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Original Article

The Effect of Waterpipe Smoking On Periodontal Health Among A Sample Of Adult Egyptian Patients: A Hospital Based Cross-Sectional Study

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ABSTRACT: This cross-sectional study aimed to evaluate the effect of waterpipe smoking on periodontal health in a sample of adult Egyptian patients. included 322 medically fit volunteers who were consecutively enrolled in the study at the diagnostic center at Cairo University's Faculty of Dentistry. A personal interview was conducted with the patient to complete a well-structured, translated questionnaire that investigated their age, gender, educational attainment, income, oral health behaviors, and tobacco habits, including waterpipe smoking duration (heads smoked per day), and extent of usage (age of initiation and number of sessions per week). A full-mouth plaque index (PI), bleeding on probing (BoP), pocket depth (PD), clinical attachment level (CAL), and gingival recession depth (RD) were measured. The prevalence of waterpipe smoking among the study sample was 17.7%. Most waterpipe smokers were males with good socioeconomic status and a daily frequency of tooth brushing. Waterpipe smokers showed significantly greater PI, PD, CAL, and RD than nonsmokers. Stage II periodontitis was the most prevalent periodontal disease among waterpipe smokers (46.2%), followed by stage I periodontitis (30.8%), gingivitis (15.4%), and stage III (7.7%). Smoking using a waterpipe may pose an equal risk for periodontal diseases as smoking cigarettes.

Keywords: Tobacco smoking; periodontitis; shisha; prevalence; risk factor

INTRODUCTION

Periodontal disease occurs due to complex interactions between bacteria, the host's response, and risk factors. Population specific factors may contribute differently to the incidence of periodontitis among different populations (Genco and Borgnakke, 2013). Many modifiable and non-modifiable factors have been associated with periodontitis, such as socio-economic status, smoking, diabetes, obesity, hypertension, genetic factors, etc. (Van Dyke and Sheilesh, 2005, Genco and Borgnakke, 2013). These factors' prevalence and impact may differ between developed and developing countries, with the latter being more prevalent. As a result, focusing on country-specific periodontitis risk factors is critical in order to plan appropriate educational programmes and effective preventative disease interventions that best serve the public's oral and general health (Eke et al., 2016, Frencken et al., 2017).

Tobacco smoking is a widespread health problem in Egypt; the most updated prevalence of tobacco smoking in Egypt was 22% in 2010 and is still growing (Frencken et al., 2017). Smoking has been recognized as one of the major risk factors for the pathogenesis of periodontitis, and its effect is dose-dependent (Ravidà et al., 2020). Tobacco use worsens periodontal disease by enhancing pathogenic microorganism invasion, reducing immunological resistance, exacerbating the inflammatory response, and subsequently accelerating alveolar bone loss (Zhang et al., 2019).

Waterpipe smoking (also known as hookah, hubble bubble, narghile, and shisha) is a sort of tobacco smoking in which charcoal-heated air passes through pierced aluminum foil and across ground tobacco to produce smoke, which is then filtered through a water basin before being inhaled through the hose and mouthpiece (Javed et al., 2019). It allows users to smoke tobacco that is available in different flavors, such as mint, cherry, and watermelon (Farag et al., 2018). Waterpipe smoking is a social habit in many countries, including Bahrain, Egypt, Kuwait, Qatar, Saudi Arabia, Lebanon, and the United Arab Emirates (Mohammed et al., 2010, Al-Houqani et al., 2012, Borgan et al., 2014, Jawad et al., 2015, Javed et al., 2016, Mostafa et al., 2018). Recently, waterpipe smoking has apparently become a widespread phenomenon, with notable patterns of distribution mostly among young, males in high socioeconomic and urban populations. Nonetheless, waterpipe smoke contains more volatile organic compounds, ultrafine particles, nicotine, and carbon monoxide than cigarette smoke, making its use associated with various medical disorders in epidemiologic studies (Perraud et al., 2019).

In Egypt, the prevalence of waterpipe smoking has been changing throughout the past few years. In 2006, the prevalence of waterpipe smoking among the adult population in lower Egypt's villages was 9%. While in upper Egypt, waterpipe smoking was much higher (46% of adult males), and 17% combined it with cigarette smoking (2006). In a later study, Cairo University's final-year medical students revealed that 17.6% of them were waterpipe users (Khan et al., 2012). Recently, it has been estimated that the prevalence of Egyptians' current waterpipe tobacco smoking were 8.7% in males and 0.1% in females in individuals aged 15–69 years (Mostafa, 2020).

Several studies on the effect of waterpipe smoking on oral and periodontal health have been conducted in various parts of the Middle East, with the authors reporting an association between waterpipe smoking and periodontal disease (Natto et al., 2004, Natto et al., 2005, Bibars et al., 2015, Khemiss et al., 2016, Khemiss et al., 2019, Mokeem et al., 2018, Javed et al., 2016, Al-Mufti and Saliem, 2018). Despite the fact that waterpipe using is a common social practice in Egypt, there is a paucity of evidence regarding the effects of waterpipe smoking on oral health and the risk of periodontal diseases in the Egyptian population.

Given the information presented above, the current hospital-based cross-sectional study

aimed to evaluate the effect of waterpipe smoking on periodontal health using the new periodontal disease classification (Tonetti et al., 2018) in an Egyptian individual attending the diagnostic clinic at the Faculty of Dentistry, Cairo University. Carrying out such a study might be useful in raising patients' awareness and the community's willingness to accept waterpipe smoking as a real problem.

MATERIALS AND METHODS

Ethical Review

The present study, with the identifier NCT04509505 at ClinicalTrials.gov, was accepted by the Research Ethics Committee, Faculty of Dentistry, Cairo University (June 2020) (Reference code: 10420). All participants who volunteered to enroll were given a thorough explanation of the process before being asked to sign a written informed consent form.

Study Design and Participants

This observational cross-sectional study involved 322 participants who attended the Diagnostic Center, Faculty of Dentistry, Cairo University, for dental treatment. Eligible subjects were enrolled consecutively at the outpatient diagnostic clinic. The present study began in November 2020 and ran until September 2021, with screening for ineligible patients continuing until the target sample size was reached. A sample size calculation was performed using the effect of waterpipe smoking on periodontal health as the primary outcome, based upon the results of a previous study (Natto et al., 2005). The estimated sample size was 322 participants using a 95% confidence level, an acceptable margin of error of 5%, and a 0.05 significance level. Using Epi Info 7.2.2.2, the sample size was estimated (Centres for Disease Control and Prevention, USA). Inclusion criteria included adult patients consulted in the outpatient clinic between the ages of 18 and 60 who agreed to participate and provided informed consent. Exclusion criteria were those individuals with chronic systemic diseases or diagnosed with psychiatric problems or who were intoxicated by alcohol or drugs; patients having problems opening their mouths or undergoing intermaxillary fixation; pregnant women; or those with orthodontic appliances.

Interview and Data Collection

Questionnaire

A questionnaire that was adapted from previous well-designed and validated questionnaires (Alzyoud et al., 2015, Al-Alimi et al., 2018) that were translated into Arabic and then reverse translated by a qualified translator to assure precision was fulfilled during a face-to-face personal interview with the patient by the examiner (ZM). The first section of the questionnaire included questions about participants' sociodemographic information, such as age, sex, educational attainment, and income. The second section assessing their oral health behaviours included tooth brushing frequency, use of auxiliary aids, and dental appointments. While the third part of the questionnaire asked about their tobacco habits, such as smoking method, waterpipe smoking, duration (heads smoked per day), and extent of usage (age of initiation and number of sessions per week).

Clinical Periodontal examination

The diagnosis and case identification of periodontal disease were carried out in accordance with the revised classification of periodontal disease (Tonetti et al., 2018), based on the patient's full oral clinical examination. Patients were either diagnosed with gingivitis or periodontitis, with the stages of periodontitis also being specified. A trained examiner (ZM) performed full-mouth clinical examinations on all recruited patients. Plaque index (PI) (Silness and Löe, 1964), dichotomous bleeding on probing (BoP) expressed as a percentage (Trombelli et al., 2018), pocket depth (PD), clinical attachment level (CAL), and gingival recession depth (RD) were the periodontal parameters recorded for all participants. With a

gentle force, PD, CAL, and RD measurements were recorded from the free gingival margin till the base of the pocket, the cemento-enamel junction (CEJ) till the base of the pocket, and the CEJ till the most apical extension of the gingival margin, respectively (Ramfjord, 1967). Measurements were taken using the UNC-15 periodontal probe at six locations for all teeth (mesio-buccal, mesio-lingual, mid-buccal, disto-buccal, disto-lingual, and mid-lingual), and they were rounded to the nearest full millimetre.

Statistical Analysis

Qualitative data were presented as frequencies and percentages. Quantitative data were presented as mean ± standard deviation (±SD), 95% Confidence Interval (95% CI) for the mean value, median and range values. For univariate analysis; Chi-square test or Fisher's Exact test was used for comparisons regarding qualitative variables. Quantitative data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). PI, BoP, PD, CAL and RD data showed non-parametric distribution, so Kruskal-Wallis test was used to compare between patients with different smoking habits. Dunn's test was used for pair-wise comparisons when Kruskal -Wallis test is significant. Model fit was tested using Chi-square test and Pseudo R2 tests and the model was fit to describe the relations between the dependent and independent variables. The regression coefficient (ß), standard error (SE), and 95% confidence interval (95% CI) were calculated. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

RESULTS

1. Descriptive Data

1.1. Waterpipe smoking frequency

The current study included 322 medically fit subjects, 198 males (61.5%) and 124 females (38.5%), ranging in age from 18 to 60 years. Almost three-quarters of them did not brush their teeth on a daily basis. Waterpipe smoking was prevalent among 17.7% of study participants, while cigarette smoking was detected in 30.4% of the participants. Between the ages of 14 and 16, the vast majority of waterpipe smokers began smoking. The average number of smoked heads per day was 2-3. Half of the waterpipe users smoked 3-9 times per week.

1.2. Prevalence of periodontal diseases in the whole sample

The frequency and distribution of periodontal disease among the whole sample are shown in Table 1. Only 1.2% of the study participants had healthy periodontium. Gingivitis and periodontitis Stage I were the most prevalent periodontal diseases, with a frequency of 30.7% and 30.4%, respectively. This was followed by periodontitis stage II (28.3%) and stage III (5.3%). Periodontitis stage III (5.3%) and stage IV (4%) showed the least prevalence.

2. Univariate Analysis

Table 2 shows the patients' gender, age, education, income, and oral hygiene practices in relation to their smoking status. There was a statistically significant difference in distributions between gender, income and daily brushing among patients with different smoking habits (P-value <0.001). Smokers were mainly males (69.2% of waterpipe smokers, 92.6% in cigarette smokers and 100% of both waterpipe and cigarette smokers), while 55% of non-smokers were females. Waterpipe smokers showed the highest prevalence in patients with an income <2000 and >4000 LE/month. The highest frequency of daily brushing was performed by waterpipe smokers, followed by non-smokers, then both waterpipe and cigarette smokers, while cigarette smokers showed the highest prevalence of not brushing.

The prevalence of periodontal diseases and patients' periodontal clinical parameters in relation to their smoking status are shown in tables 3 and 4. Individuals who smoked both waterpipe and cigarettes had the highest mean PI

score (2.41), which was statistically significant when compared to PI in nonsmokers and other smokers (P-value 0.001). Non-smokers showed a high mean % BoP (40.82%), which was statistically significant compared to waterpipe smokers (30.24%). PD was not statistically significant among waterpipe smokers, cigarette smokers, and those who smoked both waterpipe and cigarettes (P > 0.05). Individuals who smoked both waterpipe and cigarettes revealed the highest mean CAL (3.01 mm), and this was statistically significant when compared to the mm CAL of either waterpipe smokers or cigarette smokers (P-value < 0.001). However, there was no statistically significant difference between the mean mm CAL in waterpipe smokers (2.43 mm) compared to cigarette smokers (2.5 mm) (P > 0.05). There was a statistically significant difference regarding the prevalence of periodontal diseases among participants with different smoking habits (P-value <0.001). Waterpipe smokers showed the highest prevalence of periodontitis stage II, while cigarette smokers showed the highest prevalence of periodontitis stages I and IV. Waterpipe and cigarette smokers showed the highest prevalence of periodontitis stage III, while non-smokers showed the highest prevalence of healthy periodontium as well as gingivitis

Table 1: Descriptive statistics for prevalence of periodontal diseases in the study sample

Diagnosis	Number	%
Healthy periodontium	**4**	**1.2**
Gingivitis	**99**	**30.7**
Periodontitis Stage I	**98**	**30.4**
Periodontitis Stage II	**91**	**28.3**
Periodontitis Stage III	**17**	**5.3**
Periodontitis Stage IV	**13**	**4**

Table 2 Univariable analysis displaying the association of patients' sex, age, education, income, and oral hygiene practices frequency % (n) with different smoking habits

Demographic data	**Water pipe smokers % (n = 13)**	**Cigarette smokers % (n = 54)**	**Cigarette & water pipe smokers % (n = 44)**	**Non-smoker % (n = 211)**	***P-value***	***Effect size (v)***
Sex						
Male	69.2 % (9)	92.6 % (50)	100 % (44)	45 % (95)	<0.001*	0.48
Female	30.8 % (4)	7.4 % (4)	0 % (0)	55 % (116)		
Age						
8-30 y	23.1 % (3)	18.5 % (10)	25 % (11)	30.8 % (65)	0.691	0.084

31-40 y	53.8 % (7)	35.2 % (19)	31.8 % (14)	32.2 % (68)		
41-50 y	15.4 % (2)	27.8 % (15)	29.5 % (13)	24.2 % (51)		
51-60 y	7.7 % (1)	18.5 % (10)	13.6 % (6)	12.8 % (27)		
Education						
No formal education	0 % (0)	7.4 % (4)	15.9 % (7)	14.2 % (30)	0.164	0.116
Elementary school	7.7 % (1)	27.8 % (15)	29.5 % (13)	17.5 % (37)		
Secondary school	46.2 % (6)	37 % (20)	29.5 % (13)	43.6 % (92)		
Higher education	46.2 % (6)	27.8 % (15)	25 (11)	24.6 % (52)		
Income						
No income	7.7 % (1)	20.4 % (11)	13.6 % (6)	51.7 % (109)	<0.001*	0.24
<2000 LE	61.5 % (8)	50 % (27)	50 % (22)	34.1 % (72)		
2000-4000 LE	7.7 % (1)	25.9 % (14)	29.5 % (13)	12.3 % (26)		
>4000 LE	23.1 % (3)	3.7 % (2)	6.8 % (3)	1.9 % (4)		
Daily brushing						
Yes	53.8 % (7)	11.1 % (6)	22.7 % (10)	28.9 % (61)	0.006*	0.198
No	46.2 % (6)	88.9 % (48)	77.3 % (34)	71.1 % (150)		
Daily flossing						
Yes	0 % (0)	1.9 % (1)	0 % (0)	1.4 % (3)	1	0.054
No	100 % (13)	98.1 % (53)	100 % (44)	98.6 % (208)		
Regular dental visits						
Yes	0 % (0)	0 % (0)	0 % (0)	4.7 % (10)	0.219	0.13
No	100 % (13)	100 % (54)	100 % (44)	95.3 % (201)		

**: Significant at P ≤ 0.05, Different superscripts in the same row indicate statistically significant differences*

Table 3: Mean (±SD) and results of Kruskal-Wallis test for comparison between clinical parameters among patients with different smoking habits

Clinical parameters	Waterpipe smokers (n = 13)	Cigarette smokers (n = 54)	Waterpipe and cigarette smokers (n = 44)	Non-smokers (n = 211)	*P-value*	*Effect size (Eta squared)*
PI (Score)	1.62 (±0.77) a	1.87 (±0.78) a	2.41 (±0.69) b	1.75 (±0.74) a	<0.001*	0.076
BOP (%)	30.24 (±26.4) a	36.66 (±32.56) b	46.87 (24.96) c	40.82 (±27.81) b	0.026*	0.02
PD (mm)	2.39(±0.52) a	2.45 (±0.47) a	2.55 (±0.73) a	2.28 (±0.51) b	0.005*	0.031
CAL (mm)	2.43(±1.44) a	2.5 (±1.71) a	3.01 (±1.7) b	1.42 (±1.54) c	<0.001*	0.128
RD (mm)	0.94 (±0.68) a	1.15(±1.07) b	1.29 (±0.96) b	0.69 (±0.81) c	<0.001*	0.056

**: Significant at P ≤ 0.05, Different superscripts in the same row indicate statistically significant differences*

Table 4: Descriptive statistics and results of Fisher's Exact test for comparison between prevalence of periodontal diseases among patients with different smoking habits

Periodontal diseases	Water pipe smokers % (n = 13)	Cigarette smokers % (n = 54)	Cigarette & water pipe smokers % (n = 44)	Non-smokers % (n = 211)	*P-value*	*Effect size (v)*
Healthy periodontium	0 % (0)	0 % (0)	0 % (0)	1.9 % (4)	<0.001*	0.213
Gingivitis	15.4 % (2)	14.8 % (8)	9.1 % (4)	40.3 % (85)		
Periodontitis Stage I	30.8 % (4)	33.3 % (18)	27.3 % (12)	30.3 % (64)		
Periodontitis Stage II	46.2 % (6)	35.2 % (19)	43.2 % (19)	22.3 % (47)		
Periodontitis Stage III	7.7 % (1)	7.4 % (4)	11.4 % (5)	3.3 % (7)		
Periodontitis Stage IV	0 % (0)	9.3 % (5)	9.1 % (4)	1.9 % (4)		

**: Significant at P ≤ 0.05*

DISCUSSION

This cross-sectional study found that cigarette smoking was the most prevalent form of tobacco smoking among the study participants, with a prevalence of 30.4%, followed by waterpipe smoking, which constituted 17.7% of the participants. This is in accordance with data reporting the prevalence of tobacco smoking patterns among rural Egyptian males by WHO (2006), which found that 34% were current cigarette smokers, with a lesser prevalence of waterpipe smoking at 9%. The current findings are also comparable to Khan et al. (2012) who showed that 17.6% of 1425 students in their sixth and final year of medical school at Cairo University's Kasr Al Ainy Faculty of Medicine were waterpipe smokers. Moreover, the Egyptian Ministry of Health conducted a population survey among Egypt's students during the second semester of the academic year 2012–2013 and reported that 16.2% were current cigarette smokers, while the overall prevalence of waterpipe smokers was 12.2% (Health and Organization, 2014).

The current univariate analysis showed that gender distributions differed significantly among the four study groups, with the tobacco smoking groups being predominated by males; with 92% cigarette smokers, 69.2% water pipe smokers and 100% smoked both cigarette and waterpipe. While the non-smoker group included mostly females (55%).Similarly, Natto et al. (2005) reported that within a sample of 355 participants in Saudi Arabia, the percentage of males was 80.5% in the cigarette smoking group, 76.9% in the waterpipe smoking group and 76.11% in the cigarette and waterpipe smoking group. The significant difference currently noticed in gender distribution among tobacco smoking in general and waterpipe smoking in particular can be attributed to Egypt's social intolerance against female smoking, which depicts female waterpipe smoking as a disrespectful manner and stigmatized. Only 1.5% of females from Egypt smoked their first waterpipe with family members, in comparison to half of females from the Occupied Palestinian Territories (Khalil et al., 2013). Another possible explanation is that males are much more willing to admit to smoking waterpipes on a regular and large scale than females (Salloum et al., 2019).

In terms of income as a predictor of socioeconomic status, the present investigation found that most participants who have a monthly income of more than 4000 Egyptian pounds smoked waterpipes with 23.1%. While only 1.9 % of the high-income participants were non-smokers. Moreover, 51% of non-smokers and 7.7% of waterpipe smokers had no monthly income. Those findings were supported by Bibars et al. (2015), who reported that participants who earn more than 500 Jordanian Dinar were waterpipe smokers (59.7%). In addition, this pattern of high socioeconomic level in waterpipe smokers was also observed in Tunisia (Khemiss et al., 2016). Waterpipe smoking in fine cafés or restaurants was found to be more popular among Egyptians (74.0%) than among Palestinians (44.8%) and Jordanians (43.8%), even though the average price paid per session is 0.99 USD (Salloum et al., 2019, Hamadeh et al., 2020). It is obvious that waterpipe smoking gained social acceptability and popularity among Egyptian males and is no longer considered as a low-class, old-fashioned habit, most likely due to the common misbelief that it is not as dangerous or as likely to cause dependency as cigarette use due to the water-filtration step, as well as the lack of a waterpipe-specific regulatory/policy framework.

To ensure that the periodontal disease in waterpipe smokers is an effect of waterpipe smoking rather than a confounding effect of concurrent cigarette smoking, this study separated those who were water pipe smokers from those who smoked both water pipes and cigarette. Waterpipe smokers were identified as those who smoked waterpipes at least once a week (El-Setouhy et al., 2008). Furthermore, to minimize potential confounding factors and to obtain useful data, patients with chronic systemic diseases, pregnancy, psychiatric problems,

limited mouth opening, or orthodontic appliances were excluded from the study. The highest percentage of exclusive waterpipe smokers had periodontitis stage II (46.2%), followed by periodontitis stage I (30.8%), gingivitis (15.4%) and periodontitis stage III (7.7%). None of them had a healthy periodontium nor stage IV periodontitis. On the other hand, cigarette smokers were found to have the highest prevalence of stage I (33.3%) and stage IV periodontitis (9.3%). This might imply that there is no clinical significant difference between cigarette and waterpipe smoking on periodontal health. Still non-smokers had the highest prevalence of healthy periodontium (1.9%) and gingivitis (40.3%). These observations were supported by previous studies where waterpipe smokers had worse clinical indices of periodontal inflammation than non-smokers as well as greater levels of IL-1β and IL-6 (Natto et al., 2004, Baljoon et al., 2005, Natto et al., 2005, Bibars et al., 2015, Javed et al., 2016, Mokeem et al., 2018). As stated by the WHO (2006), a single session of waterpipe smoke with a duration of 45 minutes is equal to the inhalation of cigarette smoke 100 times, causing an exposure to a larger amounts of toxins with exaggerated harmful effects. Additionally, the concentration of nicotine within the blood of waterpipe smokers was equivalent to the level present in blood of heavy cigarette smokers (Neergaard et al., 2007). This suggests that waterpipe smoking might involve pathological mechanisms and production of toxic mediators which could affect the periodontal condition like cigarette smoking. The findings reported in this cross-sectional study confirm former results that waterpipe smoking, alike cigarette smoking, is associated with periodontal disease. Bibars et al. (2015) reported that high prevalence of periodontal disease in cigarette smokers (43.3%), waterpipe smokers (23.6%), both cigarette and waterpipe smokers (28.0%) and the lowest prevalence was shown in nonsmokers (13.2%).

Regarding PI, this study revealed that those with both cigarette and waterpipe smoking had the highest mean score (2.41), which was statistically significant when compared to other groups. This finding is in agreement with Bibars et al. (2015) who found that those who smoked both cigarette and waterpipe had PI scores of 2-3. Yet, the current study did not find any significant difference in PI values between waterpipe smokers, cigarette smokers, and nonsmokers, even though most waterpipe smokers performed daily tooth brushing. This could be attributed to nicotine, which accelerates *S. gordonii* planktonic cell proliferation, biofilm development, accumulation and binding protein gene expression, enhancing other pathogens' adhesion to tooth surfaces, attributing to the buildup of dental plaque biofilm in smokers (Huang et al., 2014). This was also confirmed by Natto et al. (2004) who revealed that, both waterpipe smokers and cigarette smokers had significantly higher plaque indices compared to non-smokers, despite performing oral hygiene measures as regular as non-smokers. Nevertheless, waterpipe and cigarette smokers in the present study did not have high PI scores compared to non-smokers. However, the fact that most non-smokers had poor oral hygiene measures could be a possible reason for this discrepancy.

The effect of tobacco smoking on gingival vasculature is well established. Nicotine was found to produce a vasoconstrictive effect on gingival blood vessels, which suppresses BoP (Clarke and Shephard, 1984). The current study revealed that BoP percentages were significantly lower among waterpipe smokers than non-smokers. This was consistent with previous reports concluding that waterpipe smokers had a lesser gingival bleeding compared to non-smokers (Natto et al., 2004, Javed et al., 2016). Similarly, Mokeem et al. (2018) showed that non-smokers had a significantly higher BoP in comparison with waterpipe smokers and electronic cigarette users. Al-Mufti and Saliem (2018) also reported that non-smoking chronic periodontitis patients had a higher BoP than smoking chronic periodontitis patients.

Data from this cross-sectional study revealed that smokers had significant increase in PPD and Cal compared to nonsmokers. This is consistent with previously reported findings that PPD was significantly higher in smokers than nonsmokers, with means of percentages of sites with PPD> 4 mm significantly higher in smokers (Natto et al., 2005, Bibars et al., 2015, Javed et al., 2016, Mokeem et al., 2018). Furthermore, other studies also reported insignificant difference in PPD between waterpipe smokers and cigarette smokers (Bibars et al., 2015, Javed et al., 2016), which is in line with the current observations, a finding that might reflects the similarity between waterpipe and cigarette smoking in the magnitude of periodontal tissue damage.

Of the limitations of the current cross-sectional study is that it was conducted after the first wave of the COVID-19 outbreak with government closures of cafés and restaurants owing to strict legislative regulations against public gathering and smoking. This might have made people more hesitant to admit smoking waterpipe. Because of the coronavirus pandemic, 8.1% of the current study population reported quitting smoking waterpipes.

CONCLUSION

Within the limitations of this investigation, it might be concluded that there is a significant association between periodontal diseases and waterpipe smoking. Waterpipe smoking was also found to impair the normal periodontal health of its users in almost the same way as cigarette smoking does.

Conflict of interest and source of funding

The authors declare that there is no conflict of interest and the study is self-funded.

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