



## CASE-REPORTS



# Oral Squamous Cell Carcinoma of the Tongue in the Setting of Electronic Cigarette Use

Traeden Wilson, BS <sup>1</sup> | Donald Solomon, MD <sup>1,2</sup> | Nadir Ahmad, MD <sup>1,2</sup> | Luke Stanisce, MD <sup>2</sup> | Swar Vimawala, MD <sup>2</sup> | Yekaterina Koshkareva, MD <sup>1,2\*</sup>

1. Cooper Medical School of Rowan University, Camden, NJ
2. Division of Otolaryngology – Head & Neck Surgery, Cooper University Health Care, Camden, NJ

### Abstract

The understanding of short and long-term health impacts of electronic cigarette use are limited by the paucity of longitudinal data and a wide heterogeneity amongst products. Recent in-vitro and in-vivo studies have demonstrated the carcinogenic potential of several compounds found in electronic cigarette vapors. We present a case of a 17-year-old male presented with a biopsy proven HPV negative squamous cell carcinoma of the tongue. The only pertinent history was a frequent daily use of an electronic nicotine delivery system (ENDS), or electronic cigarette. The patient underwent a partial glossectomy and ipsilateral left modified radical neck dissection. Though sufficient literature is unavailable to link ENDS to oral cancer, contemporary evidence highlights a multitude of carcinogenic properties. With rising ENDS usage amongst youth populations, both physicians and patients need to be aware of the potential risks.

**Keywords:** Oral cancer, electronic cigarette, ENDS, head & neck cancer, vaping, carcinogenesis

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## 1 | INTRODUCTION

Known by a variety of names including “e-cigs,” “vapes,” and “pens,” Electronic Nicotine Delivery Systems (ENDS) produce an aerosolized vapor in place of traditional tobacco smoke. Their popularity and use have increased in recent years, particularly in the youth population. In 2019, over a quarter of high school students reported using ENDS, representing a 78% increase from the prior year.<sup>(1)</sup> Our understanding of the short and long-term health impacts of ENDS use are limited by the paucity of longitudinal data and a wide heterogeneity amongst

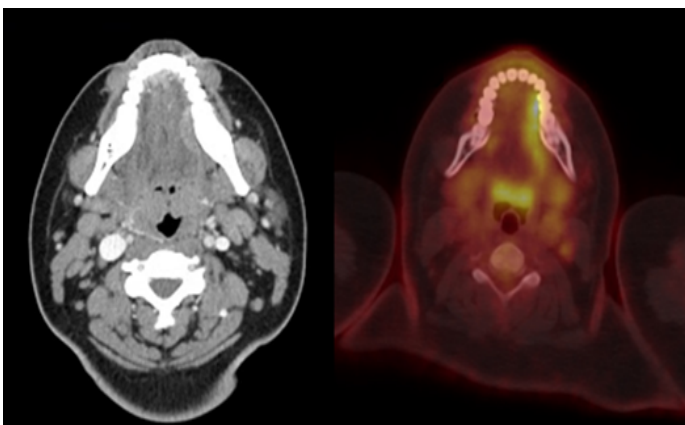
products. Recent in-vitro and in-vivo studies have demonstrated carcinogenic potential of several compounds found in ENDS vapors. Moreover, early nicotine exposure in teens may lead to a lifelong addiction and serve as a gateway to riskier behaviors with well-known adverse health effects.<sup>(2)</sup>

Herein, we present the case of a 17-year-old male with oral squamous cell carcinoma (SCCa) in the setting of self-reported ENDS use. This illustration aims to highlight the growing concerns regarding carcinogenic potential of ENDS.

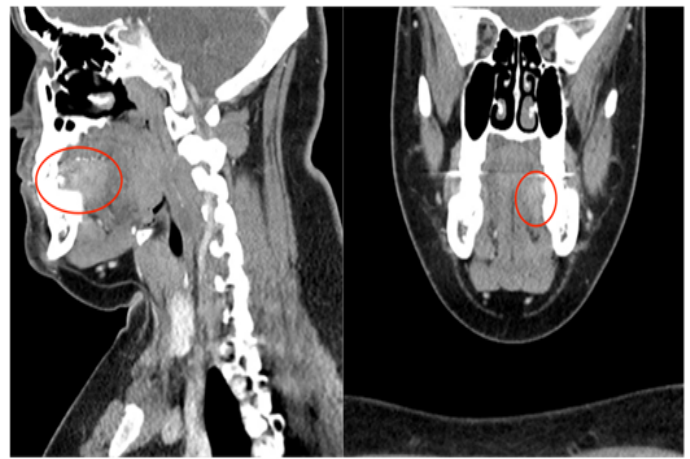
## 2 | CASE REPORT

A 17-year-old male patient was referred to our practice for a painless tongue lesion of two months' duration. A biopsy, performed by the referring physician, revealed atypical squamous proliferation highly suspicious for invasive squamous cell carcinoma. The patient denied any history of head and neck cancer, alcohol use, immunodeficiencies, or dental issues. He reported a history of daily "vaping" during the last year of high school. The patient identified mango and mint flavored Juul and Flair pods as his primary device, which he used multiple times each day. He also disclosed a one-time use of chewing tobacco after trying it during a school trip.

Examination revealed a 2.5cm x 1.5cm exophytic verrucous-type tumor confined to the lateral oral tongue. Anatomic computed tomography (CT) and proton emission topography (PET) imaging showed a hypermetabolic soft tissue mass along the left lateral aspect of the oral tongue and non-avid enlarged level IIa adenopathy (**Figure 1** and **Figure 2**). The patient underwent a partial glossectomy, ipsilateral left modified radical neck dissection followed by adjuvant radiation. Pathologic examination demonstrated an HPV-negative, pT3 pN0 M0 SCCa with perineural invasion. The depth of invasion was determined to be 10.5 mm. There was no evidence of recurrence on post-treatment imaging. At the 2.5-year post-op follow up, the patient continues to be disease free. The patient has since reportedly quit using ENDS.



**Figure 1.** Pre-operative Computed Topography imaging of the neck with contrast and Proton Emission Topography imaging of neck demonstrating soft tissue enhancement in the left oral tongue



**Figure 2.** Sagittal and coronal planes of pre-operative Computed Topography demonstrating a hyperdensity on the left oral tongue.

## 3 | DISCUSSION

This rare case of oral cancer in a youthful self-reported ENDS user calls to attention the growing concern of increased ENDS use and its particular impacts on younger populations. Similar to other studies using self-reported ENDS data, the ENDS and oral tobacco use in our study is based upon a self-report by a teenager and may or may not be fully accurate.

Since its introduction, current ENDS use ( $\geq 1$  day in past 30 days) among US adults 18 years and older has remained relatively stable at 3.2%.<sup>(3)</sup> However, current ENDS use is more prevalent amongst younger demographics (7.6% ages 18-24, 4.3% ages 25-44) compared to older adults (2.1% ages 45-64, 0.4% ages  $> 65$ ).<sup>(4)</sup> Comparatively, prevalence of active ENDS use among high school and middle school students was 20.8% and 5%, respectively. This represents a record annual increase of almost 80% and 50% for each student population.<sup>(5)</sup> As a result, ENDS is now the most used nicotine product among high school and middle school demographics.<sup>(6)</sup> Trends regarding the type of ENDS used and

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**Supplementary information** The online version of this article (<https://doi.org/10.52845/JORR/2023/4.3.2>) contains supplementary material, which is available to authorized users.

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**Corresponding Author:** Yekaterina Koshkareva, MD  
Division of Otolaryngology–Head and Neck Surgery  
Cooper University Health Care, Three Cooper Plaza,  
Suite 404 Camden NJ, 08103. E-mail: [koshkareva-yekaterina@cooperhealth.edu](mailto:koshkareva-yekaterina@cooperhealth.edu)

flavor preference are also important considerations. The most common devices in 2020 were prefilled pods or cartridges (48.5%), similar to the ones used by our patient. The most popular flavor additives were fruit (73.1%) and mint (55.8%).(7)

The presence of carcinogenic toxins in ENDS vapors and aerosols, although at significantly lower levels than combustible tobacco products, may increase the risk of oral cancer.(8) Chemical hazards found within ENDS vapor include tobacco-specific nitrosamines (TSNAs), carbonyl compounds (e.g. formaldehyde, acetaldehyde), and volatile organic compounds (e.g. toluene).(9) The International Agency for Research on Cancer (IARC) designates TSNAs, formaldehyde, and toluene as “Group 1” carcinogens indicating the strongest link to carcinogenesis. The addition of flavorant in e-cigarette liquid has been directly linked to the amount of carbonyl compounds and formaldehyde in ENDS vapor. Trace metals with known carcinogenic properties, such as Chromium, have been detected in ENDS aerosols. These substances are found in traditional tobacco products and are well associated with aerodigestive malignancy.

Multiple cellular mechanisms of carcinogenesis related to ENDS use have been shown in recent investigations. Pro-inflammatory changes, such as macrophage phagocytic dysfunction and increased cytokine secretion, are induced by ENDS and may act as precursors to neoplastic growth.(10) Yu et al. demonstrated that normal epithelial cell lines and head and neck SCCa cell lines show increased DNA double strand breakage, increased cell death, and decreased cell clonogenic survival when exposed to ENDS vapor.(11) More recently, in-vivo experimentation by Tommasi et al. observed deregulation of oncogenic genes in the oral epithelium of human ENDS users, specifically the Wnt/Ca<sup>+</sup>, protein ubiquitination pathway, and tRNA charging pathways.(12)

Though studies show that ENDS contain chemical hazards, not all ENDS products are the same. Heterogeneity of ENDS ingredients exist due to limited regulation on the production of ENDS products. This has made it difficult to accurately evaluate the carcinogenic properties of ENDS. Future studies examining the effect of ENDS on the oral epithelium are required before a causal role in

oral carcinogenesis can be attributed to ENDS. As cancer arising from smoking traditional combustible cigarettes occurs after decades of regular use, human carcinogenesis across large populations in ENDS use will not be known for years.

## 4 | CONCLUSION

Our case describes a 17-year-old with oral squamous cell carcinoma in the setting of ENDS use. The use of ENDS products has increased among younger populations, especially among middle and high school aged youth and younger adults. ENDS use has been suggested to lead to combustible cigarette use, especially when ENDS is initiated at younger ages. Though sufficient literature is unavailable to definitely link ENDS to oral cancer, contemporary evidence highlights a multitude of carcinogenic properties. With rising ENDS usage amongst youth populations, both physicians and patients need to be aware of the potential risks.

## REFERENCES

1. Cullen KA, Gentzke AS, Sawdey MD, et al. e-Cigarette Use among Youth in the United States, 2019. *JAMA*. 2019; 322(21):2095–2103.
2. Chapman S, Bareham D, Maziak W. The Gateway Effect of E-cigarettes: Reflections on Main Criticisms. *Nicotine Tob Res*. 2019; 21(5):695-698. doi:10.1093/ntr/nty067
3. Dai H, Leventhal AM. Prevalence of e-Cigarette Use among Adults in the United States, 2014-2018. *JAMA*. 2019; 322(18):1824-1827.
4. Villarroel M, Cha A, Vahratian A. (2018). Electronic Cigarette Use Among U.S. Adults, 2018 Key findings Data from the National Health Interview Survey. <https://www.cdc.gov/nchs/products/index.html>.

5. Cullen KA, Ambrose BK, Gentzke AS, Apelberg BJ, Jamal A, King BA. Notes from the Field: Use of Electronic Cigarettes and Any Tobacco Product Among Middle and High School Students - United States, 2011-2018. *MMWR Morb Mortal Wkly Rep.* 2018;67(46):1276-1277. Published 2018 Nov 16.
6. Gentzke AS, Creamer M, Cullen KA, et al. Vital Signs: Tobacco Product Use Among Middle and High School Students—United States, 2011–2018. *Morbidity and Mortality Weekly Report* 2019; 68:157–164.
7. Wang, T. W., Neff, L. J., Park-Lee, E., Ren, ; Chunfeng, Cullen, K. A., & King, B. A. (n.d.). *Morbidity and Mortality Weekly Report E-cigarette Use Among Middle and High School Students-United States, 2020.* <https://doi.org/10.1001/jama.2019.18387>
8. Sultan AS, Jessri M, Farah CS. Electronic nicotine delivery systems: Oral health implications and oral cancer risk [published online ahead of print, 2018 Dec 3]. *J Oral Pathol Med.* 2018;10.1111/jop.12810.
9. Goniewicz ML, Knysak J, Gawron M, et al. Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control.* 2014;23(2):133–139.
10. Ween MP, Whittall JJ, Hamon R, Reynolds PN, Hodge SJ. Phagocytosis and Inflammation: Exploring the effects of the components of E-cigarette vapor on macrophages. *Physiol Rep.* 2017;5(16):e13370.
11. Yu V, Rahimy M, Korrapati A, et al. Electronic cigarettes induce DNA strand breaks and cell death independently of nicotine in cell lines. *Oral Oncol.* 2016;52:58–65.
12. Tommasi S, Caliri AW, Caceres A, et al. Deregulation of Biologically Significant Genes and Associated Molecular Pathways in the Oral Epithelium of Electronic Cigarette Users. *Int J Mol Sci.* 2019; 20(3):738. Published 2019 Feb 10.

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**How to cite this article:** Yekaterina Koshkareva et al. Oral Squamous Cell Carcinoma of the Tongue in the Setting of Electronic Cigarette Use . *Journal of Otolaryngology and Rhinology Research.*2023;141-144. <https://doi.org/10.52845/JORR/2023/4.3.2>

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