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ORIGINAL ARTICLE

Impact of E-Cigarettes on Periodontal Health and Disease

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ABSTRACT

Tobacco smoking is one of the leading risk factors for periodontal disease, impacting inflammatory process of periodontal tissue. Smoking is known to hinder the immune response of periodontal tissue by causing vasoconstriction to peripheral capillaries, and by so decreasing blood flow and subsequent incoming immune cells. Compared to non-smokers, tobacco smokers were found to have higher count of periopathogens present within dental biofilm. However, over the last decade, electronic cigarettes have made a significant rise in both users and frequency of use. Although the effects of e-cigarettes on oral health are not as evident and prominent as that of tobacco smoking. This study aims to understand the impact of e-cigarettes use on periodontal tissue in comparison to tobacco smoking. A total of 182 patients were included, and divided into three groups, 49 non-smoker, 66 tobacco smokers, and 67 e-cigarettes/vape smokers. Each individual was examined clinically and periodontal indices were recorded, including gingival index, plaque index and bleeding on probing. Overall gingival index scores were worse in smokers, however, bleeding on probing were significantly higher in e-cigarettes smokers and non and lower in tobacco smokers. The study found tobacco smoking had more harmful impact on periodontal status in comparison to e-cigarettes.

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1- INTRODUCTION

Conventional tobacco cigarettes contain a plethora of highly toxic materials that negatively impact periodontal health, and oral health in general [1, 2]. of the most infamous contents are ground tobacco leaf, nicotine, tar, and trace amounts of heavy metals. Tobacco chewing and consumption is highly associated with increased rate of oral squamous cell carcinoma [3], moreover, nicotine causes diminished blood flow into periodontal tissue, leading to tissue hypoxia [2]. The tar in conventional tobacco cigarettes is cytotoxic agent that is associated with increased proinflammatory activity and dysregulation of human gingival fibroblast (hGF), causing oxidative stress, decreased rate of cell proliferation, and impaired wound healing, ultimately leading to periodontal tissue destruction [4].

Over the past decade, there has been a surge in the use of electronic cigarettes as an alternative for smoking tobacco cigarettes, especially among younger demographics [5, 6]. The appeal of e-cigarettes and surge in popularity are due to their simplistic design, added flavoring, and relative availability and affordability [6], the same e-cigarette can be used multiple times during the day depending on their battery capacity, making them ready-to-use, and offering nicotine whenever. Hence, being convenient alternative for tobacco cigarettes.

The impact of e-cigarettes and vaping on oral and periodontal health is not as well-documented as smoking tobacco, however, the impact on upper respiratory tract has been evident as suggested by multiple studies, causing irritation, increased risk of upper respiratory tract infection, decreased respiratory function, and increased carbon monoxide in hemoglobin [7]. E-cigarette liquids are composed of several key components. These components include a base, which can be propylene glycol, glycerin, or a combination of both, along with nicotine and a variety of flavors. The base serves as a carrier for nicotine and flavors in liquid [8]. The sweet flavors present in vapes' liquids, which are classified as saccharides, esters, acids, or aldehydes. These sweet flavors have the potential to interact with the hard tissues of the oral cavity, such as the teeth and gums, when the aerosols generated from vaping are inhaled. This interaction can lead to changes in the surface characteristics of the oral tissues and may contribute to the development of dental caries [8]. Studies suggested that aerosols of vapes may alter the oral microbiome, increasing the risk of periodontal diseases [9, 10]. Others have suggested that increased vape use is corelated to elevated expression of proinflammatory mediators and subsequent risk of bone loss and clinical attachment loss [11].

2- MATERIALS AND METHODS

A cross-sectional study was conducted on a total of 200 individuals at department of dentistry of Dijlah University; ages of participants ranged between 18 and 35 years old. 18 of those individuals have been excluded due to low bleeding on probing index, scoring below 10% which was excluded as it is the cut-off value for periodontal health/disease. The remaining 182 individuals diagnosed with gingivitis, were divided into three groups, 49 Non-smokers, 66 tobaccos smoker, 67 and nicotine-containing e-cigarettes/vapes users. Periodontal indices such as Gingival index (GI), Plaque index (PI) and bleeding on probing (BOP), were recorded for each individual. Resulting data was analyzed using SPSS program.

3- RESULTS AND DISCUSSION

3.1 Age

In all three groups of participants, the mean age was comparable without a statistically significant difference (0.36); this is mostly because participants were either college students attending Dijlah University, or in-patients at clinics of the department of dentistry, age range (18-35) years with a mean of 26 years.

3.2 Gender

From Tables 1 and 2, two results can be interpreted; the first result is the statistically significant number of male participants as smokers for both cigarettes and vape (0.001) than females. The other finding is that female participants were smoking vape more than cigarettes, which could be explained due to the flavoring of e-cigarettes and general perception that vaping is generally less harmful than conventional smoking [12].

Table (1): Age and genders of participants

		Count	Column N %
Sex	**Male**	116	63.7%
	Female	66	36.3%
GP	**NS**	49	26.9%
	Cig	66	36.3%
	Vape	67	36.8%

Table (2): Gender difference for each group of parcitipants

		GP						
		NS		**Cig**		**Vape**		
		Count	Row N %	Count	Row N %	Count	Row N %	
Sex	**Male**	19	16.4%	58	50.0%	39	33.6%	0.001
	Female	30	45.5%	8	12.1%	28	42.4%	

3.3 Bleeding on probing

Bleeding on probing reading were found to be lower in both groups of tobacco and e-cigarettes smokers, while it was higher non-smoker. Comparing non-smokers with both tobacco smokers and vapers, a significant difference was observed (P-value 0.007, and 0.04) respectively. However, no significant difference was also observed between tobacco smokers and vapers (P-value 0.762). This might be attributed to high nicotine content within the both tobacco and electronic cigarettes, having higher thrombogenic effect on blood vessels [2, 13].

3.4 Plaque index

Slight increase in plaque index was observed in both smokers' groups, comparisons between groups yielded insignificant differences, with P-value of 0.102 between non-smokers and tobacco smokers, 0.992 between non-smokers and vapers, and 0.092 between tobacco smokers and vapers. As plaque accumulation or lack of, is largely based on mechanical removal by individuals, and reports suggest that tobacco smoking may alter the microbiome and composition of plaque, but not the physical structure and appearance. However, some studies suggested that smoking could lead to higher plaque formation vulnerability [14, 15].

3.5 Gingival index

In regards to gingival index, there was a significant difference between non-smokers and tobacco smokers (P-value 0.001), No significant difference was found between non-smokers and vapers (P-value 0.992). However, a significant difference between tobacco smokers and vapers (P-value 0.001) was observed. This could be attributed to more toxic content within tobacco cigarettes in comparison to e-cigarettes, having no tar and X may lead to better overall gingival health [9, 15].

Table (3): Pairwise comparison between participant groups

		N	Mean	Std. Deviation		Pairwise comparisons		
						1-2	1-3	2-3
AGE1.	**1.NS**	49	22.71	4.721	0.367			
	2.Cig	66	23.82	4.775				
	3.Vape	67	23.57	3.197				
BOP	**1.NS**	49	.7127	.28585	0.005	0.007	0.04	0.762
	2.Cig	66	.3714	.37669				
	3.Vape	67	.3294	.30459				
PI	**1.NS**	49	1.1486	.36855	0.042	0.102	0.992	0.092
	2.Cig	66	1.3167	.47120				
	3.Vape	67	1.1587	.38558				
GI	**1.NS**	49	1.1031	.43832	0.001	0.001	0.992	0.001
	2.Cig	66	1.4712	.51799				
	3.Vape	67	1.0910	.50136				

4- CONCLUSION

The findings of this study concludes that tobacco smoking is indeed negatively impacts periodontal health status, and smoking cessation should be encouraged, however, it is inconclusive that vaping is the ideal alternative and is not without harmful effects on periodontal health. The study suggests further reseach on the subject, and recommends biochemical analysis of proinflammatory mediators for e-cigarettes users to firmly determine if indeed vaping and its chemicals do in fact disrupt periodontal health and equilibrium and can be considered a significant risk factor for periodontal diseases.

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