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The Impact of Electronic Cigarettes (e-Cigs) Smoking Habit on Periodontal Status and Salivary pH among Some Passive e-Cigs Smokers Referred to the College of Dentistry Clinics, King Khalid University

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Abstract

Background: Electronic cigarette (e-cigs) smoking is substitutional to traditional cigarette smoking to reduce the dangerous combustion of products. Moreover, passive smoking is involuntarily tobacco smoking due to the exposure to cigarette or tobacco smoke among non-smokers and due to there being little knowledge about the impact of passive e-cigs smoking on periodontal status and salivary pH. Therefore, the present study aimed to evaluate the effect of e-cigs smoking habit on periodontal tissue and salivary pH among some passive e-cigs smokers referred to the college of dentistry clinics, King Khalid University. **Material and Methods**: Ninety male participants who were referred to the college of dentistry clinics at King Khalid University were included in the study. Age, gender, e-cigs smoking, and general health were recorded. The participants were divided into three equal groups (n = 30) as follows: Group I (Non-passive e-cigs smokers and non-smokers) as the control group, Group II (e-cigs users), and Group III (Passive e-cigs smokers). Salivary pH, plaque control record (PCR), gingival bleeding index (GBI), clinical attachment loss (CAL), percentage of radiographic bone loss (% RBL), periodontal pocket depth (PPD), more than 5 missing teeth due to periodontal diseases (>5 MTDP), tooth mobility (TM), furcation involvement (FI), Bite collapse (BC), and less than 20 remaining teeth (10 Opposing pairs) (L20RT) as well as HbA1c were recorded. ANOVA test was used to the comparison between Groups I, II, and III in the participants' ages and periodontitis staging clinical findings. The mean of participants' age groups, the mean of

salivary pH values of study groups, and the periodontitis staging complexity and HbA1c were compared between groups with the ANOVA test, Tukey's test, and the chi-square test. P-value was recorded, and less than 0.5 was considered a statistically significant difference ($p < 0.5$). **Results**: The e-cigs users group revealed higher means of PCR, GBI %RBL values, and the participants percentages of >5 MTDP, TM, FI, L20RT, and diabetes mellitus (DM) among participants compared to the passive e-cigs smokers group and control group except for the participants percentage of BC among the participants, which was higher among the control group participants. The differences were not significant in PCR, GBI, %RBL and DM ($p > 0.5$) and significant in >5 MTDP, TM, FI, L20RT and smoking ($p < 0.05$). The passive e-cigs users group showed higher means of CAL, PPD, salivary pH values as well as the participants percentages of HbA1c > 7% values compared to the e-cigs users group and control group participants. The differences were not significant in CAL and PPD ($p > 0.5$) and significant in the participants percentages of salivary pH values ($p < 0.05$). **Conclusion**: The e-cigs smoking habit was the cause of an increase in periodontal disease severity among the electronic smokers rather than passive e-cigs smokers, although the salivary pH was higher in the latter.

Keywords

Electronic Smoking Habit, King Khalid University, Passive e-Cigs Smokers, Periodontal Status, Salivary pH

1. Introduction

The periodontal supporting tissues comprise gingiva, periodontal ligament, alveolar bone, and cementum which support the teeth and can help in the clinical assessment of oral health status [1]. Periodontal inflammatory disease is a widespread chronic disease in oral mucosa due to microbial dental plaque [2] [3] [4]. It is thought that some periodontal bacteria can initiate periodontal diseases and consider the main cause of missing teeth among the global people [5].

Smoking is a significant risk factor for the advancement of periodontal disease [6] [7]. Recently studies confirmed a potent link between smoking and worse periodontal status, an increase in dental plaque and calculus formation among smokers [8] [9] [10], causing harmful alteration in the oral microbiota, an inflammatory reaction, reducing the immune defense, consequently an increase in bone loss [11] [12] [13] [14]. Moreover, tobacco-containing outputs may be led to oral abnormal changes, such as leukoplakia, gingivitis, candidiasis, nicotine stomatitis, periodontitis, failure of surgical and prosthetic treatments, and a rise in the incidence of the oral malignant tumors [15] [16] [17]. Recently, there is a decrease in the smoking of classical cigarettes with the increase in the use of new tobacco products, such as electronic cigarettes [18].

The e-cigs is a mobile device based on battery-operated where its tank con-

tains three main liquid components: a transportersolution (propylene glycol or vegetable glycerin), nicotine (unless without nicotine), and favoring; which are heated by a resistor liberating an aerosol and breathed by the user during smoking [10]. The ingredients of e-cigs are controlled by the FDA as planning for smoking discontinuation or a less damaging replacement smoking for traditional cigarette smoking [19] [20]. The transition from traditional cigarette smoking to e-cigs decreases the number of cigarettes smoked without quitting smoking, and the risk effect of cigarette smoking on oral diseases remains a high probability [21] [22]. Some studies have revealed that smokers using e-cigs have the poor periodontal status [23] [24] [25].

Environmental tobacco smoke (passive smoking) exposure may be a risk factor for several systemic diseases in society [26]. There is an association between periodontal diseases in non-smokers and passive smoking, and passive smokers were affected 1.6 times more by the periodontal disease compared to those non-smokers, according to the clinical findings of Arbes *et al.*'s study [27] [28].

Saliva fluid has a significant role in preserving oral health by pH levels adaption and interfering with dental mineralization and periodontal health [29] [30]. The alteration in some characteristics of saliva can lead to abnormal changes in the oral environment, causing plaque and calculus formation as risk factors for gingivitis and periodontitis [31]. Some studies revealed that when the saliva is at a neutral or more alkaline pH, the healing of periodontal tissues improves, whereas a lower alkaline pH level might have a necrotizing effect on the periodontal tissues [32]. On the other hand, there is an association between the period time of smoking and salivary pH values according to the clinical findings of Parvinen T. study where he found that the levels of salivary pH rise during the first time of smoking periods and decrease with continuous smoking [33]. Even though many studies reported that e-cigs smoking has an impact on periodontal status and salivary pH values but the impact of passive e-cigs smoking on periodontal tissues and salivary pH and their relationship to the severity of periodontal diseases among referred participants to the college of dentistry clinics, King Khalid University is unknown. Therefore, we aimed to evaluate the periodontal parameters and the salivary pH values in e-cigs smokers, passive e-cigs smokers, and non-smokers based on the period time of smoking to clarify their relationship with periodontal status.

2. Materials and Methods

2.1. Study Design and Sample Size

This cross-sectional study was carried out between March 2022 and June 2022. The sample size for the study was 90 participants aged between 18 and 80 years who visited as outpatients in the college of dentistry, King Khalid University, Abha, Saudi Arabia. The patients were divided into 3 equal groups (n = 30): Group I as the control group (non-passive e-cigs smokers and non-smokers), Group II (e-cigs users), and Group III (passive e-cigs smokers). A predictive formula (Kang *et al.*, 2008) was applied in the assessment of the sample size of

the current study [34].

Data were collected by clinical interview and a periodontal examination. The clinical interview comprised questions about patients' characteristics, socioeconomic, medical/dental history and health, and attitudes, such as smoking. The glycated hemoglobin (HbA1c) of participants was recorded based on the medical reports in their files. The patients responded to questions about their data, systemic status, e-cigs smoking habit, and environmental smoking. Patients were divided according to their e-cigs smoking history into e-cigs smokers, passive e-cigs smokers, and non-smokers. The non-smoking group included the patients who confirmed that they had never smoked. The smoking group consisted of all patients who used e-cigs regularly every day for a year or more. All participants were in attendance, with the remaining at least 20 teeth.

2.2. The Inclusion and Exclusion Criteria

The inclusion criteria consisted: The male participants are regular e-cigs smokers every day for a year or more, the passive e-cigs male smokers every day for a year or more, the male participants who are at least 18 years of age, the male participants who have agreed to participate in the study and signed the patient's informed consent, the participants who are in good systemic healthy, and the participants who are not subjecting any medical therapy and any periodontal therapy in the past 6months. The exclusion criteria consisted: the participants who received medical therapy within the previous 6 months, irregular e-cigs smoking smokers who reported e-cigs smoking at some times or used e-cigs regularly every day for less than one year, irregular passive e-cigs smokers or passive e-cigs smokers less than one year, use of any complement vitamins nutrition, the participants who are with oral cancer, the participants who with oral lesions due to e-cigs smoking and had received medications, chemotherapy, or radiation therapy that caused dry mouth, the participants who are with systemic conditions which impact the salivary pH, the participants who are under drug therapy which impacts the salivary pH, the participants who had received periodontal therapy six months before the study, the participants who are with xerostomia, and the participants who are with completely edentulous ridges.

2.3. Ethical Statement

Ethical approval and ethical clearance certificate from the institutional review board of King Khalid University College of dentistry (IRB/KKUCOD/ETH/2021-22/045) were gained. This study was carried out according to the Declaration of Helsinki. The participants were separately informed about the objective of the study. All participants signed informed written consent before the study. The participants obtained all information details before starting the study. The treatment of participants' oral lesions was done with the right specialists.

2.4. Periodontal Status Assessment

The oral hygiene and gingival status assessment was done in outpatient clinics at

the college of dentistry, King Khalid University, and included dental plaque, gingival bleeding on probing, and periodontal tissues assessments. The following periodontal parameters were recorded: plaque control record (PCR) [35]; gingival bleeding index (GBI) [36]. The periodontal status was assessed by applying the guidelines of the 2017 World Workshop on periodontal diseases and conditions through recording the following clinical parameters: clinical attachment loss (CAL); percentage of radiographic bone loss (% RBL); periodontal pocket depth (PPD); more than 5 missing teeth due periodontal diseases (>5 MTDP); tooth mobility (TM); furcation Involvement (FI), bite collapse (BC), and less than 20 remaining teeth (10 Opposing pairs) (L20RT) [37].

2.5. Salivary pH Assessment

Saliva samples were obtained from the participants. Un-stimulated saliva was collected before the periodontal examination and after asking the participants to wash their mouths with water to remove the food debris or other materials. The samples were collected after 1 - 2 min for water clearance at least one hour after the last meal where each participant spit saliva into a sterile lab tube until 5 ml, then the salivary pH was recorded by using pH indicator strips [Dental Saliva pH indicator strips pH 6.5 - 9.0; gradation 0.5; color coded].

2.6. Statistical Analysis

The mean and standard deviation of participants' ages, periodontal disease staging clinical findings, and salivary pH values in the current study groups were calculated using the ANOVA test and Tukey's test. The periodontitis staging complexity clinical findings and periodontitis grading modalities among study groups were compared through the Chi-square test; on the other hand, the salivary pH among the three groups was compared to age, plaque control record, gingival bleeding index, clinical attachment loss, percentage of radiographic bone loss, and periodontal pocket depth by evaluating the correlations. A p-value of less than 0.05 was considered statistically significant ($p < 0.05$).

3. Results

According to the clinical findings, the current study evaluated the periodontal status and salivary pH values in three different groups of participants depending on the e-cigs smoking status. **Table 1** and **Figure 1** reveal the mean and standard deviation (±SD) of the age of participants included in the present study. The mean ages were recorded to be 32.3 ± 14.07 years old in Group I, 34.1 ± 8.84 years old in Group II, and 31.7 ± 5.5 years old in Group III. The table of participants' ages did not show any statistically significant differences in the comparison between Groups I, II, and III ($p > 0.5$). The values of salivary pH in the three groups were recorded in **Table 2** and **Figure 2**. The mean salivary pH values in Group III (6.8 ± 0.12) were higher than the mean values recorded in Group I (6.7 ± 0.161) and Group II (6.3 ± 0.072). A highly statistically significant differ-

ence link was detected between e-cigs smoking habit, passive e-cigs smokers, and salivary pH values according to the use of ANOVA test in the comparison between Groups I, II, and III ($p < 0.001$) as well as in the comparison between Groups I and II ($p < 0.001$), Groups I and III (0.026) and Groups II and III ($p < 0.001$) according to Tukey's test. Table 3 and Figure 3(a) & Figure 3(b) exhibit the clinical findings of periodontal disease staging of Groups I, II, and III. The three groups correspond in the effect of e-cigs smoking habit and passive e-cigs smoking on the clinical findings of periodontal disease staging. Regarding PCR, gingival GBI, and % RBL, there were higher in these clinical findings values among the participants in Group II (68.03 ± 27.23, 73.4 ± 21.6, 44.17 ± 19.1, respectively) without statistically significant differences compared to Group III and I that having a lower mean of PCR (58.1 ± 25.7, 57.1 ± 23.5, respectively), GBI (61.1 ± 26.8, 68.9 ± 23.01, respectively) and % RBL (40 ± 16.1, 20.5 ± 10.6, respectively) ($p > 0.05$). In contrast, Group III had mean values of CAL (3.3 ± 3.2) and PPD (3.13 ± 0.9) higher than Groups I (3.2 ± 1.5, 2.9 ± 0.8, respectively) and II (3.1 ± 2.2, 2.6 ± 1.1, respectively) also without statistically significant differences ($p > 0.05$).

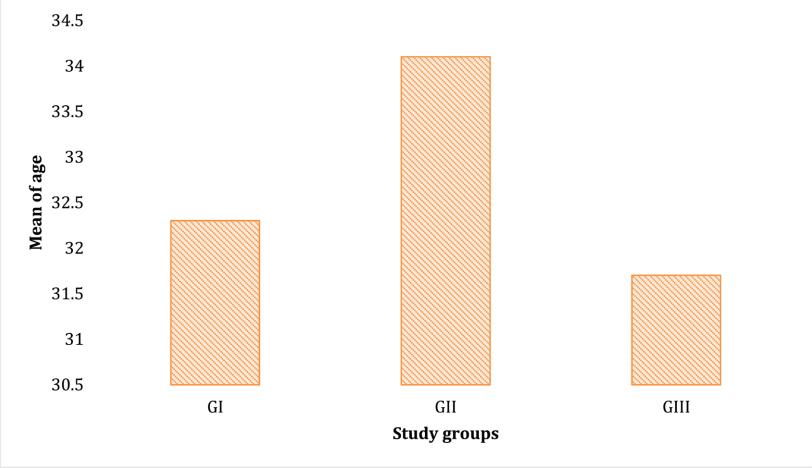


Figure 1. The mean ages of study groups. G: Group.

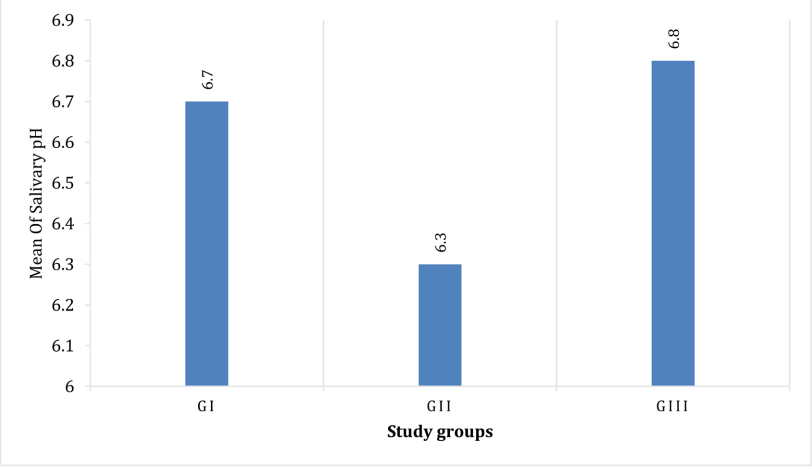


Figure 2. The mean of salivary pH values of study' groups. G: Group.

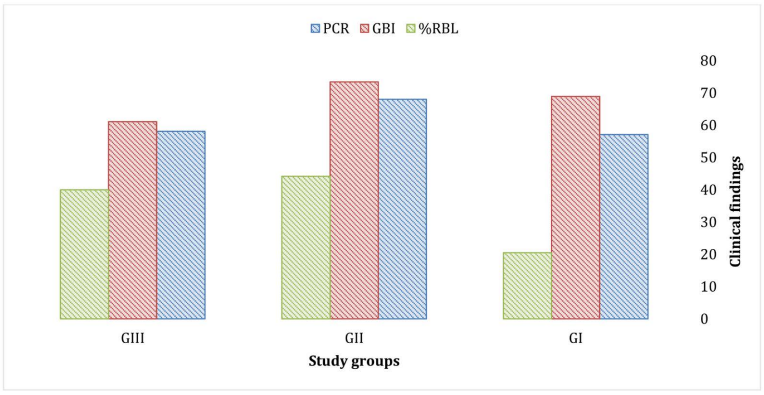
Table 1. Mean and standard deviation of ages study groups.

	Age			ANOVA	
	Group I	Group II	Group III	F	p-value
Range	18 - 80	20 - 53	25 - 50	0.459	0.634
Mean ± SD	32.3 ± 14.07	34.1 ± 8.84	31.7 ± 5.5		

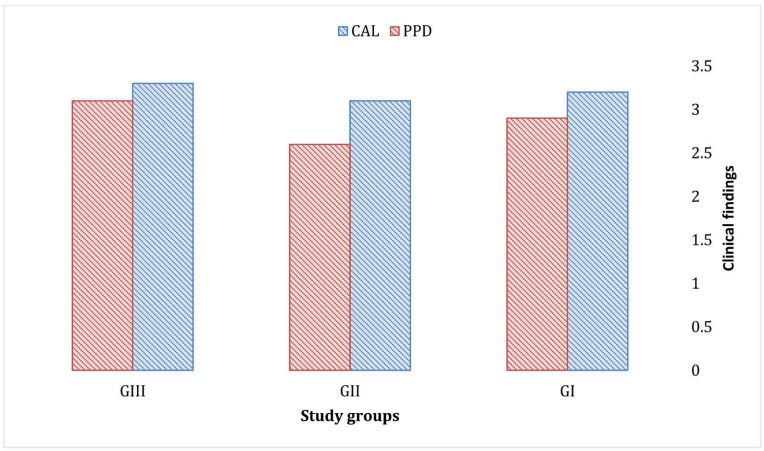
Table 2. Mean and standard deviation of salivary pH of study's groups.

	Salivary pH			ANOVA	
	Group I	Group II	Group III	F	p-value
Range	6.5 - 7	6.2 - 6.5	6.6 - 7.2	142.545	<0.001**
Mean ± SD	6.7 ± 0.161	6.3 ± 0.072	6.8 ± 0.12		
Tukey's test					
Group I & Group II		Group I & Group III		Group II & Group II	
<0.001**		0.026*		<0.001**	

* Significant difference between three groups at p-value less than 0.05, ** highly statistical significant difference between three groups.



(a)



(b)

Figure 3. (a) The clinical parameters of periodontal diseases staging. G: Group, PCR: Plaque control record, GBI: Gingival bleeding index, % RBL: Percentage of radiographic bone loss; (b) The clinical parameters of periodontitis staging G: Group, CAL: Clinical attachment loss, PPD: Periodontal pocket depth.

Table 3. Mean and standard deviation of periodontal disease staging clinical findings.

Items		Groups			ANOVA	
		Group I	Group II	Group III	F	p-value
PCR	Range	15 - 100	10 - 100	10 - 100	1.673	0.194
	Mean ± SD	57.1 ± 23.5	68.03 ± 27.23	58.1 ± 25.7		
GBI	Range	20 - 100	27 - 100	10 - 100	2.039	0.136
	Mean ± SD	68.9 ± 23.01	73.4 ± 21.6	61.1 ± 26.8		
CAL	Range	1 - 5	1 - 8	1 - 7	0.019	0.981
	Mean ± SD	3.2 ± 1.5	3.1 ± 2.2	3.3 ± 3.2		
% RBL	Range	2 - 50	15 - 60	10 - 40	1.771	0.231
	Mean ± SD	20.5 ± 10.6	44.17 ± 19.1	40 ± 16.1		
PPD	Range	1 - 5.6	1 - 4	1 - 5	1.833	0.170
	Mean ± SD	2.9 ± 0.8	2.6 ± 1.1	3.13 ± 0.9		

PCR: Plaque control record, GBI: Gingival bleeding index, CAL: Clinical attachment loss, % RBL: Percentage of radiographic bone loss, PPD: Periodontal pocket depth.

Regarding the clinical findings of periodontitis staging complexity in Table 4 and Figure 4, the e-cigs users group revealed the highest values in the participants' percentage affected with >5 MTDP (33.3%), TM (63.3%), FI (40%) and L20RT (10 Opposing pairs) (36.7%), whereas BC revealed the highest values in the participants' percentage affected (16.7%) among the participants of the control group. There were significant differences in the participants' distribution according to periodontitis staging complexity in the comparison between Groups I, II, and III ($p < 0.05$). The participants' distribution according to some periodontitis grading modalities was summarized in Table 5 and Figure 5. The percentage of participants who distributed of HbA1c test by more than 7% (33.3%) among Group III was higher than Group I (8.3%) and Group II (7.1%) without present statistical significance differences ($p > 0.05$). The correlation analysis in Table 6 indicated no significant and positive correlations between salivary pH and CAL and PPD. Moreover, salivary pH values revealed no significant and negative correlations with participants' ages, PCR, GBI, and % RBL.

4. Discussion

The e-cigs is a new device therapy for cigarette smoking by evaporating flavoring agents, nicotine, and propylene glycol as a smoking cessation method; but several studies could not confirm the efficacy of this method to complete stopping traditional cigarette smoking [38] [39] [40] [41] [42]. Several studies in Saudi Arabia were carried out on conventional tobacco products' effects on oral hygiene, but there is a shortage of studies that reveal the impacts of e-cigs smoking habit and passive e-cigs smoking on periodontal tissues and salivary pH values. Therefore, we carried out this study among referred patients to the college of dentistry clinics, King Khalid University, to compare e-cigs users with passive e-cigs smokers and nonsmokers to evaluate the effect of e-cigs smoking and passive e-cigs smoking on periodontal health status and salivary pH.

Table 4. The participants' distribution according to periodontitis staging complexity.

		Groups			Chi-square	
		Group I n(%)	Group II n(%)	Group III n(%)	X^2	p-value
>5 MTDP	N	24 (80.0%)	20 (66.7%)	29 (96.7%)	10.246	0.006*
	P	6 (20.0%)	10 (33.3%)	1 (3.3%)		
TM	N	20 (66.7%)	11 (36.7%)	21 (70.0%)	14.527	0.024*
	P	10 (33.3%)	19 (63.3%)	9 (30%)		
FI	N	28 (93.3%)	18 (60.0%)	29 (96.7%)	19.818	0.003*
	P	2 (6.7%)	12 (40%)	1 (3.3%)		
BC	N	25 (83.3%	29 (96.7%)	29 (96.7%)	9.181	0.05*
	P	5 (16.7%)	1 (3.3%)	1 (3.3%)		
L20RT	N	26 (86.7%)	19 (63.3%)	30 (100%)	18.111	<0.001**
	P	4 (13.3%)	11 (36.7%)	0 (0.0%)		

* Significant difference between three groups at p-value less than 0.05, ** highly statistical significant difference between three groups, >5 MTDP: More than 5 missing teeth due perio. Diseases, TM: Tooth mobility, FI: Furcation involvement, BC: Bite collapse, L20RT: Less than 20 remaining teeth (10 Opposing pairs), P: Positive, N: Negative, n: Number.

Table 5. The participants' distribution according to some periodontitis grading modalities.

		Groups			Chi-square	
		Group I n(%)	Group II n(%)	Group III n(%)	X^2	p-value
DM	N	18 (60%)	16 (53.3%)	21 (70.0%)	1.797	0.407
	P	12 (40%)	14 (46.7%)	9 (30%)		
HbA1c	<7%	11 (91.7%)	13 (92.9%)	6 (66.7%)	3.162	0.206
	>7%	1 (8.3%)	1 (7.1%)	3 (33.3%)		

DM: Diabetes Mellitus, HbA1c: Glycated hemoglobin, n = Number, P: Positive, N: Negative.

Table 6. The correlations between participants' ages and some clinical findings of periodontitis severity and salivary pH.

Correlations	Salivary pH.	
	r	p-value
Age	−0.100	0.348
Plaque control record PCR±	−0.127	0.236
Ginival bleeding index	−0.113	0.292
Clinical attachment loss CALL	0.073	0.702
% of radiographic bone loss	−0.547	0.081
Periodontal pocket depth	0.245	0.068

r: The Pearson correlation coefficient.

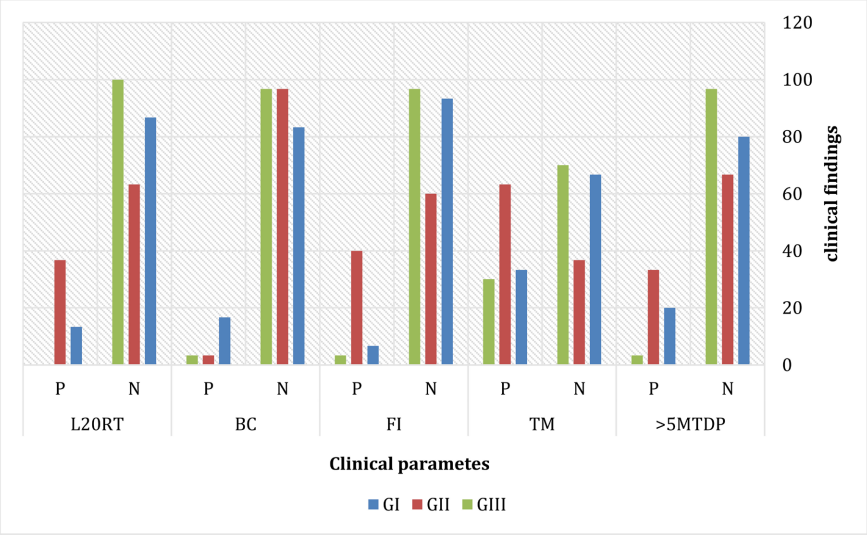


Figure 4. The clinical periodontal parameters of periodontal diseases staging complexity. G: Group, >5 MTDP: More than 5 missing teeth due perio. Diseases, TM: Tooth mobility, FI: Furcation Involvement, BC: Bite collapse, L20RT: Less than 20 remaining teeth (10 Opposing pairs), P: Positive, N: Negative.

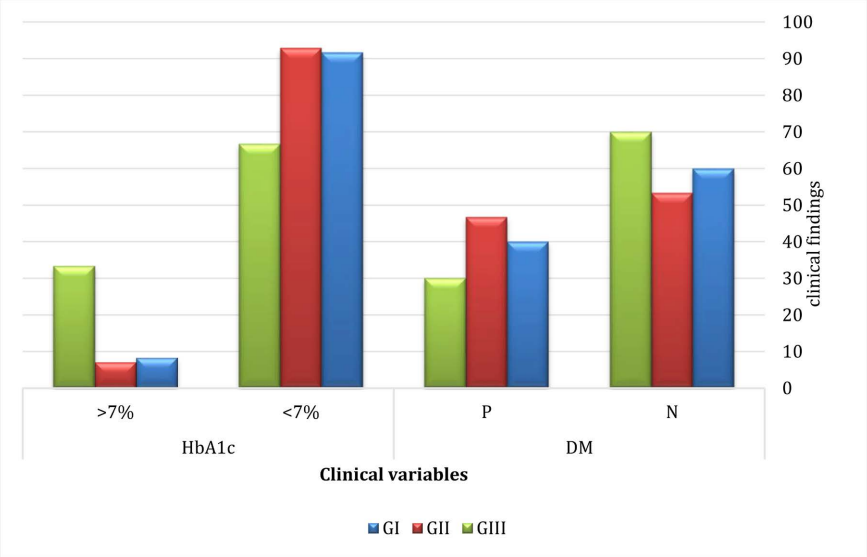


Figure 5. The participants' distribution according to some periodontitis grading modalities. G: Group, DM: Diabetes Mellitus, HbA1c: Glycated hemoglobin, DM: Diabetes Mellitus, HbA1c: Glycated hemoglobin, P: Positive, N: Negative.

The participants' ages in the present study ranged from 18 to 80 years, where the means ages of non-passive e-cigs smokers and non-smokers (Group I), e-cigs users (Group II), and passive e-cigs smokers (Group III) were 32.3 ± 14.07 years, 34.1 ± 8.84 years and 31.7 ± 5.5 years, respectively. These results confirmed the hypothesis that the mean age of e-cigs smokers is 19 years (youngers), whereas the mean age of cigarette smokers reaches 34 years [43] [44].

There is a common misapprehension that e-cigs are less impact on periodontal tissues as disagreed with the results of this study which revealed a significant

rise in the destruction of the periodontal tissues compared to those of non-smokers. The results of this study showed an increase, relating to PCR, GBI, % RBL as well as the percentage of participants with missing teeth more than five teeth due to periodontal diseases, percentage of participants affected with TM, percentage of affected participants with FI and percentage of affected participants with Less than 20 remaining teeth among the e-cigs smokers moreover an increasing relating to CAL and PPD among passive e-cigs smokers considered in this study. The PCR increase among e-cigs smokers and passive e-cigs smokers, detected in the present study, could be related to the defect in the capacity of e-cigs smokers and passive e-cigs smokers in their oral hygiene measures. In contrast, the GBI increasing among e-cigs smokers, detected in the present study, disagree with clinical proof that nicotine produces peripheral blood vessels vasoconstriction, thus decreasing gingival bleeding [45]. An increase relating in periodontitis staging and complexity parameters among e-cigs smokers and passive e-cigs smokers could be explained by the reality that nicotine acts as a participating factor to periodontal destruction by impacting the capability of fibroblasts collagen and integrin production as well as stimulation of proinflammatory cytokines production in periodontal tissues [46] [47] [48]. The results of this study confirm that those who consume tobacco are susceptible to periodontal diseases, nevertheless of the tobacco product type [6].

These clinical findings agree with other American studies that revealed a link between e-cigs smoking and more incidence of periodontal diseases and poor oral health status, which may be due to the chemicals and toxicants discharged from e-cigs [49] [50].

The clinical findings of this study also agree with other studies, which showed a potential association between passive smoking and periodontal disease [51] [52].

Concerning the control group in this study, the difference in the PCR, GBI, CAL, % RBL, and PPD were no significant differences between e-cigs users and passive e-cigs users. Whereas, the difference in the percentage of participants who were affected with more than 5 teeth missing due to periodontal diseases, TM, FI, and less than 20 remaining teeth (10 Opposing pairs) were with significant differences between e-cigs users and passive e-cigs users. This incidence raises an inquiry because e-cigs are supposed to be less damaging effects on periodontal health as a substitution method for stopping traditional smoking [53].

According to a previous study, the accurate salivary pH varied between 6.2 and 7.6, agreeing with our study results, which revealed ranges of salivary pH between 6.3 and 6.8 [54]. On the other hand, another study revealed that there were no statistically significant differences in salivary pH between e-cigs users and non-smokers, harmonious with our study results [55]. Moreover, the salivary pH values in smokers were lower than in non-smokers, according to the results of Parmar *et al.*, and Grover *et al.*, studies [56] [57]. Similar findings were recorded by our study, where the salivary pH values among e-cigs smokers were lower than non-smokers and passive e-cigs smokers without statistical signifi-

cant differences. The study of Kumar *et al.* showed that salivary pH values of tobacco smokers with periodontal diseases were lower than non-smokers with periodontal diseases, which agrees with the clinical findings of our study [58].

5. Strength and Limitations

This study adds to the previous studies, which revealed a decrease in the addiction to nicotine in traditional cigarettes with e-cigs use. Thus it is considered a method for helping all smokers who need to leave smoking. Despite several studies clarified that the main ingredients of e-cigs liquids could be possibility hurtful due to unknown impacts of these ingredients on the human body [59].

Until now, there was a shortage of studies conducted at King Khalid University on the periodontal health of e-cigs smokers and passive e-cigs smokers. Consequently, the clinical findings of this study can help clarify the harmful impacts of e-cigs smoking and passive e-cigs smoking on the periodontal tissues compared to non-smokers. Furthermore, the design of this study in the oral and periodontal health scope was to discuss the importance of changing from traditional cigarette smoking to e-cigs smoking can support the improvement of oral health and periodontal status, which reflect positively on the patient's general health.

The limitations of the present study included that the participants of this Saudi study were representative of the Aseer region only. Also, the study was cross-sectional, which did not allow us to investigate the association between the use of e-cigs and periodontal status and salivary pH values for participants who had reported a history of e-cigs smoking habit and passive e-cigs smoking regularly every day for a year or more. Moreover, the results of this study could be impacted by the mistakes of participants' selection that depended on their reports. Moreover, e-cigs smoking duration and frequency were not included in the design of the study, and as there are no criteria of measurement to assess e-cigs smoking, therefore, it is hard to compare this study's results to the results of other studies.

6. Conclusions

The e-cigs smoking habit with passive e-cigs smoking may contribute to the pathogenesis of periodontal diseases and salivary pH due to inhaled nicotine along with different flavoring agents. The present study has revealed that e-cigs smoking and passive e-cigs smoking had unwanted impacts on periodontal status. The results detected in this study will not only provide data for more research on e-cigs smoking habit and passive e-cigs smoking effects on periodontal status and salivary pH but also other types of tobacco smoking including conventional cigarette smoking and Hookah smoking effects on periodontal status and salivary pH.

There is a rise in e-cigs users' number in the world due to the wide-spread idea that e-cigs has less impact on general health as analogized to the traditional

cigarettes. Additional studies are needed to confirm the risk of e-cigs smoking habit and passive e-cigs smoking on periodontal status and salivary pH. The results of this study could help the oral health community to establish and transfer proper notices about the safety of e-cigs smoking habits and passive e-cigs smoking; and the regulation of the new tobacco products. We recommend that enough follow-up time of e-cigs smoking effects on oral and periodontal status should be included in future studies compared to traditional smoking and assess if this method is secure for smoking stopping.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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