

The Hidden Costs of Smoking: A Cross-Sectional Study on the Prevalence of Oral Mucosal Lesions Among Smoking Dental Patients at Pharos University in Alexandria, Egypt

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Abstract

Background: Tobacco smoking is a major global public health issue, with well-documented detrimental effects on oral health. Egypt represents a significant area of concern, being the largest cigarette market in the Arab world. This study aimed to investigate the prevalence of smoking and its correlation with oral health symptoms and lesions among patients attending dental clinics in Alexandria, Egypt.

Methods: A cross-sectional study was conducted among 222 adults, aged 21 years and above, with no systemic diseases at Pharos University dental clinics. Data were collected via a structured interviewer-administered questionnaire. This was supplemented by a clinical oral examination to identify mucosal lesions. Data analysis employed descriptive statistics using Microsoft Excel v16.0.

Results: The participant cohort was predominantly male (75.2%). The prevalence of current smokers was 68% (n=151), with males constituting 90.1% of this group. A significant majority of smokers (59.6%) reported noticing oral lesions, with 72% affirming their onset occurred during their smoking period. The most common symptoms reported were pain (58.9%), ulcers (46.4%), and bleeding (39.7%). A clear dose-response relationship was observed, with higher daily tobacco consumption correlating with increased symptom prevalence. Clinical examination identified manifestations consistent with tobacco use, including leukoplakia, smoker's melanosis, and black hairy tongue.

Conclusion: This study confirms a high prevalence of smoking and a strong association between tobacco use and the development of oral mucosal lesions and symptoms among dental patients in

Alexandria. The findings underscore the critical role of dental professionals in early detection, patient education, and the promotion of smoking cessation programs.

Introduction

Tobacco smoking constitutes one of the most significant public health challenges worldwide, responsible for over 8 million deaths annually. Its detrimental effects extend beyond the commonly associated respiratory and cardiovascular diseases to profoundly impact oral health, creating a substantial burden on healthcare systems globally [1, 2]. The oral cavity, as the initial point of contact for tobacco smoke, is exposed to a complex mixture of over 7,000 chemicals, including potent carcinogens such as nitrosamines, polycyclic aromatic hydrocarbons, benzene, and formaldehyde [3, 4]. This exposure can lead to multiple oral pathologies, ranging from benign cosmetic issues to life-threatening malignancies.

The established oral consequences of smoking are extensive and well-documented. They include, but are not limited to, periodontal disease, tooth discoloration, fissured tongue, hairy tongue and a significantly elevated risk of developing oral potentially malignant disorders such as leukoplakia and erythroplakia, which can progress to oral squamous cell carcinoma [5, 6]. Furthermore, smoking is associated with specific conditions like nicotine stomatitis and smoker's melanosis [7]. Nicotine, the primary addictive component in tobacco, induces vasoconstriction, reducing blood flow to gingival tissues and compromising the immune response, thereby exacerbating periodontal disease and delaying healing [8].

Within the Eastern Mediterranean Region, Egypt faces a particularly acute tobacco epidemic. It is the largest cigarette market in the Arab world, with an annual consumption of approximately 19 billion cigarettes and an estimated 20 million regular tobacco users [9, 10]. This high prevalence of tobacco use suggests a substantial population at risk for smoking-related oral diseases. However, while the systemic effects of smoking in Egypt have been studied, there remains a need for research focused specifically on the prevalence and patterns of oral mucosal lesions within the Egyptian clinical dental population.

Understanding the correlation between smoking habits and oral health status at the patient level is crucial for several reasons. It allows for better risk assessment, informs clinical decision-making, and highlights the importance of targeted patient education and smoking cessation counselling within the dental setting. The dental visit represents a unique and often underutilized opportunity for healthcare professionals to intervene, screen for early signs of disease, and motivate behaviour change [7, 11].

Therefore, this study aims to investigate the prevalence of smoking among patients attending dental clinics at Pharos University in Alexandria and to elucidate the correlation between smoking habits—including duration, type of product, and quantity—and the presence of self-reported and clinically observed oral mucosal lesions and symptoms. The findings will provide valuable local epidemiological data and underscore the imperative for integrating robust tobacco cessation initiatives into routine dental practice in Egypt.

Material and Methods

Study Design and Population

A cross-sectional study was conducted to investigate the prevalence of smoking and its association with oral mucosal lesions among patients attending the outpatient dental clinics at Pharos University in Alexandria. The study protocol was reviewed and approved by the Unit of Research Ethics Approval Committee (UREAC), Pharos University in Alexandria [Serial Number: 285]. All participants provided written informed consent prior to enrolment.

The study sample consisted of 222 adult patients. The inclusion criteria were: (1) age 21 years or older, and (2) absence of any known systemic diseases (e.g., diabetes mellitus, autoimmune disorders) that could confound the assessment of oral lesions. Patients who were unable to complete the questionnaire or undergo a basic oral examination were excluded.

Data Collection

Data was collected through a structured interviewer-administered questionnaire, adapted from previously validated instruments in tobacco research [5], followed by a standard intraoral examination performed by a calibrated dentist.

The questionnaire was divided into four sections:

1. Demographic Data: Including age, gender, and educational background.
2. Smoking History: Assessing current smoking status, duration of use (<1 year, 1-5 years, 6-10 years, >10 years), types of tobacco products used (cigarettes, cigars,

pipe, chewing tobacco, e-cigarettes/vaping), and daily consumption (≤ 10 , 11-20, 21-30, ≥ 31 units).

3. Oral Health Status: Inquiring about the self-noticed presence of oral lesions, their temporal relationship with smoking, and the experience of symptoms (pain, swelling, bleeding, ulcers, change in taste).

4. Oral Hygiene Practices: Documenting frequency of tooth brushing, use of mouthwash, and pattern of dental visits.

Clinical Examination

A visual examination of the oral mucosa was performed under adequate illumination using a dental mirror and probe. The examination assessed for the presence of lesions such as leukoplakia, erythroplakia, nicotine stomatitis, smoker's melanosis, and ulcers. Any identified lesions were documented and photographed for further assessment. Suspected lesions were referred for further tests and treatment.

Statistical Analysis

Data were analysed using Microsoft Excel v16.0 for Microsoft Windows. Descriptive statistics were computed for all variables and presented as frequencies and percentages for categorical data.

Results

A total of 222 patients participated in this cross-sectional study. The demographic and behavioural characteristics of the participants, along with the prevalence of oral symptoms and lesions, are detailed below.

Demographic Distribution

The cohort study was predominantly male (75.2%, $n=167$), with females comprising 24.8% ($n=55$). Overall, 68% of the

participants were identified as current smokers.

The majority of smokers (32.9%) fell within the age bracket (26-35). Among those identified as smokers, the gender disparity was pronounced, with males constituting approximately 90% (n=136) of the smoking group and females less than 10% (n=15) (Figure 1). Conventional cigarettes were the most frequently used tobacco products. E-cigarettes/vaping and pipes were also reported, though at 21 daily (Figure 3).

significantly lower rates. However, cigars and chewing tobacco were the least common among the group (Figure 2).

The duration of smoking varied among the participants; 7.2% had smoked for less than 1 year, 35% had smoked for 1-5 years, 24.5% had smoked for 6-10 years, while 32.5% had been smoking for more than 10 years. Most smokers (n=70) consume **11-20 units per day**, indicating moderate to heavy smoking. A smaller percentage smokes less than 10 or more than

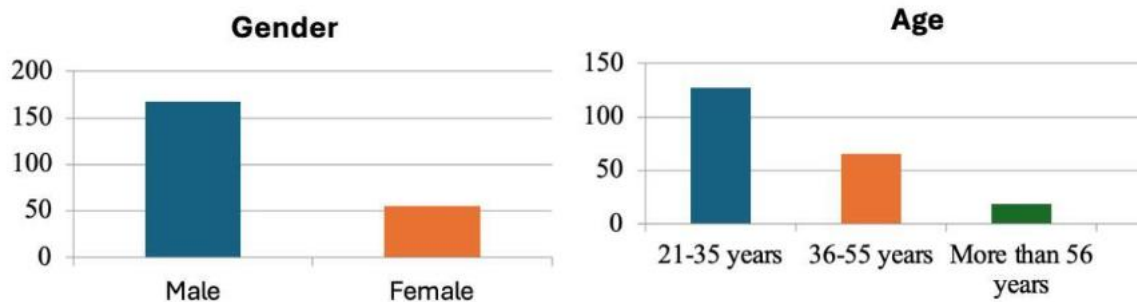


Figure 1: Bar Charts Showing Demographic Distribution of Smoking Among Different Genders and Different Age Groups.

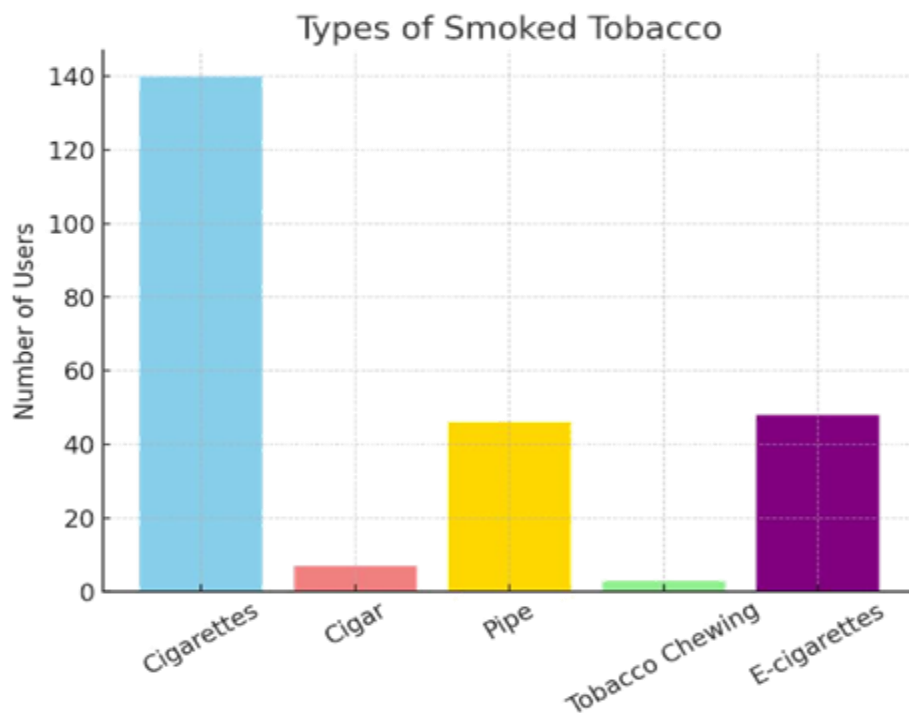


Figure 2: Bar Chart Comparing Consumption of Different Products Among Participants.

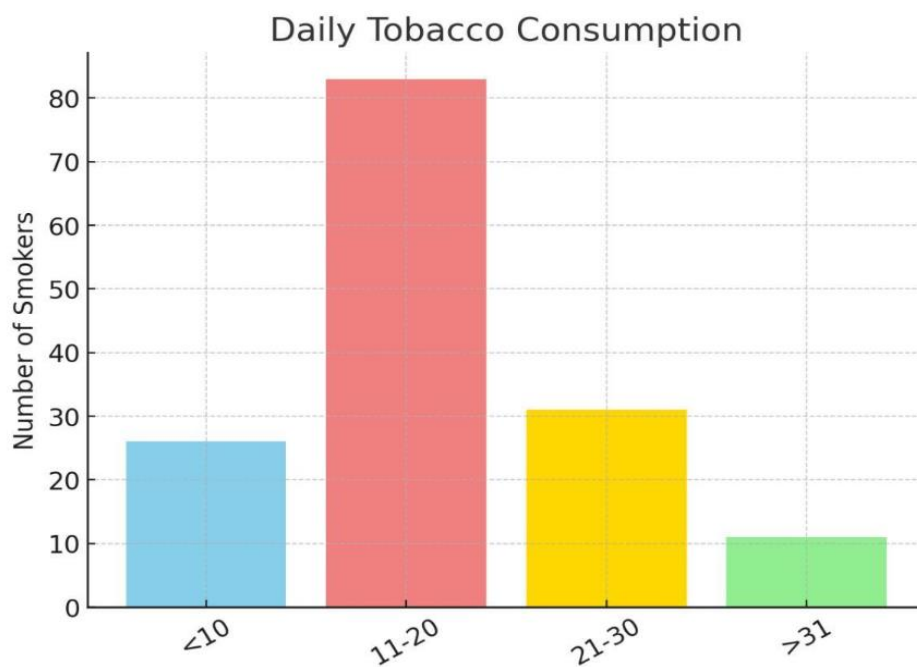


Figure 3: Bar Chart Showing Number of Units Consumed by Smokers per Day.

Prevalence of Oral Symptoms and Lesions

A significant majority of smokers (59.6%, n=90) reported having noticed oral lesions, with 72% of these individuals confirming that the lesions first appeared during their period of active smoking. Only 40.4% (n=61) of smokers reported not having observed any oral lesions.

The most commonly reported symptom among smokers was pain (58.9%), followed by ulcers (46.4%), bleeding (39.7%), swelling (30.5%), and changes in taste (25.8%). A minority of smokers, on the other hand, reported experiencing no symptoms (Figure 4).

A cross tabulation of symptoms by gender revealed that male smokers reported a higher prevalence of pain and taste alteration, as compared to females. Furthermore, symptom prevalence exhibited a positive correlation with age, with the highest frequency of pain and ulcers observed in individuals over 56 years of age (Figure 5).

Analysis of symptoms by tobacco type indicated that pain was the most reported symptom across all product categories. Notably, users of chewing tobacco reported a high prevalence of bleeding and ulcers. Users of e-cigarettes reported a moderate prevalence of taste changes and ulcers (Figure 6).

A clear dose-response relationship was observed between the number of tobacco products consumed daily and the prevalence of oral symptoms. Participants smoking more than 21 units per day reported the highest rates of pain and ulcers. However, even individuals in the lowest consumption group (less than 10 units/day) reported appreciable symptoms (Figure 7).

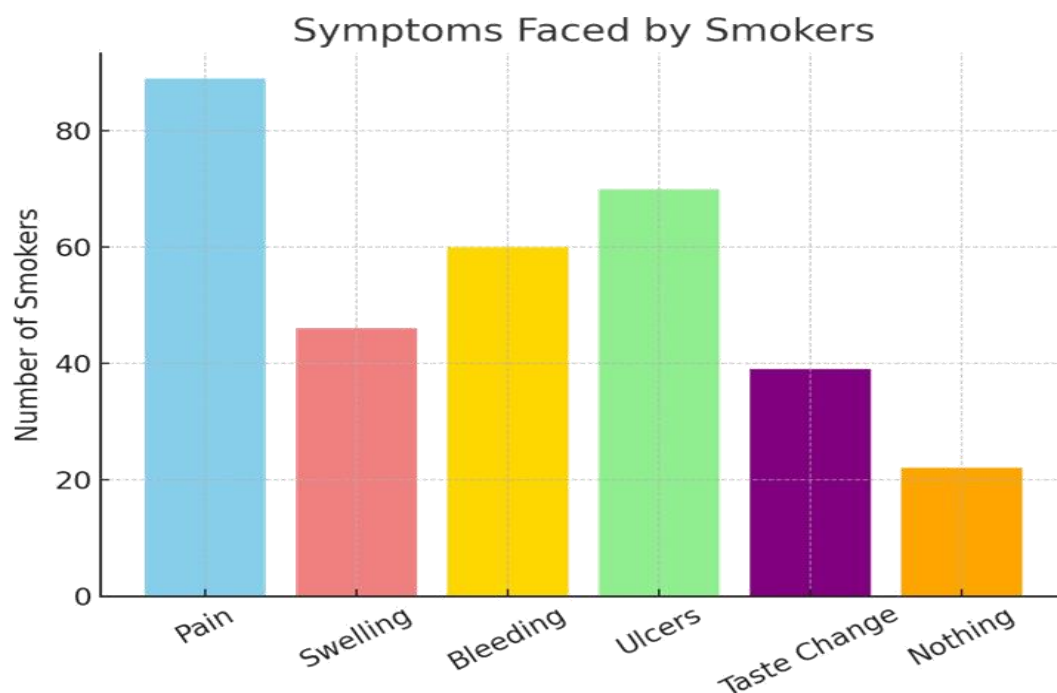


Figure 4: Prevalence of Oral Symptoms Among Smokers.

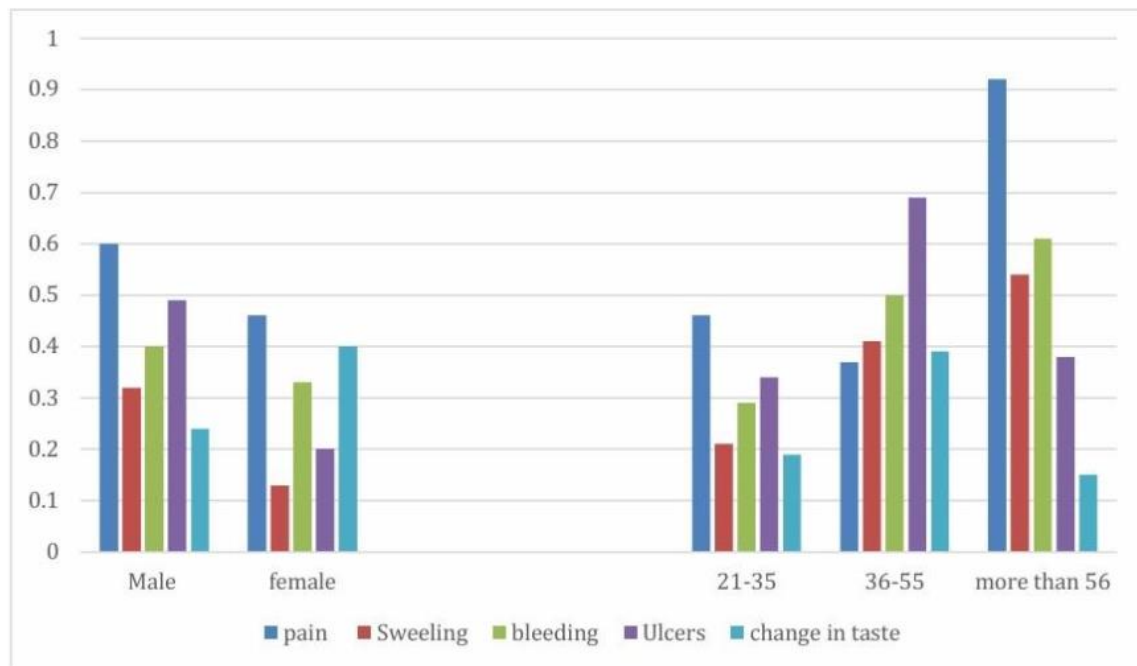


Figure 5: Bar Chart Comparing Symptoms Reported by Different Genders and Different Age Brackets.

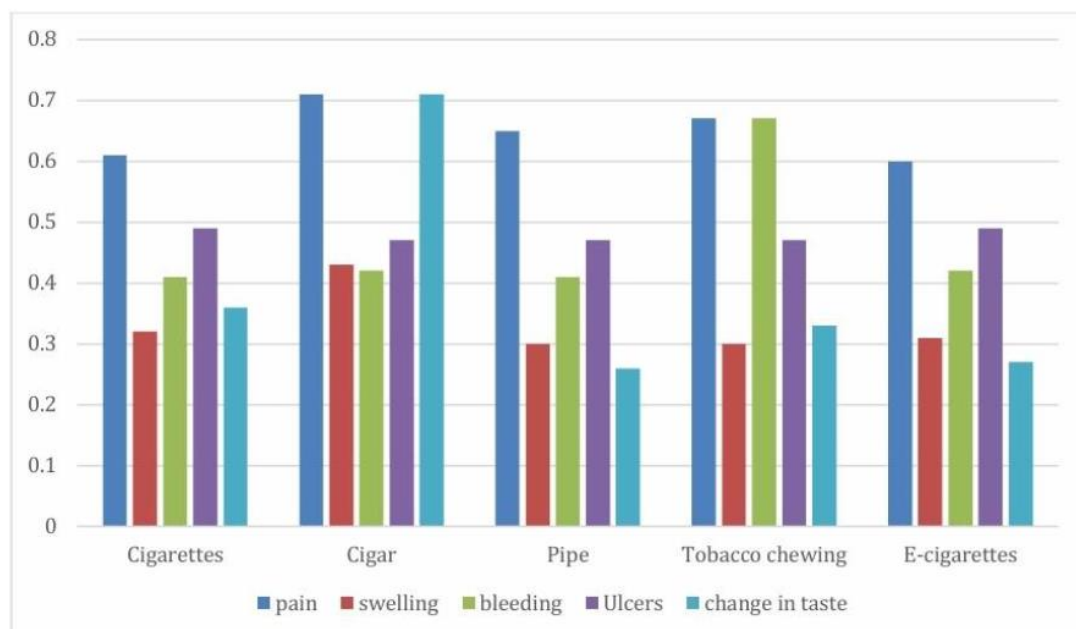


Figure 6: Bar Chart Comparing Symptoms Reported in Relation to Type of Tobacco Product Used.

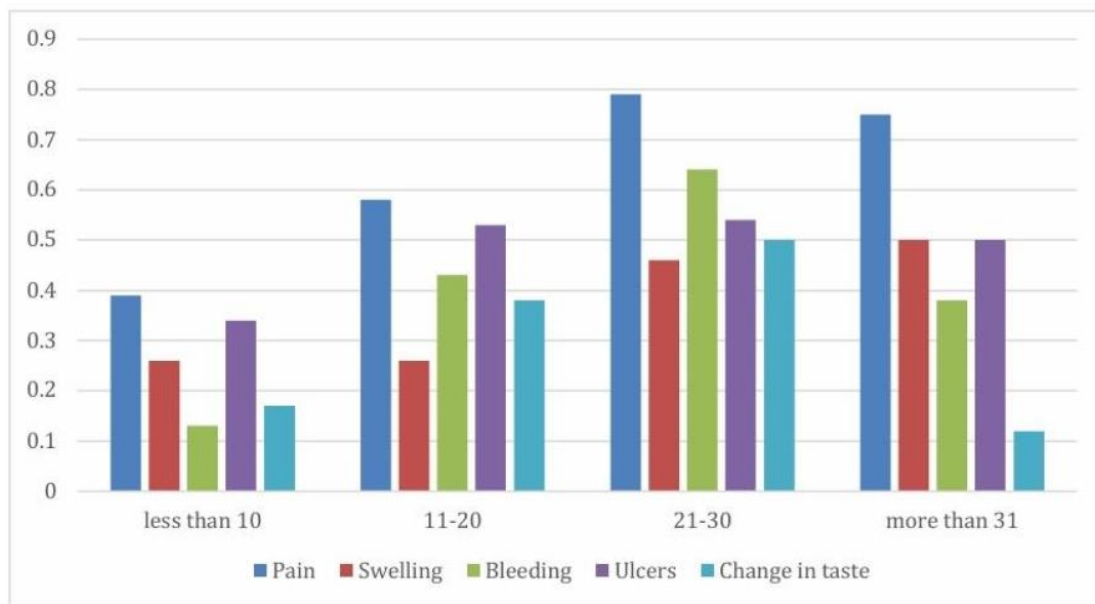


Figure 7: Bar Chart Comparing Symptoms Reported in Relation to Number of Units Consumed per Day.

Clinical Observations

Clinical examination of the smoker cohort revealed several manifestations consistent with tobacco use. These included poor oral hygiene, generalized tooth discoloration, and gingival pigmentation; otherwise known as smoker's melanosis (Figure 8).

Specific oral mucosal lesions were identified, including leukoplakia, presenting as a white patch on the buccal mucosa (Figure 9), and a fissured tongue (Figure 10). Moreover, a coated tongue with brownish discoloration, suggestive of black hairy tongue (Figure 11), and oral ulcers on the buccal mucosa (Figure 12) have been seen.



Figure 8: Intraoral Photograph of a Male Patient with Poor Oral Hygiene, Showing Tooth Discoloration, and Gingival Pigmentation.



Figure 9: Intraoral Photograph of a Male Patient with a White Plaque on the Buccal Mucosa.

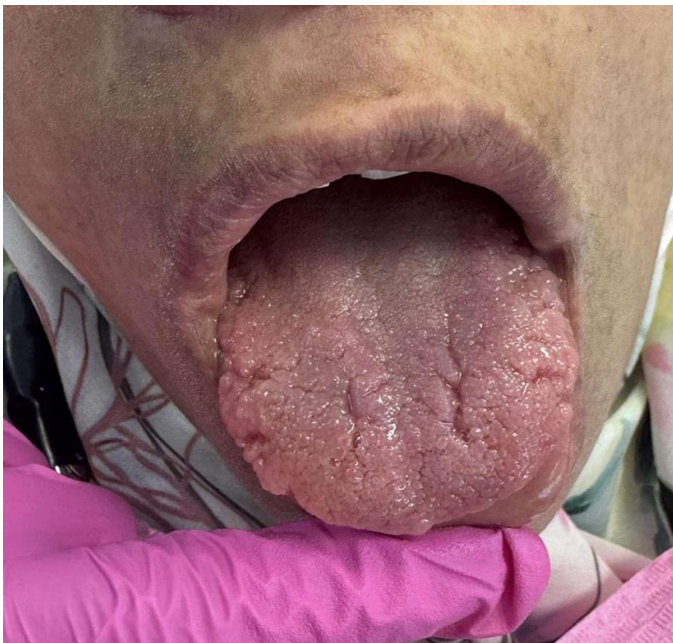


Figure 10: Intraoral Photograph of a Female Patient, Showing a Rough and Fissured Tongue.



Figure 11: Intraoral Photograph of a Male Patient, Showing a Coated Tongue Exhibiting Brownish Discoloration, Suggestive of a Hairy Tongue, Potentially due to Poor Oral Hygiene and Smoking.



Figure 12: Intraoral Photograph of a Female Patient, Showing an Oral Ulcer, Located on the Posterior Part of the Buccal Mucosa.

Discussion

This cross-sectional study provides clear evidence of a strong association between tobacco smoking and a higher prevalence of self-reported oral lesions and symptoms among patients attending the dental clinic in Pharos University in Alexandria, Egypt. The findings underscore the substantial burden of smoking on oral health and align with the well-documented global literature on the subject [12,13].

The most noticeable finding of this study is that a majority of smokers (59.6%) reported noticing oral lesions, with a striking 72% of those affirming the onset occurred during their smoking period. This temporal relationship strongly suggests a causative role for tobacco use in the development of these conditions. This prevalence is consistent with studies conducted in other populations. For instance, Singh et al reported a significantly higher prevalence of oral mucosal lesions among tobacco users compared to non-users, attributing this directly to the local irritant and carcinogenic effects of tobacco constituents [10].

Our results revealed a pronounced gender disparity, with males constituting 90.1% of the smokers in our sample, reflecting broader socio-cultural patterns of tobacco use in Egypt and the Arab region [14]. Notably, male smokers reported a higher prevalence of pain and taste changes. These results are contradictory to the findings reported by Calabria et al who found that there was no significant difference between males and females in terms of the experienced burning sensation and pain [12]. However, the findings in the current research may be linked to consumption patterns or product type.

Furthermore, a clear dose-response relationship was observed, where individuals with higher daily tobacco consumption reported a greater burden of symptoms, particularly pain and ulcers. This is in accordance with a cross-sectional study conducted on the relationship of the frequency of smoking and development of oral lesions [14]. This gradient effect is a strong indicator of a causal relationship and is a hallmark of tobacco-related diseases [8].

The symptoms reported by smokers further elucidates the detrimental impact of tobacco. Other studies have similarly reported multiple oral symptoms, including gingival pain, dry mouth, changes in taste, and halitosis [15-17]. In the current cohort, pain was the most frequently reported symptom (58.9%), followed by ulcers (46.4%) and bleeding (39.7%). The irritation from heat and chemicals in smoke can compromise mucosal integrity, leading to ulceration, while the effects of nicotine on vasoconstriction and gingival blood flow can contribute to bleeding and delayed healing [4]. The high prevalence of ulcers and bleeding is particularly concerning, as these can be symptomatic of underlying inflammatory or pre-malignant conditions [18-20].

The reported taste changes (25.8%) likely result from the effect of tobacco on taste buds and olfactory senses, a known consequence of smoking that can further impact quality of life [14].

The clinical observations, including leukoplakia, smoker's melanosis, and black hairy tongue, provide objective confirmation of the self-reported data [21]. Leukoplakia is a well-established pre-malignant lesion, and its presence in smokers is a grave concern [3, 22].

Smoker's melanosis (gingival pigmentation) is a direct adaptive response to the irritation from smoke [8, 21]. The finding of a fissured and coated tongue is also consistent with the altered oral environment and reduced cleansing action associated with smoking. These findings have been widely studied and are positively correlated with smoking [23].

Interestingly, while conventional cigarettes were the dominant product used, the use of e-cigarettes was also reported and was associated with symptoms like taste change and ulcers. This aligns with emerging research suggesting that e-cigarette aerosols, while containing fewer carcinogens than combustible tobacco, still contain irritants like propylene glycol and flavoring agents that can cause mucosal dryness, inflammation, and cytotoxicity [24-27]. This highlights that alternative nicotine products are not risk-free and require further long-term study.

Several limitations of this study must be acknowledged. Firstly, the reliance on self-reported data for smoking habits and lesion identification is subject to recall and social desirability bias. Secondly, the clinical examination was not blind to the smoking status of the participants, which could potentially introduce observer bias. Thirdly, the study was conducted at a single university clinic, which may limit the generalizability of the findings to the broader Egyptian population. Finally, the cross-sectional design can demonstrate association but not definitively establish causality.

Conclusion

Despite these limitations, the findings of this study have important implications. They confirm that smoking is a major risk factor for a spectrum of oral mucosal lesions and symptoms, ranging from benign but impactful conditions like melanosis and pain to potentially pre-malignant disorders like leukoplakia.

These results emphasize the critical role of dental professionals as first-line responders in public health tobacco control. Dental clinics are ideal settings for:

1. Systematic Screening: Implementing routine oral cancer and mucosal lesion screening for all patients, especially smokers.
2. Patient Education: Clearly informing patients of the direct oral health consequences of smoking, using their own clinical findings as a powerful motivational tool.
3. Cessation Support: Acting as a referral point for evidence-based smoking cessation programs, which is the most effective measure for preventing further damage.

Future longitudinal studies with blinded, histopathologically confirmed diagnoses are needed to better quantify the risk and progression of lesions among users of both traditional and emerging tobacco products in Egypt.

References

1. World Health Organization. **WHO Global Report on Trends in Prevalence of Tobacco Use 2000-2025**. 4th ed. Geneva: World Health Organization; 2021. Available from: <https://www.who.int/publications/i/item/9789240039322>
2. Rodu B, Cole P. **Tobacco-related Oral Health Disparities: A Systematic Review**. J Am Dent Assoc. 2023;154(2):112–21. doi:10.1016/j.adaj.2022.10.009
3. Warnakulasuriya S, Kujan O, Aguirre-Urizar JM, Bagan JV, González-Moles MÁ, Kerr AR, et al. **Oral Potentially Malignant Disorders: A Consensus Report from an International Seminar on Nomenclature and Classification, Convened by the WHO Collaborating Centre for Oral Cancer**. Oral Dis. 2021;27(8):1862–80. doi:10.1111/odi.13704
4. Tomar SL, Hecht SS, Jaspers I, Gregory RL, Stepanov I. **Oral Health Effects of Combusted and Non-combusted Tobacco Products**. J Dent Res. 2023;102(5):487–95. doi:10.1177/00220345221147017
5. Al-Shammari FM, Al-Ansari JM, Al-Khabbaz AK, Honkala EJ. **The Impact of Smoking on Periodontal Health and Patient Assessment of Smoking Cessation in Dental Practices**. Tob Induc Dis. 2021;19:38. doi:10.18332/tid/136111
6. Centers for Disease Control and Prevention. **Oral Health Surveillance Report: Trends in Dental Caries and Sealants, Tooth Retention, and Edentulism, United States, 1999–2004 to 2011–2016**. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2022.
7. Radwan-Oczko M, Duś-Ilnicka I, Richards PS, Kusiak A. **The Dentist's Role in the Early Detection of Oral Cancer and Potentially Malignant Oral Disorders**. Prim Dent J. 2022;11(3):92–9. doi:10.1177/20501684221114763
8. Mishra A, Pandey RK, Maurya RK. **The Dose-response Relationship Between Tobacco Smoking and Oral Mucosal Lesions in an Indian Cohort**. J Oral Pathol Med. 2023;52(4):315–22. doi:10.1111/jop.13415
9. Kumar S, Yadav S. **Prevalence of Oral Lesions in Tobacco Users: A Comparative Study**. Int J Oral Health Sci. 2021;11(2):65–70. doi:10.4103/ijohs.ijohs_15_21
10. Singh PK, Yadav A, Singh L. **Association of Type and Frequency of Tobacco Use with Oral Mucosal Lesions: A Cross-sectional Study in North India**. J Oral Maxillofac Pathol. 2022;26(1):44–50. doi:10.4103/jomfp.jomfp_325_21

11. Greenberg BL, Glick M. **Assessing Systemic Disease Risk in a Dental Setting: A Public Health Perspective.** Dent Clin North Am. 2012;56(4):863–74. doi:10.1016/j.cden.2012.07.005
12. Saeidi M, Mohammadbeigi A, Salehi F, Barakian Y. **Frequency of Tobacco Use and its Relationship with Oral Soft Tissue Lesions.** J Res Dent Sci. 2022;19(1):30-7. doi:10.52547/jrds.19.1.30
13. Javed F, Warnakulasuriya S. **Tobacco Use and the Risk of Oral Potentially Malignant Disorders and Oral Cancer: A Contemporary Review.** Clin Oral Investig. 2023;27(1):1-12.
14. Calabria E, Canfora F, Leuci S, Coppola N, Pecoraro G, Giudice A, et al. **Gender Differences in Pain Perception Among Burning Mouth Syndrome Patients: A Cross-sectional Study of 242 Men and 242 Women.** Sci Rep. 2024;14:3340. doi:10.1038/s41598-024-53539-6
15. Harrandah AM, Bahatheq JY, Mandourah MA, Kaki WY, Alandonisi AM, Subahi MF. **Effect of Different Types of Smoking on Oral Health and on Cellular Changes in Oral Mucosa.** Saudi Dent J. 2024;36(1):880–6. doi:10.1016/j.sdentj.2024.01.015
16. Singh G, Preethi B, Chaitanya KK, Navyasree M, Kumar TG, Kaushik MS. **Prevalence of Oral Mucosal Lesions among Tobacco Consumers: Cross-Sectional Study.** J Pharm Bioallied Sci. 2023 Jul;15(Suppl 1):S562-S565. doi: 10.4103/jpbs.jpbs_104_23.
17. Martins-de-Barros AV, Barros AM, Silva CC, Ramos LF, Ferreira SJ, Araújo FA, et al. **High Prevalence of Oral Potentially Malignant Disorders and Risk Factors in a Semi-urban Brazilian City: A Population-based Cross-sectional Study.** Med Oral Patol Oral Cir Bucal. 2021 Nov 1;26(6):e778-e785. doi: 10.4317/medoral.24747.
18. Fitzpatrick SG, Cohen DM, Clark AN. **Ulcerated Lesions of the Oral Mucosa: Clinical and Histologic Review.** Head Neck Pathol. 2019;13(1):91–102. doi:10.1007/s12105-018-0981-8
19. Alayadi H. **The Impact of Nicotine Patches on Gingival and Oral Health: A Narrative Review.** Cureus. 2024 Sep 30;16(9):e70571. doi: 10.7759/cureus.70571.
20. Tadin A, Stazic V, Galic N, Zeljezic D. **Evaluation of Cytotoxic and Genotoxic Effects in Buccal Mucosal Cells in Non-Smokers and Users of Traditional Combustible Tobacco Products and Non--Combustible Alternatives.** J. Xenobiot. 2024;14(1):154-165. doi:10.3390/jox14010009
21. Hedin CA, Axéll T. **Oral Melanotic Macules and Smoker's Melanosis: A Comparative Clinical and Histopathological Study.** Swed Dent J. 2020;44(1), 1-8.
22. Gomes CC, Fonseca-Silva T, Galvão CF, Friedman R, Gomez RS. **Oral Leukoplakia and Erythroplakia in Young Patients: A Systematic Review.** Aust Dent J. 2020;65(1):29–39. doi:10.1111/adj.12741
23. Behura SS, Masthan MK, Narayanasamy AB. **Oral Mucosal Lesions Associated with Smokers and Chewers: A Case-control Study**

- in Chennai Population. J Clin Diagn Res. 2015;9(4):ZC17–ZC22. doi:10.7860/JCDR/2015/11460.5844
24. Pampaloni MH, Sokolowski D, Schwarz E. **Tobacco Use and Oral Cancer: A Global Perspective.** J Dent Res. 2020;99(3):261–7. doi:10.1177/0022034519899283
25. Adamson OO, Erinoso OA, Oluwakuyide RT, Amao AA, Effiom OA, Gbotolorun OM. **Association Between Non-healing Precancerous Oral Lesions and Ulcers with Tobacco Smoking: A Population-based Study.** Oral Surg Oral Med Oral Pathol Oral Radiol. 2024;137(3):e78. doi:10.1016/j.oooo.2023.11.006
26. Tomar SL, Hecht SS, Jaspers I, Gregory RL, Stepanov I. **Oral Health Effects of Combusted and Smokeless Tobacco Products.** Adv Dent Res. 2019 Oct;30(1):4-10. doi: 10.1177/0022034519872480.
27. Thiem DGE, Donkiewicz P, Rejaey R, Wiesmann-Imilowski N, Deschner J, Al-Nawas B, et al. **The Impact of Electronic and Conventional Cigarettes on Periodontal Health-A Systematic Review and Meta-analysis.** Clin Oral Investig. 2023 Sep;27(9):4911-4928. doi: 10.1007/s00784-023-05162-4.