

Evidence grows for vaping's role in gum disease

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A series of new studies by researchers at NYU College of Dentistry highlights how e-cigarettes alter oral health and may be contributing to gum disease. The latest, published in *mBio*, finds that e-cigarette users

have a unique oral microbiome—the community of bacteria and other microorganisms—that is less healthy than nonsmokers but potentially healthier than cigarette smokers, and measures worsening gum disease over time.

"To our knowledge, this is the first longitudinal study of [oral health](#) and [e-cigarette use](#). We are now beginning to understand how [e-cigarettes](#) and the chemicals they contain are changing the oral microbiome and disrupting the balance of [bacteria](#)," said Deepak Saxena, who led the research with Xin Li; both are professors of molecular pathobiology at NYU College of Dentistry.

Gum disease affects nearly half of U.S. adults over 30 years of age. Smoking cigarettes is a known risk factor for developing gum disease, but less is known about the impact of e-cigarettes—which vaporize nicotine and other chemicals—on oral health, especially the long-term consequences of vaping.

The researchers studied the oral health of 84 adults from three groups: cigarette smokers, e-cigarette users, and people who have never smoked. Gum disease was assessed through two dental exams six months apart, during which plaque samples were taken to analyze the bacteria present.

Changes to gum health

All participants had some gum disease at the start of the study, with cigarette smokers having the most severe disease, followed by e-cigarette users. After six months, the researchers observed that gum disease had worsened in some participants in each group, including several e-cigarette users.

A key indicator of gum disease is clinical attachment loss, measured by gum ligament and tissue separating from a tooth's surface, leading the

gum to recede and form pockets. These pockets are breeding grounds for bacteria and can lead to more severe gum disease. In a study of the same participants published in [Frontiers in Oral Health](#), the research team found that clinical attachment loss was significantly worse only in the e-cigarette smokers—not non-smokers and cigarette smokers—after six months.

A unique microbiome

The researchers then analyzed the bacteria found in the plaque samples and determined that e-cigarette users have a different oral microbiome from smokers and nonsmokers—building on findings the team previously reported in [iScience](#) and [Molecular Oral Microbiology](#).

While all groups shared roughly a fifth of the types of bacteria, the bacterial makeup for e-cigarette users had strikingly more in common with [cigarette smokers](#) than nonsmokers. Several types of bacteria, including *Selenomonas*, *Leptotrichia*, and *Saccharibacteria*, were abundant in both smokers and vapers compared to nonsmokers. Several other bacteria—including *Fusobacterium* and *Bacteroidales*, which are known to be associated with gum disease—were particularly dominant in the mouths of e-cigarette users.

When plaque samples were gathered and analyzed in the six-month follow-up, the researchers found greater diversity in bacteria for all groups studied, yet each group maintained its own distinct microbiome.

"Vaping appears to be driving unique patterns in bacteria and influencing the growth of some bacteria in a manner akin to cigarette smoking, but with its own profile and risks to oral health," said Fangxi Xu, a junior research scientist in Saxena's lab and the study's co-first author.

An altered immune response

The researchers found that the distinct microbiome in e-cigarette users was correlated with clinical measures of gum disease and changes to the host immune environment. In particular, vaping was associated with different levels of cytokines—proteins that help regulate the immune system. Certain cytokines are linked to an imbalance in oral bacteria and can worsen gum disease by making people prone to inflammation and infection.

TNF α , a cytokine that causes inflammation, was significantly elevated among e-cigarette users. In contrast, cytokines IL-4 and IL-1 β were lower among e-cigarette users; IL-4 tends to be reduced in people with gum disease and increases after treatment, which suggests that certain bacteria in the mouths of e-cigarette users may be actively suppressing immune responses.

The researchers concluded that the distinct oral microbiome of e-cigarette users elicits altered immune responses, which along with clinical markers for [gum disease](#) illustrate how vaping presents its own challenge to oral health.

"E-cigarette use is a relatively new human habit," said Scott Thomas, an assistant research scientist in Saxena's lab and the study's co-first author. "Unlike smoking, which has been studied extensively for decades, we know little about the health consequences of [e-cigarette](#) use and are just starting to understand how the unique microbiome promoted by vaping impacts oral health and disease."

More information: Electronic Cigarette Use Promotes a Unique Periodontal Microbiome, *mBio*, [DOI: 10.1128/mBio.00075-22](https://doi.org/10.1128/mBio.00075-22)

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