SECTION 2. THEORETICAL MEDICINE: BASIC DEVELOPMENT TRENDS

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THE IMPACT OF E-CIGARETTE SMOKING AND VAPING ON ORAL HEALTH

ВПЛИВ ВЕЙПІНГУ ТА КУРІННЯ ЕЛЕКТРОННИХ СИГАРЕТ НА СТАН РОТОВОЇ ПОРОЖНИНИ

Volokhova L. B.
Dental therapist, CEO
Dr. Volokhova Medical Center
Kyiv, Ukraine

Волохова Л. Б.
стоматолог-терапевт, керівник
Медичний центр Dr. Volokhova
Medical Center
м. Київ, Україна

In recent years, Ukraine has experienced an increase in the popularity of electronic smoking devices, especially e-cigarettes and tobacco heating systems. The WHO is urging rapid regulation of e-cigarettes, stating they are not a safe alternative to tobacco, are addictive, and pose health risks, particularly for children and young people. By 2026, more than 100 million adults are expected to use vapes, and the nicotine content raises the risk of disease. Studies in Ukraine also show a significant rise in electronic cigarette users over the past decade. Among all tobacco and nicotine products, usage has grown by 5–10%. Additionally, one in five teenagers (19.6%) has used e-cigarettes in the past 30 days, and this trend has stayed steady since 2017. Young people also frequently use alternative tobacco and nicotine products like pouches and smokeless tobacco, which deliver nicotine, an addictive substance harmful to adolescents' health [1].

Vaping and the use of other ENDS[1] may help some people quit smoking, while for others, it is more of a recreational activity. Simultaneously, the use of e-cigarettes and tobacco heating systems is increasing among both young people and adults due to the common belief that they are safe and pose no health risks. At the same time, a study by Lubis I, Hasibuan S, Noer A, and

[1] Electronic Nicotine Delivery Systems (ENDS), including e-cigarettes and vapes, are battery-operated devices that heat a liquid to create an aerosol, often containing nicotine, flavoring, and other chemicals. ENDS may be designed to look like cigarettes or tanks with refillable reservoirs and rechargeable batteries.

Sinabutar HS found no difference in perceived oral health problems between electronic cigarette users and traditional smokers. [2, p. 110].

It should be noted that e-cigarette and other ENDS use are not safe alternatives to traditional smoking; instead, they are linked to a variety of negative effects on oral health.

Iacob A.M., Escobedo Martínez M.F., Barbeito Castro E., and other scientists summarize existing literature on the effects of vaping on oral health and the mechanism of action in oral tissues to:

- **Associated Risks:** That the use of vapes is associated with an increased risk of periodontitis and caries, though less severe than that of traditional smokers.
- **Specific Oral Effects:** Vaping is associated with an increased risk of gingivitis and periodontal disease, as well as reduced saliva antioxidant capacity [3, p. 5].

Other studies have reported damage to cell DNA, increased oxidative stress, inflammation, and altered healing. Research has also examined how these factors influence DNA damage in human oral cells, alterations in antioxidant capacity and nucleotide metabolites in saliva, and the antibacterial properties of saliva. These findings emphasize the need for further longitudinal studies to evaluate their effects on oral health. According to the references in our qualitative synthesis, vaping is linked to several negative effects on oral health [2, p. 110]. The impact of vaping on periodontal health raises the risk of periodontal disease and may also cause greater damage to the oral cavity.

Increase Risks of Carcinogenesis, Cavities, and Periodontal Disease

A higher risk of carcinogenesis, cavities, and periodontal disease has been observed among e-cigarette users. E-cigarette aerosols contain known carcinogens such as formaldehyde, acetaldehyde, and acrolein, which can be produced when the e-liquid is overheated. Vaping significantly increases the risk of tooth decay and cavities, especially because of the chemical composition of the liquids. Nicotine in e-cigarettes constricts blood vessels, impairing blood flow to the gums and hindering the body’s immune system from fighting infections. It is also important to consider the potential impact of e-cigarette use on orthodontic treatment. A decline in overall immunity associated with e-cigarette use can further worsen oral health and complicate the management of chronic dental diseases.

Impaired Antioxidant Capacity of Saliva

E-cigarettes affect saliva's antioxidant capacity, as evidenced by decreased levels of protective components such as superoxide dismutase (SOD) and glutathione (GSH), suggesting increased oral oxidative stress. The antioxidant ability of saliva is lower in regular smokers compared to non-smokers. Reports also indicate changes in saliva composition,

reductions in its antioxidant properties, and disruptions in the oral microbiome balance. This decline weakens the immune defense in the oral cavity. Studies demonstrate that electronic cigarette users experience a decrease in total antioxidant activity in saliva and a reduction in enzymes that neutralize free radicals, indicating oxidative stress [4].

The Influence of the Composition of the Oral Microbiome

E-cigarettes influence the oral microbiome by shifting the balance between harmful and benign bacteria, potentially leading to conditions like periodontitis, gingivitis, and other infections [5]. Dysbiosis is associated with increased microbial diversity because disruptions in the microbial environment enable certain resident species to thrive, creating ideal conditions for opportunistic microbes. Bacteria such as Porphyromonas gingivalis and Fusobacterium nucleatum are major agents of periodontal destruction and are closely associated with disease progression. Additionally, Porphyromonas gingivalis is a primary microbial cause of periodontitis. The impact of vaping on the mouth mainly involves changes in the microbiome, characterized by dysbiosis – a shift in the types and quantities of microorganisms that fosters the growth of harmful bacteria. This process significantly elevates the risk of e-cigarette users developing cavities, inflammatory periodontal diseases, and gum problems, which are more common among individuals with this harmful habit [6].

Specific Negative Impact on the Deterioration of the Oral Cavity

Sweet flavors containing propylene glycol and glycerin are especially harmful because they suppress the growth of beneficial oral bacteria, such as Streptococcus sanguinis and gordonii, while not affecting the growth of cariogenic S. mutans. In fact, they even promote the formation of biofilms by Streptococcus mutans, thereby promoting colonization of the oral cavity. Since Streptococcus mutans feeds on carbohydrates, and sweet vape flavors contain sugars, these conditions create an ideal environment for its growth and production of lactic acid, which mainly causes cavities [7, p. 987]. Analysis of salivary microflora showed higher levels of the gram-negative bacteria Porphyromonas and Veillonella among e-cigarette users than among traditional cigarette smokers and non-smokers.

In conclusion, it is important to recognize that the widespread use of vapes, especially among young people, may require more effective awareness campaigns to inform the public about their risks and improve understanding of the potential harm they can cause to the oral cavity. Vaping exposes users to toxic chemicals, heavy metals, and high nicotine levels that can lead to addiction and damage to oral health, particularly in youth. Therefore, there is an urgent need for comprehensive public education, especially targeting young people, about the potential risks of e-cigarette

use, along with more scientific research to fully assess their effects on oral and overall health.

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