

## “Periodontal Status and Treatment Need in Relation to Gender and Smoking Methods”

<sup>1</sup>Nada K Imran, <sup>1\*</sup>Ali A Abdulkareem PhD

<sup>1\*</sup>Department of Periodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq

Corresponding author: Ali A. Abdulkareem

E-mail address: ali.dentist@gmail.com

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### Abstract

**Background** Pathogenesis of periodontal diseases is known to be modulated by range of risk factors. These factors may negatively affect periodontal health and increase the demand of more complicated treatment approach. Different smoking types and potentially gender is among risk factors that require further highlighting. To investigate possible relation of gender and different smoking methods with periodontal health status and treatment needs in sample of Iraqi patients. **Materials and methods** The current cross-sectional prospective study included 638 patients in final analysis. They were grouped according to gender, smoking status and smoking methods. Demographic data were recorded followed by plaque index, gingival index, and probing pocket depth. Treatment demand was determined by using Basic Periodontal Examination index. **Results** Men were more affected by periodontitis than women and plaque scores and more complicated treatment needs were significantly higher in men than women. Clinical parameters were significantly higher in smokers as compared to non smokers. According to smoking type, cigarette smoking was associated with significantly higher pocket depth than other smoking methods. Nevertheless, all smoking types were significantly higher than non smokers in regard with pocket depth and treatment needs. **Conclusions** Based on the results of this pilot study, gender could influence the severity and extent of periodontal diseases. All smoking types showed negative impact on periodontal health and increase the need of complicated treatment.

**Keywords: Gender, smoking, e-cigarettes, risk factors, periodontitis**

### Introduction

Periodontal health is integral to maintain proper function, esthetic, and reducing the prevalence of tooth loss (Benjamin, 2010). Majority of population are affected by gingivitis which if not treated at earlier phases may progress to periodontitis (Nazir, 2017). Despite the fact that dental plaque is the primary etiological agent for periodontal diseases; yet, their initiation and progression are modified by range of risk factors (Kinane, 1999). Proposed risk assessment model for periodontitis, based on

progression of gingivitis to periodontitis, generalized the susceptibility to periodontitis to all individuals and the risk increased proportionally with aging. However, this model neglects gender as a possible risk factor for modulating pathogenesis of periodontal diseases (Shiau and Reynolds, 2010a). Impact of sexual dimorphisms on the pathogenesis of periodontal diseases was suggested by other studies that showed the prevalence and susceptibility of periodontitis in men appears to be significantly higher than women (Eke et al, 2012, Shiau and Reynolds, 2010b). Furthermore, men showed higher neglectful oral hygiene behaviour which is reflected by poorer periodontal health status independent of other systemic conditions such as diabetes mellitus as compared to women (Schulze and Busse, 2016). Smoking is an established risk factor for morbidity and mortality worldwide. Last decades showed increased motivational and educational programs about harmful effect of smoking, still the number of smokers is relatively high and more than 70% of smokers worldwide are from developing countries (Gilmore et al, 2015). Beside global burden of smoking on the health, economy and social aspects, smoking is a well-recognized risk factor for periodontal diseases (Gautam et al, 2011). Classical picture of smoking is connected to cigarette smoking; nevertheless, other smoking types acquired popularity in the last decades. Since its introduction to market at 2003 by a Chinese pharmacist, e-smoking gained the reputation of being less harmful than other smoking types and could be used as a safe way to cease smoking (Callahan-Lyon, 2014). In addition, the stylish trendy look of e-smoking devices with range of flavours of the e-liquids have aided in spreading the use of these devices especially among the teenagers (Callahan-Lyon, 2014). Chemical composition of e-liquids was not fully investigated till 2009, when its contents were revealed by the FDA. According to the available literature, the effect of vaping on periodontal health is not fully clarified till now. However, switching from cigarette smoking to vaping did not help in improving gingival health (Wadia et al, 2016). Further, chemical by-products of e-liquid cause increased oxidative stress and inflammatory cytokines level such as PGE2 (Sundar et al, 2016). Similar to e-smoking, waterpipe or commonly known as "shisha" or "hookah" also acquired popularity amongst wide range of ages in both genders, with general acceptance of the idea that shisha smoking is also safer alternative to smoking (Wong et al, 2016). Studies proved that shisha smoking is as harmful as cigarette smoking on the general health (Kadhum et al, 2015). Impact of shisha smoking on periodontal health was investigated and the results showed significant increase in pocket depth and attachment loss as compared to non-smokers (Bibars et al, 2015). Although effect of smoking on periodontium is well-documented; however, comparison of different smoking types, specifically e-smoking received limited attention. According to our knowledge, the relation of treatment needs and periodontal status with gender and smoking types in Iraqi individuals has received limited attention. Therefore, this pilot study was designed to investigate these potential relations.

## **Material and methods**

### **Study design**

This was a prospective cross-sectional study conducted at the Dental hospital, College of Dentistry/ University of Baghdad from January, 2019 till March, 2019. This study was reviewed and approved by ethical committee of College of Dentistry/ University of Baghdad (Ref. 003618 in 08/01/2019) in consistency with the declaration

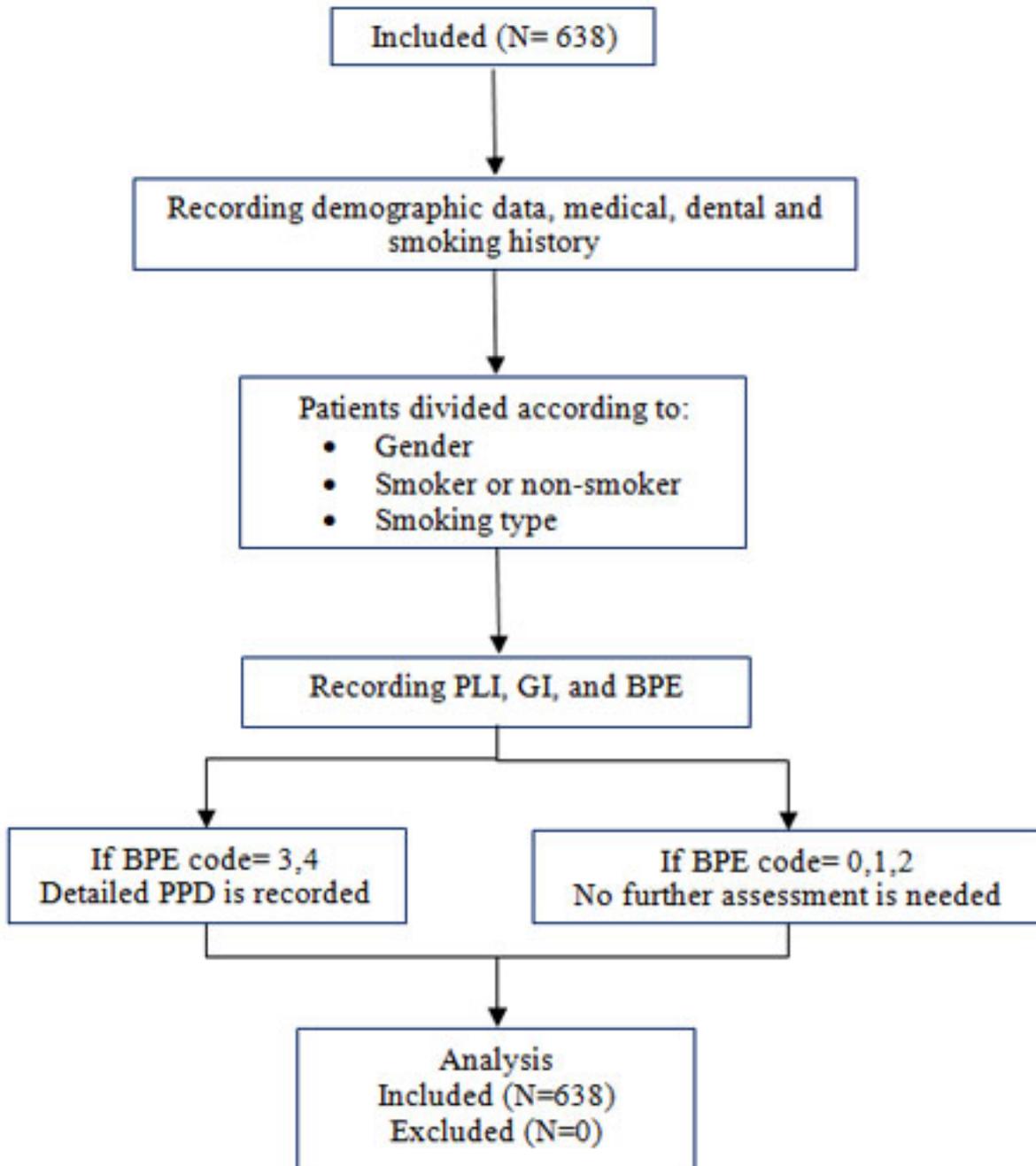
of Helsinki and Tokyo for human researches. All patients were considered for inclusion except those with history of systemic disease, under antibiotic treatment in the last three months, pregnant women, patients who had received periodontal treatment in the last two months, and those who not willing to participate. The details and nature of the study was explained to the patients before signing the written consent. Also, the participants were acknowledged that they could quit the study at any point without giving reason.

### **Health history and oral examination**

Recruitment period lasted for three months during which 927 subjects were examined and 638 subjects were included in this study. For each subject, demographic data, dental and medical history, smoking history and diagnosis were recorded. Subjects were divided according to their gender or smoking status into non smokers (never smoked or quit smoking more than five years ago) or smokers (smoke daily or quit smoking less than five years ago) (Chatzopoulos and Tsalikis, 2016). This was followed by determination of three clinical parameters calibrated examiners. These parameters included plaque index (PLI) (Silness and Loe, 1964), gingival index (GI) (Loe and Silness, 1963), and Basic Periodontal Examination (BPE). Recording of BPE codes were done in accordance with guidelines of British Society of Periodontology. Detailed probing pocket depth (PPD) charting was recorded when a BPE code 3 or 4 was identified. Study design is summarised in diagram 1.

### **Statistical Methods**

Descriptive statistic (bar charts) was used to describe categorical data, while inferential analysis was used for numerical variables. The mean and standard deviation were used to describe continuous variables. Student's t-test and ANOVA test followed by Tukey's post-hoc analysis was used for calculating differences for PLI, GI, and PPD. While frequency distribution and statistical differences between BPE codes were calculated by using Chi-square test. Statistical difference was considered significant when  $p < 0.05$ . Analysis of data was performed by using GraphPad Prism software (version 8, San Diego, CA, USA).

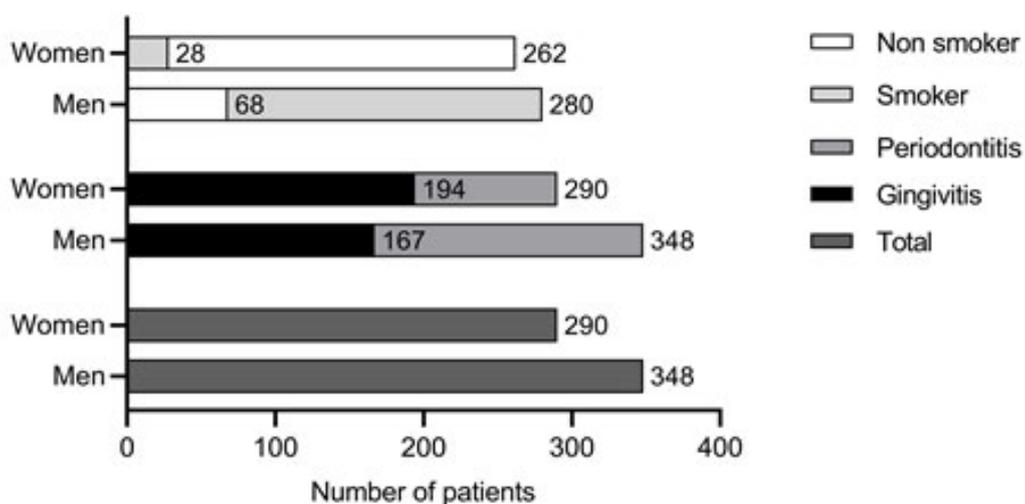


**Diagram (1): Flow diagram of the study.**

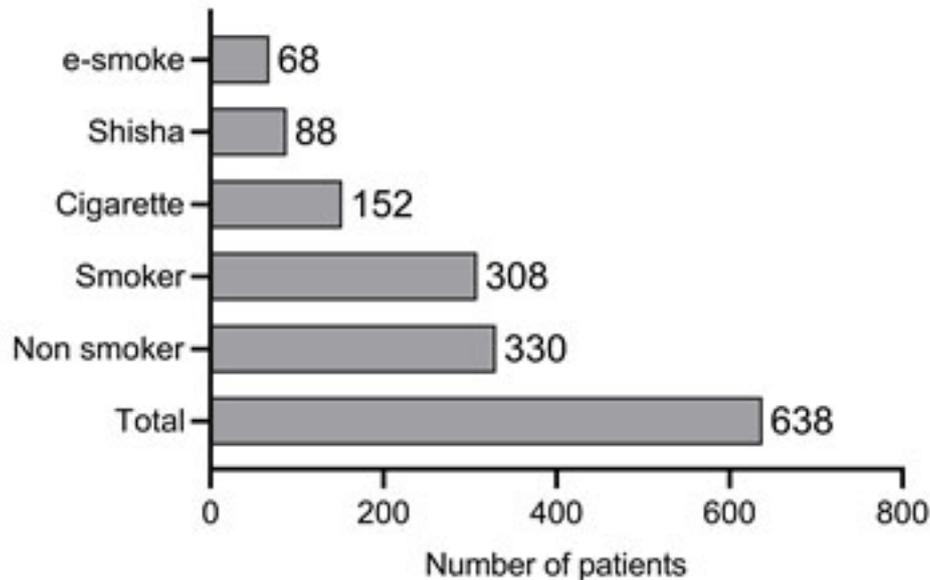
## Results

A total of 638 patients were examined, average age equals to 33.5 years and age range between 15-72 years. Distribution of the sample according to gender showed that men patients comprises 55% while women represented 45% of the population. According to the diagnosis, results revealed that 361 patients (167 men, 194 women) were affected by gingivitis, the rest of the patients (N=277) were affected by periodontitis (182 men, 96 women). Number of smoking men was 208 patients which is much larger than the women counterpart (N=28) (Figure 1). Distribution of the sample according to smoking status showed that 330 were non smokers and 308 were smokers. Further distribution according to the type of smoking showed that cigarette

smoking was the most popular type followed by shisha smoking and finally e-smoke representing 88 and 68 patients respectively (Figure 2). PLI was significantly higher ( $p < 0.05$ ) in association with men than women; however, no significant difference was noted in GI between the two genders. Both PLI and GI of smokers were significantly higher ( $p < 0.05$ ) than non smokers. Further analysis showed that no significant difference was indicated in PLI and GI according to different smoking types (Table 1). Further analysis of clinical parameters indicated no significant difference in PPD between the two genders. Yet, PPD of smokers was significantly higher ( $p < 0.05$ ) than non smokers. More specifically, cigarette smokers were associated with significantly deeper ( $p < 0.05$ ) periodontal pockets than other smoking types (Table 1). Comparison of PLI and GI of different smoking types and non smokers showed that both indices were significantly higher ( $p < 0.05$ ) in association with cigarette and shisha smokers but not with e-smoke in comparison to non smokers. Analysis of BPE scores showed that number of men who required more complicated periodontal treatment and furcation involvement were significantly higher ( $p < 0.05$ ) than women counterparts. Observation showed that the percent of patients who demonstrated bleeding on probing was equal to 11.5% (men 4.2%, women 7.3%). Generally, patients with calculus and plaque retentive factors represented 40.6% (men 23.8%, women 16.9%). Percent of patients with pocket depth equal to 4-5mm was 39.5% (men 22.6%, women 16.9%) while percent of patients exhibiting PPD > 6 mm was 7.3% (men 3.8%, women 3.4%) (Table 2). The same pattern was observed in association with smoking status in which treatment demands of smokers were significantly higher than non smokers. Out of smokers, cigarette smoking was significantly higher than shisha and e-smoking in term of higher treatment scores and furcation involvement (Table 2). Overall, percent of patients who require oral hygiene instruction only was (11.5%), removal of calculus retentive factor was equal to 40.6%, while those who needed additional root surface debridement and more complicated treatment represented 46.8% (6.9% require furcation treatment).



**Figure (1): Characteristics of genders according to diagnosis and smoking status. Men represented 55% of the sample while women accounted for 45%. Number of men affected by periodontitis (N=182) is higher than women (N=96). The same applied for number men smokers which is equal to (N) 280 opposed by much fewer smoking women (N=28).**



**Figure (2):** Frequency distribution of the sample according to smoking status and smoking methods. Cigarette smoking is the highest followed by shisha and e-smoking devices representing (N) 152, 88, and 68 respectively.

**Table (1):** Comparison of clinical parameters according to gender, smoking status and smoking type.

	N (%)	PLI	GI	PPD	Comparisons	P-value	
		Mean± SD	Mean± SD	Mean± SD			
Gender*	Men	350 (55)	1.41± 0.45	1.21± 0.32	4.75± 0.98	PLI male vs PLI female	0.001
	Women	288 (45)	1.24± 0.38	1.26± 0.29	4.69± 0.88	GI male vs GI female	ns
	Total (%)	638 (100)				PPD male vs PPD female	ns
Smoking status*	Smoker	308 (48)	1.44± 0.39	1.18± 0.25	4.77± 0.99	PLI smoker vs PLI non smoker	<0.001
	Non smoker	330 (52)	1.24± 0.43	1.28± 0.35	4.50± 0.68	GI smoker vs GI non smoker	0.014
	Total (%)	638 (100)				PPD smoker vs PPD non smoker	0.014
Smoking type**	Cigarette	152 (49)	1.46± 0.41	1.14± 0.24	5.03± 1.15	PLI cigarette vs PLI shisha	ns
	Shisha	88 (29)	1.49± 0.35	1.25± 0.25	4.68± 0.89	PLI cigarette vs PLI e-smoke	ns
	e-smoke	68 (22)	1.32± 0.40	1.20± 0.25	4.68± 0.69	PLI shisha vs PLI e-smoke	ns
	Total (%)	308 (100)				PLI cigarette vs PLI non smoker	<0.001
					PLI shisha vs PLI non smoker	0.002	
					PLI e-smoke vs PLI non smoker	ns	
					GI cigarette vs GI non smoker	0.005	
					GI shisha vs GI non smoker	0.002	
					GI e-smoke vs GI non smoker	ns	
					GI cigarette vs GI shisha	ns	
					GI cigarette vs GI e-smoke	ns	
					GI shisha vs GI e-smoke	ns	
					PPD cigarette vs PPD shisha	0.007	
					PPD cigarette vs PPD e-smoke	<0.001	
					PPD shisha vs PPD e-smoke	ns	
					PPD cigarette vs PPD non smoker	<0.001	
					PPD shisha vs PPD non smoker	0.024	
					PPD e-smoke vs PPD non smoker	0.016	

\* P-value by student t-test.

\*\* P-value by ANOVA and Tukey's post-hoc.

**Table (2): Comparison of basic periodontal examination (BPE) scores according to gender, smoking status, and smoking type.**

		BPE scores						Total	BPE codes comparison	P-value**
		0	1	2	3	4	*			
Gender		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
	Men	2 (0.4)	27 (4.2)	152 (23.8)	144 (22.6)	24 (3.8)	29 (4.6)	350 (55)	0	ns
	Women	5 (0.8)	46 (7.3)	108 (16.9)	108 (16.9)	22 (3.4)	15 (2.3)	288 (45)	1	0.026
	Total N (%)	7 (1.1)	73 (11.5)	259 (40.6)	252 (39.5)	46 (7.3)	44 (6.9)	638 (100)	2	0.0064
									3	0.023
Smoking status									4	ns
	Smoker	0 (0)	20 (3.1)	120 (18.8)	142 (22.2)	27 (4.2)	27 (4.2)	308 (48)	*	0.035
	Non smoker	7 (1.1)	54 (8.4)	137 (21.5)	112 (17.6)	20 (3.1)	17 (2.7)	330 (52)	0	ns
	Total N (%)	7 (1.1)	74 (11.5)	257 (40.3)	254 (39.8)	47 (7.3)	44 (6.9)	638 (100)	1	0.0001
									2	ns
Smoking type									3	0.04
	Cigarette	0 (0)	7 (1.1)	66 (10.3)	71 (11.1)	7 (1.1)	17 (2.7)	152 (49)	4	ns
	Shisha	0 (0)	7 (1.1)	27 (4.2)	42 (6.5)	12 (1.9)	7 (1.1)	88 (29)	*	ns
	e-smoke	0 (0)	5 (0.8)	29 (4.6)	27 (4.2)	7 (1.1)	2 (0.4)	68 (22)	0	ns
	Total N (%)	0 (0)	20 (3.1)	122 (19.2)	139 (21.8)	26 (4.2)	26 (4.2)	308 (100)	1	ns
								2	0.0001	
								3	0.0001	
								4	ns	
								*	0.0012	

\* furcation involvement.

\*\* Chi-square test.

## Discussion

The current pilot study investigated the relation of periodontal treatment demands and periodontal health with gender as potential risk factor and to common smoking types in Iraqi community. Misconception about shisha and e-smoking as being a good way to stop smoking or being less harmful (Wong et al, 2016) in addition they consider as trendy behaviour and increase number of shisha café with relatively cheap prices. All these factors helped in spreading these smoking methods in Iraqi community. Sample was collected from patients attending dental hospital of University of Baghdad. In order to minimize possible effect of other risk factors, patients with systemic conditions such as diabetes mellitus were excluded. Effect of gender on pathogenesis of periodontal diseases was overlooked by previous studies. Although majority of keystone studies about natural history of periodontal disease suggested that men mostly suffer from destructive form of these conditions. These results could be biased since they were based on examining single gender rather than comparing severity of periodontal diseases in men and women (Loe et al, 1992, Loe et al, 1986, Neely et al, 2001). Results of this study indicated that men were more affected by periodontitis than women who are consistent with current literature (Shiau and Reynolds, 2010a, Eke et al, 2012). This could be attributed to higher levels of sex steroids in men that modulate immunological response to injury or inflammation which is associated with higher level of inflammatory cytokines including TNF- $\alpha$  and IL-1 $\beta$  (Shiau and Reynolds, 2010b). In addition, significantly higher PLI in men compared to women is also consistent with other study which suggest that men are less careful about their oral hygiene level than women regardless of other risk factors (Schulze and Busse, 2016). Majority of the smokers were men with much smaller number of smoker women, this could be to the effect of tradition in our community that consider smoking for women is shameful habit which may forbid the women from declaring that they are smokers. In general, results of this study showed significantly deeper periodontal pocket in association with smoker patients which is consistent with previous study (Gautam et al, 2011). Although PLI and GI of e-smokers were not significantly different from non smokers. However, all smoking types were associated with significantly deeper PPD than non smoker which is similar to other studies (Gautam et al, 2011). The mecha-

nism of periodontal destruction associated with e-smoking is not fully elucidated yet but strong evidence from human studies suggest that e-cigarette could be as harmful as conventional cigarette smoking (Lerner et al, 2015). This effect mostly due to oxidative stress and upregulation of reactive oxygen species produced from e-cigarette aerosols (Lerner et al, 2015). In addition, e-cigarette could lead to bone loss and connective tissue destruction by causing protein and DNA strands damage (Pradeep et al, 2013). Furthermore, the destruction of periodontal tissues associated with e-smoking is thought to increase levels of matrix metalloproteases and prostaglandins (Javed et al, 2017). Even after centuries of its invention, the assumed mechanism of shisha smoking that based on passing the smoke through water to purify it thereby reducing the hazard of smoking by-products still accepted, such concept was proven to be deceiving (Maziak, 2013, Kadhum et al, 2014). Shisha smoke contains high levels of toxic products including nicotine polycyclic aromatic hydrocarbons (Sepetdjian et al, 2010, Eissenberg and Shihadeh, 2009) which seriously affect general and periodontal health. Bibars et al, (2015) investigated the effect of shisha smoking on periodontal health, the results of their study showed no significant difference between shisha and cigarette smoking on scores of PLI, GI, and PPD. This was consistent with our findings in association with PLI and GI but not with PPD. This is could be to differences in sampling size or ethnic variations or differences in smoking frequency and duration which were not specified in both studies. Consistent with clinical results, treatment need analysis showed that men were more affected by deep periodontal pockets and furcation involvement more than women. This finding was supported by similar results in another community (Sanei and Nikbakht-Nasrabadi, 2005) and work of Demirer et al, (2012) which suggested that gender could be a determinant for periodontal treatment needs. The same pattern was seen in comparison of smokers with non smoker in which smokers require more sophisticated periodontal treatment. This agree with results reported worldwide that showed increased periodontal treatment need and deeper periodontal pockets in adult smokers compared to non smokers (Chatzopoulos and Tsalikis, 2016, Demirer et al, 2012, İhtiyacı, 2010). General treatment need specified in the current study was almost similar to that determined by other studies (Hamasha and Albashaireh, 2006, Mahajani et al, 2016, Sanei and Nikbakht-Nasrabadi, 2005). One of the limitations of the current work was a pilot cross-sectional study that only included limited number of patients whom were attending dental hospital of College of Dentistry/ University of Baghdad seeking for treatment. In addition, possible role of gender as a risk factor needs other studies that exclude extraneous variables such as socioeconomic level, age, oral hygiene and dietary habits. Furthermore, smoking history required recording of further details which is timewise was not feasible. Thus, investigation of frequency and duration of different smoking methods on a community level and their relation to periodontal health are required in the future. Indeed, further studies on different smoking methods will help the medical community to pinpoint the exact risk associated with different smoking types, thereby delivering rightful message to the public and decision-making institutes to take appropriate action against smoking.

## Conclusions

It can be concluded that men had lower oral hygiene level and are affected by severe forms of periodontal diseases and higher treatment needs than women. Smoking was associated with more severe form of periodontal disease regardless of the smoking method. According to smoking methods, cigarette smoking requires more complicated treatment. In addition, inhalation of chemicals and nicotine from aerosols of e-liquid and shisha smoke negatively impact periodontal health in a similar manner to conventional cigarettes. Despite limitations, this pilot study could provide baseline data for larger scale investigation for Iraqi community.

## Conflict of interest

All authors state that the manuscript for this paper is original, and it has not been published previously (or part of MSc. dissertation or PhD thesis) and is not under consideration for publication elsewhere, and that the final version has been seen and approved by all authors.

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