

Can Vaping affect the Periodontal Health? A Review

Vaping or e cigarette smoking for a long term can undeniably have an impact on the periodontal tissues.

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Abstract: The aim of this review article is to evaluate the original published articles and discuss the concerned effects of the e-cigarettes on the health of the periodontium. An internet search was done and various published articles were evaluated. Although it is very known that e-cigarettes has been used as an effective remedy for quitting smoking habit and thereby reducing the chances of its hazardous effects on overall body health this article summarizes that it still affects the health of the gingival and periodontal tissues. Various studies have revealed that choosing e-cigarettes as an alternative for smoking might help for a short period of time but its use in the long run may potentially develop the risk of periodontal disease.

1. Introduction

Electronic smoking devices are not a new phenomenon, with a patent being recorded in 1965 in the USA.¹ The modern rise of e-cigarettes is attributed to Hon Lik, a Chinese inventor, who filed a US patent in 2005 for an 'electronic atomization cigarette that contains nicotine without tar'.² E-cigarettes are the electronic devices that produce aerosol. Aerosol is a mixture of fine particles/ liquid droplets suspended in a gaseous medium. E-cigarette is made up of 4 components. A mouth piece, flavor cartridge, atomizer, Lithium battery.³

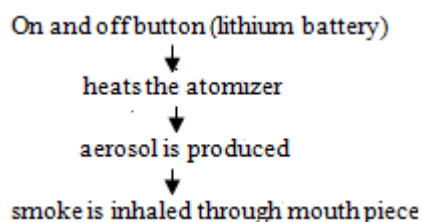
Types of E-Cigarettes

1st generation: Also known as cig-a-likes/minis. It is low cost and disposable. 200-300 puffs per cartridge which is equivalent to 1 pack of 20 cigarettes. It has limited battery life. The nicotine delivery is poor.

2nd generation: Also known as 'tanks'. It resembles a pen. It contains a tank which is refillable. It has larger batteries and is rechargeable.

3rd generation: Also known as 'mods'. It has advanced features like adjustable voltage systems and is digitalized.

2. Mechanism



Some common features of periodontal diseases include:

halitosis (bad breath), red swollen gums, bleeding gums, recession of gum tissues, formation of periodontal pockets, tooth mobility. Nicotine is an alkaloid found in plants. It is found in the leaves of *Nicotiana rustica*, *nicotiana tabacum*, *dubiosia hopwoodii*. It also occurs in edible plants such as eggplant, potatoes and tomatoes. It is highly addictive and acts as either stimulant or relaxant. It increases metabolic rate and reduces appetite resulting in lower body weight of smokers as compared to non smokers.^{12,15}

Nicotine and periodontal health:

Nicotine is vasoconstrictor. It constricts the arteries and reduces the amount of oxygenated blood flow and nutrients to the gums thereby reducing the wbc's that provide anti-inflammatory action against harmful foreign substances. 3 types of bacteria thrive in a deoxygenated environment- *porphyromonasgingivalis*, *aggregatibacter actinomycetem comitans*, *prevotella intermedia*.²² These bacteria are found in plaque, tartar and pocket depth of up to 3mm. This leads to the destruction of PDL and alveolar bone. Without sufficient blood gingival and periodontal tissues cannot be healthy. Also nicotine is a muscle stimulant which causes bruxism due to hyperactivity of the muscles. Tobacco smoke induces changes in cell structure and function by altering cell signaling pathways, which is predominantly harmful to bronchial and oral epithelial cells.^{13,14}

Aerosols and periodontal health:

E-cigarettes produce aerosol. Aerosol can cause carbonyl inflammatory action. Also heat produced from the vapor leads to xerostomia (dry mouth). Saliva contains lysozymes that kill the bacteria. Therefore xerostomia leads to formation of harbor for the bacteria to pool in. Especially in the advanced featured cigarettes the voltage is regulated at high temperature for more effect which causes xerostomia. Extreme heat can necrotize the blood vessels. When e-cigarettes are heated to high temperature it produces carbonyls like formaldehyde, acetaldehyde. Researchers have noted that Propylene based e-liquids produced more carbonyls. There were multiple user questionnaires/surveys that repeatedly detailed 'mouth and throat dryness and irritation' as one of the most common reported side effects of e-cigarette use.^{4,5,6} An *in vitro* study on periodontal ligament fibroblasts demonstrated decreased fibroblast proliferation rates with menthol additives.⁶ The topical effects of nicotine are worthy of specific consideration. Interestingly, the nicotine in the aerosol is primarily absorbed in the buccal and pharyngeal mucosa, rather than the alveoli, demonstrating the potential to have effects on the oral tissues.^{7,8}

3. Smoking and Vaping

It is worth bearing in mind that the comparator to e-cigarette 'vapour' is burnt tobacco smoke. We know from seminal studies that smokers of burnt tobacco smoke have essentially

a 50 percent mortality rate (half of smokers die from smoking related diseases and half of those will die in middle age [35-69]). Burnt tobacco smoke contains an estimated 10,000 to 100,000 chemicals, including 70 known carcinogens.³ E-cigarette aerosol has been studied in detail and a review of the research on the topic by Cahn and Siegel concluded that we already have a much better knowledge of e-cigarette aerosols than we ever have of cigarette smoke. Toxins have been found in e-cigarettes in several studies including diethylene glycol (used in anti-freeze), lead, nickel and chromium.⁹ These are found in much lower levels than in burnt tobacco smoke. A study by Goniewicz et al investigated 12 brands of e-cigarettes, finding levels of toxicants to be nine to 450 times lower than in burnt tobacco.¹⁰

4. Conclusion

Main aim of invention of e-cigarettes was to replace the conventional cigarette in order to help in smoking cessation for addicts.^{16,17} A cochrane collaboration systematic review published in 2014,²¹ concluded that nicotine containing e-cigarettes increased the chances of quitting conventional cigarettes and helped more smokers to reduce the amount they smoked by at least half. But the potential effect associated with the periodontal health has received very little attention. Studies have revealed that it not only affects the periodontium but also affects the overall oral health including the risk of caries and tooth sensitivity as well as hampered post extraction healing. Taking into consideration all the effects of vaping E- cigarettes should be ideally used as a cessation aid followed by its ultimate cessation.^{19,20,21}

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