habits are independently associated with oral-health findings.

The study has several limitations that should be considered when interpreting the findings. First, the hospital-based convenience sample limits generalizability to the wider population of Peshawar or Khyber Pakhtunkhwa. Second, the sample was overwhelmingly male, which restricts interpretation across gender groups. Third, the study was descriptive and cross-sectional, so temporality and causality cannot be established. Fourth, the questionnaire was self-structured, and participant-reported behaviors and perceptions may be affected by recall bias or social desirability bias. Fifth, the manuscript does not provide detailed diagnostic criteria, examiner calibration, or lesion classification, which may affect reproducibility and diagnostic precision. Sixth, the available data are aggregated, so inferential analysis, confidence intervals, subgroup comparisons, and adjusted estimates could not be validly calculated. Despite these limitations, the study provides useful local evidence showing that snuff/naswar use is highly prevalent within the sample and that oral lesions, dental abnormalities, and risk-perception gaps are common among smokeless tobacco users attending selected hospitals in Peshawar.

CONCLUSION

This descriptive cross-sectional study found that snuff was the predominant smokeless tobacco product among hospital-attending smokeless tobacco users in Peshawar, with most participants being male and a large proportion reporting use for less than 15 years. Oral-health findings were common, particularly placement-site lesions, dental caries, gum recession, gingivitis, and halitosis. Although most participants acknowledged that smokeless tobacco negatively affects oral health, a large majority still believed that it was safer than cigarette smoking, indicating a substantial comparative-risk misconception. These

findings support the need for targeted oral-health education, routine oral screening of smokeless tobacco users, counseling on naswar-related oral risks, and larger community-based analytical studies using standardized oral examination criteria and adjusted statistical analysis.

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