The impact of traditional smokers versus electronic cigarette smokers on periodontal parameters in iraqi males

O impacto do uso de cigarros tradicionais versus uso de cigarros eletrônicos nos parâmetros periodontais em homens iraquianos

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ABSTRACT

Objective: To compare the effects of vaping and cigarette smoking and indicate their impact on periodontal health. **Material and Methods:** A total of 90 subjects divided into three groups. Group I: 30 Traditional cigarettes smoker who have smoked up to 10 cigarettes, Group II: 30 electronic cigarettes subjects who have been using vape at least one year and never smoke, and Group III: 30 subjects who have no smoking history. Using a mirror and a periodontal probe, periodontal parameters (plaque index, gingival index, probing depth and clinical attachment loss) were used to evaluate periodontal health. **Results:** The findings showed that the periodontal parameters had a highly significant differences at P ≤ 0.01 between traditional and electronic smoking groups. While clinical attachment loss demonstrated non-significant difference P ≥ 0.05 in comparison between electronic cigarettes and the group who never smoke. **Conclusion:** The results of this study suggested that traditional cigarettes and electronic cigarettes both had unfavorable impact on periodontal health status, never the less quit smoking showed positive impacts on periodontal parameters.

KEYWORDS

Cigarette; Periodontitis; Periodontium; Smoking; Vape.

RESUMO

Objetivo: O objetivo foi comparar os efeitos do uso do cigarro eletrônico e do cigarro convencional, indicando seus impactos na saúde bucal. **Material e Método:** 90 indivíduos foram divididos igualmente em três grupos: Grupo I, usuários de cigarro convencional que fumaram até 10 cigarros por dia; Grupo II: usuários de cigarro eletrônico que utilizam este por pelo menos há 1 ano e não fumavam antes disso; Grupo III: usuários sem qualquer história de hábitos tabagistas. Utilizando um espelho bucal e uma sonda periodontal, parâmetros periodontais (índice de placa, índice gengival, profundidade de sondagem e perda de inserção clínica) foram coletados para avaliar a saúde periodontal. **Resultados:** As evidências mostraram que os parâmetros periodontais apresentaram diferença significativa (P ≤ 0.01) entre os grupos I e II. **Conclusão:** Os resultados deste estudo sugerem que tanto o uso de cigarro convencional como o de cigarro eletrônico possuem impactos desfavoráveis na saúde periodontal, e que a cessação do uso destes mostraram impactos positivos nos parâmetros periodontais.

PALAVRAS-CHAVE

Cigarro; Periodontite; Periodonto; Tabagismo; Vaping.

INTRODUCTION

Periodontal disorders have multiple causes, including interactions between the human body and microbial plaque and an accelerated immune-inflammatory response [1,2]. The most frequent and important independent risk factor for periodontal disease that has an ability to influence the host immune-inflammatory response is smoking [3]. Traditional cigarette smoking is now recognized as a significant risk factor for periodontitis [4].

By reducing the production of cytokines and inflammatory mediators, causing oxidative stress, and impairing gingival vascular function, smoking changes the immune response of the host [5].

According to epidemiological research, smoking significantly increases the chance of developing periodontal disorders. Smokers obviously accumulate more dental calculus than non-smokers. Additionally, smoking is linked to an increased risk of alveolar bone loss, periodontal pocket formation, and periodontal attachment loss [6].

Nicotine is one of the tobacco components. The primary action in vasoconstrictive action is the gingivae's end-arterial vasculature as well as other substances in tobacco can also result in tissue necrosis and ulceration, which are symptoms of periodontal disease. Nicotine stops gingival fibroblasts from growing and prevents them from producing collagen and fibronectin. The ability of oral leukocytes, particularly neutrophils, to migrate and phagocytose may be minimized, and they might have a role in the inactivation of tissue proteinase enzyme inhibitors [7,8]. A masking effect of tobacco smoking on the symptoms of gingival inflammation may give smokers a false sense of being assured about their health of the gingival tissue [9].

In recent years, electronic cigarettes (E-cigarettes) have gained great popularity as a replacement for traditional cigarettes [10,11]. Previous studies have revealed that using E-cigarettes as an alternative for tobacco smoking may be helpful for a short duration but its use for longer time may conceivably develop the risk of periodontal disease [6].

E-cigarettes are battery-operated, handheld devices [12] that create aerosols. An aerosol is a mixture made up of tiny particles and droplets of fluid that have been delayed in a gaseous medium [13].

In order for E-cigarettes to operate effectively, a mixture of propylene glycol, glycerol, nicotine, and other flavoring ingredients must be heated to produce vapors that provide nicotine that is inhaled. Potentially, these ingredients have adverse oral health outcomes. Electronic cigarettes use e-liquids, which possess an easier composition when compared with traditional tobacco products [14]. These liquids heat up in the device and condensate into a viscous aerosol when the smoker inhales them. While some of the aerosol adheres to oral cavity structures, others are absorbed into the bloodstream [15].

Now there are more than 10,000 commercial formulations of e-liquid available. These formulations make up the majority of A bases, nicotine, and flavors, which have a negative effect on oral health [16].

Medical and public debate surrounds the safety of E-cigarettes and their use as an alternative to tobacco consumption. However, E-cigarettes are probably going to be more safe than cigarette smoking, according to a recent assessment by the Royal College of Physicians [17]. But still, users of E-cigarettes have mentioned unpleasant side effects such as dry mouth, sensitive teeth, and mouth ulcers [18].

Therefore, it is necessary to determine if vaping is safer than smoking, and it is vital to look at any probable links between electronic cigarettes and periodontal disease. Therefore, the present study aimed to investigate the relationship between electronic cigarettes and traditional cigarettes and compere their effects on periodontal health status among Iraqi adults.

MATERIAL AND METHODS

At the Department of Periodontology, the investigation was done between 2022 and 2023. A total of 90 males between the ages of 27 and 40 underwent a clinical evaluation and completed questionnaires about their smoking history. Forms for informed consent were completed by each participant after being informed of the objectives and methods of the study. The Ethics Committee at the University granted the necessary clearance.

Three groups of participants were formed, as follows:

- Group I: The traditional cigarette (T-cigarette) smokers' group, consisted of 30 smoker subjects; who were defined as those who have smoked up to 10 cigarettes per day for at least 12 months.

- Group II: The electronic cigarette (E-cigarette) users' group, consisted of 30 subjects; who were defined as those who stated they had never smoked in any way before and had been using E-cigarettes solely at least one year.

- Group III: Never-smokers (control) group are those who claim to have never used any kind of smoking.

Patients' clinical exams assessed their plaque index (PLI) [19], gingival index (GI) [20], probing depth (PD), and clinical attachment loss (CAL). A Williams periodontal probe was used for measuring each clinical parameter. With the exception of third molars, six locations around each tooth were used to collect clinical periodontal measures. The following criteria were used to diagnose the patients as having periodontitis: Pocketing >3 mm is shown at 2 teeth with buccal or oral CAL 3 mm, or their CAL was discovered at 2 non-adjacent teeth [21].

The following were the inclusion criteria: (a) Vaping individuals without a history of tobacco use who use just E-cigarettes. (b) Cigarette smokers are those who smoke up to 10 cigarettes per day for at least a year. (c) Those never smoked or used any other tobacco product.

The exclusion criteria were: (a) Cigar, pipe, and/or water pipe smoking (b) Completely edentulous individuals; (c) Those who have systemic diseases, such as autoimmune disorders, diabetes, hepatitis B and C, renal disorders, acquired immune deficiency syndrome, and cardiac disorders (d) Third molars; (e) Individuals who indicated they had periodontal therapy within the previous six months; and (f) People who claimed to have taken antibiotics steroids, non-steroidal anti-inflammatory medications, or antibiotics in the three months before .

Statistical analysis

In this study, descriptive statistics in the form of means and standard deviation were generated using the computer program IBM® SPSS® version 27. Independent sample t-tests and a one-way analysis of variance (ANOVA) test were employed as statistical tests to compare groups generally. Additionally, the means of the three groups were compared applying the calculation for the least significant difference (LSD) Additionally, the level of highly significantly (HS) was accepted at $P \leq 0.01$, the level of significance (S) was accepted at $P < 0.05$, the level of non-significant (NS) was accepted at $P \geq 0.05$.

RESULTS

Clinical evaluations of each group were conducted, and the data were statistically analyzed. Table I shows the mean, minimum, maximum value, and standard deviations ($\pm$SD) of age and clinical parameters for all participants.

Table II illustrates the mean values and $\pm$SD of periodontal parameters of the three study groups, it was clearly shown that T-cigarettes group had the higher mean among the study groups followed by E-cigarettes group. While the control group showed the minimum mean value.

For intergroup comparisons ANOVA test among groups was performed; showed that there was highly significant difference both between and within groups for PLI, GI, PD and CAL, as shown in Table III.

In addition, the results of LSD testing revealed a highly significant difference between the T-cigarettes, E-cigarettes, and non-smokers groups for PLI, GI, and PD at $P \leq 0.01$ for each

Table I - Descriptive statistical results of age and the clinical parameter of all participants

	Minimum	Maximum	Mean	SD±
Age	25	45	34.69	6.02
PLI	0.02	3	0.84	0.58
GI	0.01	3	0.88	0.65
PD	0	5.01	1.91	2.11
CAL	0	3.6	1.03	1.45

PLI: Plaque index, GI: Gingival index, PD: Probing depth, CAL: Clinical attachment loss, SD: Standard deviation.

of the multiple comparisons between each pair of groups. For CAL, however, there was a highly significant difference between the T-cigarettes, E-cigarettes and control group at P≤ 0.01 and non-significant difference between E-cigarettes and control group at P≥ 0.05 [Table IV].

Table II - Descriptive statistical results of the clinical parameter of each group

Groups	PLI		GI		PD		CAL	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
T-cigarette	1.44	0.60	1.63	0.54	4.01	1.13	3.04	0.29
E-cigarette	0.71	0.19	0.70	0.23	1.73	2.02	0.06	0.36
Control	0.37	0.14	0.31	0.15	0	0	0	0

PLI: Plaque index, GI: Gingival index, PD: Probing depth, CAL: Clinical attachment loss, SD: Standard deviation.

Table III - ANOVA Test for Clinical Parameters between Groups

Index	ANOVA	SS	df	MS	F	P	Significance
PLI	Between Groups	17.87	2	8.93			
	Within Groups	12.21	87	0.14	63.66	0.000	*HS
	Total	30.08	89				
GI	Between Groups	27.65	2	13.82			
	Within Groups	10.80	87	0.12	111.31	0.000	*HS
	Total	38.45	89				
PD	Between Groups	243.28	2	121.64			
	Within Groups	155.91	87	1.79	67.87	0.000	*HS
	Total	399.2	89				
CAL	Between Groups	181.67	2	90.83			
	Within Groups	6.34	87	0.073	1246.21	0.000	*HS
	Total	188.01	89				

*P≤0.01 (HS). 95% confidence interval. HS: High significant, PLI: Plaque index, GI: Gingival index, PD: Probing depth, CAL: Clinical attachment loss SS: Sum of squares, df: Degree of freedom, MS: Mean square, F and P: Statistical Expressions.

Table IV - Least significant difference test to compare the means of clinical parameter among groups

Index	Groups		MD	SE	P	Significance
PLI	T-cigarette	E-cigarette	0.72	0.096	0.000	*HS
		Control	1.06	0.096	0.000	*HS
	E-cigarette	Control	0.34	0.096	0.001	*HS
GI	T-cigarette	E-cigarette	0.92	0.09	0.000	*HS
		Control	1.32	0.09	0.000	*HS
	E-cigarette	Control	0.39	0.09	0.000	*HS
PD	T-cigarette	E-cigarette	2.27	0.34	0.000	*HS
		Control	4.01	0.34	0.000	*HS
	E-cigarette	Control	1.73	0.34	0.000	*HS
CAL	T-cigarette	E-cigarette	2.98	0.06	0.000	*HS
		Control	3.04	0.06	0.000	*HS
	E-cigarette	Control	0.06	0.06	0.342	NS

P≥0.05 (NS), *P≤0.01 (HS). 95% confidence interval. NS: Nonsignificant, HS: High significant, PLI: Plaque index, GI: Gingival index, PD: Probing depth, CAL: Clinical attachment loss, MD: Mean difference, SE: Standard error, P: P-value.

DISCUSSION

The American Academy of Periodontology lists smoking as a risk factor that may have an impact on periodontal tissue [22]. There are an estimated 65 million users of E-cigarettes worldwide, and their use is growing [23].

According to our research, those who smoke or vape have a higher risk of developing periodontal disease than those who aren't smokers.

T-cigarette smokers demonstrated higher plaque index readings than E-cigarette users. The greater prevalence of PLI among tobacco users may be related to that cigarette smokers showed an increase risk of producing adherent biofilms than E-cigarette users or non-smokers [24-26]. Due to the adverse effect of smoking on salivary glands that resulted in increased salivary viscosity, causing them to secrete primarily mucosal saliva. Changes in the composition of saliva, such as in the immunoglobulins and enzymes, might responsible for defense mechanisms alterations that possibly resulted in the plaque formation [27,28].

In another hand, gingival index showed a higher value in E-cigarette users than the non-smokers. Due to the increased suppressive impact on E-cigarettes bleeding can be linked to the nicotine content of E-liquid [29]. According to recent research, using E-cigarettes causes DNA damage, oxidative stress and inflammatory reactions [30,31]. Also in vitro studies reveled that the flavoring agents that are associated with the aerosol of E-cigarettes have been proved to enhance DNA injury and promote several inflammatory proteins such as cyclooxygenase and prostaglandin E2 in gingival cells [32,33].

T-cigarette smokers had a higher probing depth means when compared with the E-cigarette users. This demonstrated that frequent tobacco use enhances oxidative stress in periodontal tissues and can lead to alveolar bone loss and periodontal disease if left uncontrolled or untreated [34,35].

Regarding clinical attachment loss, the current study findings showed that the mean CAL in T-cigarette smokers was higher than that of non-smokers and E-cigarette users. These variations in CAL among study groups could be attributed to changes in the composition of subgingival plaque, the virulence of subgingival bacteria, and modifications in the host response, all of which increase the resorption of bone and deterioration of periodontium [36,37]. Nicotine present in tobacco products could influence the collagen tissues negatively by raising collagenase production, inhibiting gingival fibroblast development, and decreasing collagen and fibronectin production [38].

CONCLUSION

The result of this study concludes that tobacco cigarettes and electronic cigarettes have a negative effect on periodontal health. But on the other hand, electronic cigarettes demonstrated a lesser impact than tobacco on periodontal parameters, which possess an easier composition when compared with traditional tobacco products.

Our research showed that smoking cessation appeared to have a positive impact on periodontal indicators and that T- and E-cigarettes both had negative impacts. The negative impact of e-cigarettes was comparable to that of T-cigarettes; however, it was less severe with regard to PD. Our data suggest that additional lengthy research is required to properly comprehend the impact of E-cigarette use on periodontitis.

Author's Contributions

Conflict of Interest

Funding

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects' oversight committee guidelines and policies of the research ethics committee our institute. The approval code for this study is: MUOSU-202116.

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