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Research Article

IMPACT OF ELECTRONIC CIGARETTE USE ON SELF-REPORTED ORAL HEALTH OVER TWO YEARS IN ADULTS IN WEST OF IRAN

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Abstract

Background: Electronic nicotine delivery systems (ENDS) are increasingly used by individuals without prior tobacco exposure, yet their long-term oral health effects in non-smokers remain unclear. The present study aimed to evaluate the longitudinal effects of electronic cigarette use on oral health among non-smoking adults over two-years in the west of Iran. **Methods:** A prospective 24-month observational study was conducted among 66 non-smoking adults aged 16–75 years. Participants underwent periodic clinical oral examinations and completed standardized questionnaires. Demographic, socioeconomic, oral hygiene, and exposure-related variables were recorded. **Results:** Gingivitis (45%), xerostomia (40%), tooth sensitivity (35%), and dental caries (30%) were the most prevalent complications. Symptoms typically developed within 4–9 months after initiation of electronic cigarette use. No oral malignancies were observed. **Conclusion:** Electronic cigarette use was associated with clinically relevant oral health deterioration in non-smokers.

Keywords: Electronic cigarettes, Oral health, Complications.

INTRODUCTION

Over the past decade, electronic cigarettes have rapidly emerged as one of the most widely used nicotine delivery systems worldwide. Initially introduced as a potential harm reduction alternative for conventional cigarette smokers, electronic cigarettes are now increasingly used by individuals with no prior history of tobacco consumption. This trend is particularly pronounced among adolescents and young adults, for whom vaping has become a socially acceptable and often normalized behavior. Aggressive marketing strategies, appealing flavor profiles, and the perception that electronic cigarettes are safer than combustible tobacco have significantly contributed to their widespread adoption in younger populations. Recent epidemiological data indicate that vaping prevalence among young adults has surpassed that of traditional cigarette smoking in many countries. This shift represents a growing public health concern, as early initiation of nicotine exposure is associated with long-term dependence, neurobiological vulnerability, and progression to other substance use. Despite mounting evidence of respiratory and cardiovascular risks associated with electronic cigarette use, oral health consequences remain comparatively under-recognized, particularly among non-smokers who may underestimate potential harms. The oral cavity serves as the primary point of contact for electronic cigarette aerosols, which contain nicotine, propylene glycol, vegetable glycerin, and a wide range of flavoring chemicals. While many of these compounds are considered safe for ingestion, their repeated aerosolized exposure may have deleterious effects on oral tissues. Experimental studies have demonstrated that electronic cigarette aerosols can induce oxidative stress, inflammatory cytokine release, and epithelial barrier dysfunction within oral mucosa. Furthermore, the hygroscopic nature of propylene glycol may reduce salivary flow, thereby compromising the protective functions of saliva and increasing susceptibility to dental caries, gingival inflammation, and mucosal irritation. Young adults may be particularly vulnerable to these effects due to frequent and prolonged vaping behaviors, often involving high-nicotine concentrations and flavored products that encourage repeated use. In addition, many young users do not engage in regular dental care and may maintain suboptimal oral hygiene practices, further amplifying the risk of oral complications. Importantly, because electronic cigarettes do not produce the characteristic staining or odor associated with traditional smoking, early signs of oral pathology may go unnoticed by both users and clinicians. Although a growing body of literature has examined the systemic health effects of vaping on oral health outcomes remain limited. This gap is particularly evident in Middle Eastern populations, where cultural, behavioral, and regulatory factors may influence vaping patterns differently from Western contexts. Understanding the oral health implications of electronic cigarette use in non-smokers is essential for informing preventive strategies, clinical counseling, and public health policy. The present study aimed to evaluate the longitudinal effects of electronic cigarette use on oral health among non-smoking adults over a two-year period. By focusing on a population without prior tobacco exposure, this study seeks to isolate the specific oral health risks attributable to vaping and to highlight the importance of early intervention and education, particularly among younger adults for whom electronic cigarette use has become increasingly prevalent.

METHODOLOGY

Study Design and Setting

A prospective observational longitudinal study. This means researchers followed the same group of people forward in time (from 2023 to 2025) to see how their oral health changed. This study Conducted at the Kermanshah University of Medical Sciences, likely within their dental clinics or public health research facilities in Iran.

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Participant Selection

The study focused on a very specific group to isolate the effects of vaping (Table 1).

Table 1. Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Tobacco History	Non-smokers: Individuals with no history of combustible tobacco use (to isolate the effects of vaping).	Current or former smokers of traditional cigarettes or cigars.
Vaping Status	Current users of Electronic Nicotine Delivery Systems (ENDS) or those initiating use at the start of the study.	Individuals not using any form of electronic nicotine products.
Age Range	Adults and adolescents aged 16–75 years.	Individuals under the age of 16 or over 75.
Medical History	Generally healthy individuals capable of undergoing periodic exams.	Pre-existing systemic diseases (e.g., uncontrolled diabetes) that could influence gum health.
Medication	Participants not on chronic medication that alters saliva.	Use of medications known to cause extreme xerostomia (dry mouth) independently of vaping.
Oral Baseline	Willingness to undergo periodic clinical examinations for 24 months.	Presence of pre-existing oral malignancies or severe advanced periodontal disease at baseline.

Data Collection Procedures

We used a two-pronged approach to collect data over the 24-month period based on clinical examinations, and standardized questionnaires arranged by Self-Reported symptoms such as xerostomia, tooth Sensitivity, halitosis, and oral lesions.

Exposure Assessment

The study tracked specific details about the participants' vaping habits, including:

Duration of use (how many months they had been vaping), and frequency of use (daily vs. occasional).

Statistical Analysis: We used descriptive Statistics, Chi-square , and Fisher's Exact Test. In this study P-value > 0.05is significant.

RESULTS

Baseline Characteristics

Baseline demographic, socioeconomic, oral hygiene, and exposure characteristics of the study population are summarized in Table 2.

Table 2. Baseline demographic, socioeconomic, oral hygiene, and exposure characteristics of non-smoking e-cigarette users (N = 66)

Characteristic	Category	n (%)
Age group (years)	16–25	14 (21.2)
	26–35	16 (24.2)
	36–45	13 (19.7)
	46–55	11 (16.7)
	≥56	12 (18.2)
Sex	Male	38 (57.6)
	Female	28 (42.4)
Occupation	Agriculture	10 (15.2)
	Employed (public/private)	18 (27.3)
	Self-employed / Business	14 (21.2)
	Retired	9 (13.6)
	Unemployed	15 (22.7)
Educational level	Primary/secondary	20 (30.3)
	High school	18 (27.3)
	University or higher	28 (42.4)
Economic status	Low	19 (28.8)
	Middle	31 (47.0)
	High	16 (24.2)
Oral hygiene practices	Regular (≥2/day)	29 (43.9)
	Irregular (≤1/day)	37 (56.1)
Dental visits	Regular	24 (36.4)
	Irregular/none	42 (63.6)
Smokers in household	No	66 (100)

Oral Health Complications and Temporal Patterns

During the 24-month follow-up period, a progressive increase in oral health complaints was observed. Early symptoms such as halitosis and xerostomia were commonly reported within the first 3–6 months of electronic cigarette use. More structural and inflammatory conditions, including gingivitis, tooth sensitivity, and dental caries, became more prominent between 6 and 9 months. Table 3 summarizes the prevalence and mean onset time of oral health complications.

Table 3. Prevalence and time to onset of oral health complications following electronic cigarette Use (N = 66)

Oral Complication	Prevalence (%)	Mean Onset (Months)
Gingivitis (gum inflammation)	45%	6
Xerostomia (dry mouth)	40%	5
Tooth sensitivity	35%	7
Dental caries	30%	8
Halitosis	25%	4
Oral ulcers	20%	9
Oral tumors	0%	—

No cases of oral malignancy or premalignant lesions were detected during the study period.

No statistically significant differences in complication prevalence were observed between age or sex subgroups ($p > 0.05$). Participants reporting irregular oral hygiene practices showed a higher frequency of gingivitis and caries compared with those reporting regular brushing, although these differences did not reach statistical significance.

DISCUSSION

This longitudinal study demonstrates that electronic cigarette use is associated with a high prevalence of oral health complications in individuals with no prior history of tobacco smoking. The most frequently observed condition was gingivitis, affecting 45% of participants, suggesting that vaping may induce gingival inflammation even in the absence of combustible tobacco exposure. Experimental and clinical studies have shown that electronic cigarette aerosols can stimulate oxidative stress and pro-inflammatory cytokine release in human epithelial cells and fibroblasts, thereby promoting inflammatory responses within tissues [1]. Xerostomia was one of the earliest and most common symptoms, reported by 40% of participants, typically within the first five months of electronic cigarette use. This finding is consistent with previous reports indicating that propylene

glycol, a major component of e-liquids, has hygroscopic properties that reduce salivary flow by drawing moisture from oral tissues [2]. Saliva plays a critical role in maintaining oral homeostasis by buffering acids, providing antimicrobial activity, and facilitating enamel remineralization. Reduced salivary secretion may therefore predispose users to secondary complications, including dental caries and tooth sensitivity. Tooth sensitivity and dental caries were observed in 35% and 30% of participants, respectively, with a later onset compared to xerostomia. This delayed presentation suggests cumulative enamel and dentin damage over time. Previous studies have demonstrated that many flavored e-liquids possess acidic pH levels, which may contribute to enamel demineralization and increased dentinal permeability, thereby explaining the sensitivity reported by users [3]. In addition, vegetable glycerin increases aerosol viscosity, promoting adherence of cariogenic bacteria such as Streptococcus mutans, which may accelerate the development of dental caries [4]. Halitosis and oral ulceration were also relatively common findings. Halitosis may reflect alterations in the oral microbiome induced by electronic cigarette aerosols, as supported by microbiome analyses demonstrating increased pathogenic bacterial colonization in vapers [5]. Oral ulcers, reported by 20% of participants, may result from direct chemical irritation of the oral mucosa and impaired epithelial repair mechanisms [6].Notably, no oral malignancies or premalignant lesions were identified during the two-year follow-up period. While this finding is reassuring, it should be interpreted with caution, as oral carcinogenesis typically involves prolonged latency periods. Experimental evidence suggests that chronic exposure to electronic cigarette aerosols may induce DNA damage and cellular senescence in oral tissues, raising concerns about potential long-term oncogenic risk [7,8]. Extended longitudinal studies are therefore necessary to fully assess cancer-related outcomes. Overall, the findings of this study challenge the perception that electronic cigarettes are a harmless alternative to traditional smoking, particularly for non-smokers. The observed pattern of early functional disturbances followed by structural oral damage highlights the importance of early intervention, routine dental monitoring, and public health education aimed at individuals who vape.

Limitations

Limitations include reliance on self-reported data, modest sample size, and restriction to a single geographic region.

Conclusion

Electronic cigarette use was associated with a high prevalence of oral health complications in non-smoking adults within two years of initiation. Gingivitis, xerostomia, dental caries, and tooth sensitivity were the most common findings. These results emphasize the importance of incorporating oral health counseling into vapingrelated public health strategies.

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Conflict of Interest: The authors declare no conflicts of interest.

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