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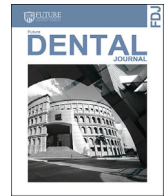
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Effect of Two Different Forms of Smoking on Periodontium: A Retrospective Study

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ABSTRACT

Aim of the study: Is to compare the effects of smoking T-cigs and vaping E-cigs on clinical periodontal parameters in patients. **Materials and Methods:** It consisted of a clinical examination of a total of 60 individuals aged between 29 and 39 years. They responded to a questionnaire about their smoking history, and they were divided into 2 groups as E-cig vapers and T-cig smokers. Full-mouth plaque index (PI), bleeding on probing (BOP), clinical attachment loss (AL), and probing depth (PD) were measured at six sites per tooth on all maxillary and mandibular teeth except third molars. **Results:** T-cigarette had significantly higher probing depth, attachment level and plaque index than E-cigarette group. For bleeding index, T-Cigarette had higher value than E-Cigarette group as well yet the difference was not statistically. **Conclusion:** E-cigs vaping is not as hazardous to periodontal health as T-cigs smoking.

1. INTRODUCTION

In several industrialized and developing countries, diseases caused by cigarette smoking and tobacco use are on the rise. Tobacco use raises the risk of cardiovascular disease (including ischemic and peripheral heart disease, as well as stroke), lung cancer, and chronic obstructive pulmonary disease. Despite various smoke-free campaigns, government tobacco-control legislation, and widespread awareness of the dangers of smoking, tobacco use continues to be overly popular^[1].

The World Health Organization estimates that there are more than 1 billion smokers globally, with that figure predicted to rise to 1.7 billion by 2025^[2]. According to these trends, nearly 10 million people will die each year as a result of tobacco use by 2030, with 70% of these fatalities occurring in low- and middle-income countries^[3].

As a result of excessive cigarette/tobacco usage, the harm caused by this habit, as well as the effects of tobacco smoke on the environment, has spread widely over the world. As a result, in addition to the negative effects of smoking on overall health, researchers are interested in learning more about the influence of cigarette/tobacco consumption on oral health, such as dental implant failures, oral malignancies, and periodontal disorders^[1].

Overall, across all lifestyle factors, smoking has been identified as the most important preventable risk factor for periodontitis. Smoking has been shown to have a negative impact on periodontal cells and tissues, and hence on periodontal disease progression and treatment response, in both experimental and clinical investigations in the periodontal sector^[1].

Traditional cigarettes (T-cigs) are a well-known risk factor for periodontitis, increasing the risk two to fivefold, and grading periodontitis is influenced by the level of smoking, according to the latest classification of periodontitis^{[4], [5]}.

Smoking alters the immunological response of the host through mechanisms such as modification of cytokine and inflammatory mediator production, restriction of gingival vascular function, and creation of an oxidative stress source^[6]. Smoking cessation programs can help reduce the risk of periodontitis and improve clinical outcomes. As the duration of non-smoking rises, smoking cessation is said to lessen the negative effects of smoking and slow the course of periodontal damage^[7].

Inhaling the vapors of electronic cigarettes (E-cigs) has been increasingly popular among those who want to quit smoking in recent years^[8]. E-cigarettes are battery-operated, handheld devices that heat an E-liquid (including different levels of nicotine and flavor additives like propylene glycol or glycerin) to produce a vapor that resembles tobacco smoke.

E-liquid contains a variety of substances, including aldehydes, heavy metals, and tobacco-specific nitrosamines, in addition to a high quantity of nicotine^[9]. As people become more aware of and use electronic cigarettes, there has been some discussion concerning the potential toxicological effects^[10]. Organizations like the World Health Organization and the Food and Drug Administration have expressed concerns about the health impacts of using E-cigarettes^[11].

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The most common claimed motivation for vaping e-cigs is to quit combustible smoking [12], however some consumers also report vaping e-cigs for social amusement and entertainment [12]. Individuals may misinterpret e-cig vaping as less harmful than regular tobacco smoking; recent evidence from in vitro studies [13]-[15] has demonstrated that e-cig aerosol induces oxidative stress, inflammation, and alteration of lung cellular function by compromising myofibroblast maturation, generating mitochondrial stress, and promoting DNA breakage.

In terms of oral health, vaping has been linked to conditions such oral submucous fibrosis and periodontal diseases [16], [17]. Sundar et al. [18] found that exposing oral epithelial cells and periodontal ligament (PDL) fibroblasts to e-cigarette vapor/aerosol with flavorings increased DNA damage and increased expression of proinflammatory cytokines like cyclooxygenase (COX)-2 and prostaglandin E2 (PGE2) in these cells in vitro.

Furthermore, e-cigarette vaping has been shown to boost the expression of advanced glycation end products (AGEs) and their receptors in oral epithelial cells, including gingival tissues [18]. Vaping e-cigarettes may be harmful to oral health in this scenario.

In a recent pilot study, Wadia et al. [17] showed statistically significantly higher gingival inflammation among individuals vaping e-cigs; however, all participants in this study [17] were former cigarette smokers. Despite the fact that E-cigarette use is on the rise, there is little research on the effects of vaping E-cigarettes on periodontal health. As a result, the sole impact of e-cigarette vaping on periodontal health has remained a mystery.

For this reason, the aim of this study was to compare the effects of smoking T-cigs and vaping E-cigs on clinical periodontal parameters in patients. It was initially hypothesized that vaping E-cigs produces fewer harmful effects on clinical parameters of periodontium, compared with smoking tobacco.

2. MATERIALS AND METHODS

The study took place in the Department of Periodontology, College of Dentistry, Ain Shams University in Cairo, Egypt, between May and October 2021. It involved a clinical assessment of 60 people ranging in age from 29 to 39 years old. The study's purpose and protocol were well explained, and all participants signed informed consent forms. All participants were informed that they had the right to withdraw from the study at any time during the assessment without consequence.

Inclusion and exclusion criteria

The participants responded to a questionnaire administered by an experienced researcher (MB) about their smoking history, and they were classified as E-cig vapers and T-cig smokers.

For enrollment, participants met the following inclusion criteria:

- I. T-cig smokers: those who had smoked for at least 12 months and a minimum of 10 cigarettes per day;
- II. E-cig vapers: participants without previous history of tobacco use who had been exclusively vaping e-cigs for at least 12 months.

Exclusion criteria included:

- i. Dual- smoking patients (use of both T-cigs and E-cigs);
- ii. Cigar, pipe and waterpipe smokers;
- iii. Smokeless-tobacco use;
- iv. Non-smokers;
- v. Diabetics;

- vi. Completely edentulous individuals;
- vii. Patients with any disease that can affect periodontal health;
- viii. Patients who had received any periodontal treatment in the last 6 months;
- ix. Alcohol consumers;
- x. Patients who had taken any drugs which can affect periodontal tissues, such as antibiotics and non-steroidal anti-inflammatory drugs, within the past 6 months.

Participants included according to the above criteria were divided into two groups:

- Group I: T-cig smoker group consisted of 30 patients;
- Group II: E-cig vaping group consisted of 30 vaper patients;

Clinical Periodontal Examination

A trained and calibrated examiner (AR) masked to the study groups performed the clinical periodontal examination. Full-mouth plaque index (PI), bleeding on probing (BOP), clinical attachment loss (AL), and probing depth (PD) were measured at six sites per tooth (mesio-buccal, mid-buccal, disto-buccal, disto-lingual/ palatal, mid-lingual/palatal, and mesio-lingual/palatal) on all maxillary and mandibular teeth except third molars. PD was measured to the nearest millimeter using a graded Williams periodontal probe (Hu-Friedy).

Statistical Analysis:

Numerical data were presented as mean and standard deviation (SD) values. Shapiro-Wilk's test was used to test for normality. Parametric data (probing depth and attachment level) were analyzed using independent t-test. Non-parametric data (plaque and bleeding indices) were analyzed using Mann-Whitney U test. The significance level was set at $p < 0.05$ within all tests. Statistical analysis was performed with R statistical analysis software version 4.1.2 for Windows*.

3. RESULTS

Descriptive statistics for different measured parameters are presented and results of intergroup comparisons presented in table (1), showed that T-cigarette had significantly higher probing depth, attachment level and plaque index than E-cigarette group ($p < 0.001$). For bleeding index, T-Cigarette had higher value than E-Cigarette group as well yet the difference was not statistically significant ($p = 0.085$). Mean values of different measured parameters are presented in figure (1).

Table (1)

Intergroup comparisons

Measurement	(Mean±SD)		Statistic	p-value
	T-Cigarette	E-Cigarette		
Probing depth (mm)	4.29±1.43	2.87±1.50	3.81	<0.001*
Attachment level (mm)	3.40±0.68	2.19±0.82	6.31	<0.001*
Plaque index	2.24±0.56	1.24±0.75	810.50	<0.001*
Bleeding index	1.44±0.44	1.15±0.88	603.00	0.085

* significant ($p < 0.05$)

* R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.

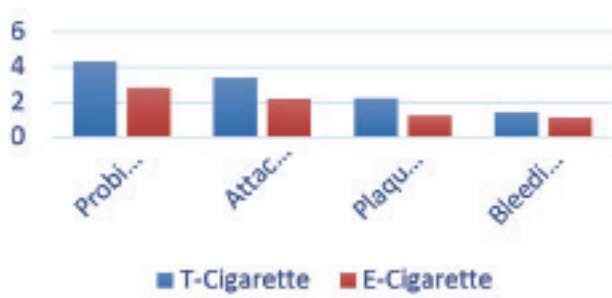


Figure (1) — Bar chart showing mean values of different measured parameters

4. DISCUSSION

Vapers are mainly T-cig smokers or dual-smokers, according to reports.^{[19], [20]} Participants who reported never using tobacco in any form and exclusively smoking E-cigs for at least 12 months were rigorously designated as E-cigs vaping individuals in the current study.

The results of this research were substantially greater among persons in group 1 than among individuals in groups 2 in partial agreement with the provided hypothesis. Previous studies^{[21]-[23]} have found that T-cigs smokers have considerably higher plaque accumulation, clinical AL, and PD than E-cigs smokers.

The inclusion of nicotine in e-cigarettes may explain the differences in BOP. Nicotine is a vasoconstrictor, which suggests it reduces natural blood flow to the gums, potentially leading to tissue ischemia and poor recovery (Silverstein, 1992).

One interpretation in this situation is that tobacco smoking is linked with elevated expression of AGEs and their receptors in gingival tissues, which aggravate oxidative stress and inflammatory responses.^[23] BOP (a classic marker of periodontal disease severity) was masked among individuals in the two groups.

5. CONCLUSION

Within the limitation of the present study, it is concluded that E-cigs vaping is not as hazardous to periodontal health as T-cigs smoking.

Statement of Conflict of Interest

The authors declare that they have no conflicts of interest.

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