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Tobacco smoking and periodontal bone height in a Saudi Arabian population

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Abstract

Aim: To study the association between tobacco smoking, in particular water pipe smoking, and periodontal bone height.

Methods: A study sample of 355 individuals in the age range 17–60 years was recruited from Jeddah, Saudi Arabia. The smoking behavior was registered through a questionnaire during interview. Participants were stratified into water pipe smokers (33%), cigarette smokers (20%), mixed smokers (19%) and non-smokers (28%). The periodontal bone height was measured from digital panoramic radiographs mesially and distally to each tooth and expressed as a percentage of the root length.

Results: The mean periodontal bone height was 76.2% for water pipe smokers, 75.8% for cigarette smokers, 80.2% for mixed smokers and 80.9% for non-smokers. The association between smoking and mean bone height was statistically significant controlling for age ($p<0.001$). The association between life-time smoking exposure and mean bone height controlling for age was statistically significant in water pipe smokers and cigarette smokers ($p<0.01$).

The prevalence of bone loss in excess of 30% of the bone height was 27% in water pipe smokers, 24% in cigarette smokers, 9% in mixed smokers and 6% in non-smokers. The prevalence was significantly greater in water pipe smokers and cigarette smokers compared with non-smokers ($p<0.001$). The relative risk of periodontal bone loss associated with water pipe and cigarette smoking after adjustment for age was 3.5-fold and 4.3-fold elevated, respectively, compared with non-smoking ($p<0.01$).

Conclusion: An association between tobacco smoking and periodontal bone height reduction is observed. The impact of water pipe smoking is of the same magnitude as that of cigarette smoking.

Key words: bone height; bone loss; cigarette; periodontal disease; Saudi Arabia; smoking; tobacco; water pipe

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Current knowledge suggests that tobacco smoking is a risk factor for periodontal disease. The contention is based on observations that cigarette smoking is associated with increased prevalence and severity of periodontal disease (Bergström & Floderus-Myrhed 1983, Feldman et al. 1983, Bergström and Eliasson 1987, Feldman et al. 1987, Bergström et al. 1991, 2000a, b, Haber & Kent 1992, Horning et al. 1992, Bolin et al. 1993, Khader et al. 2003). The negative impact of smoking on the periodontal bone is evident from an elevated reduction rate of the bone height (Feldman et al. 1987, Bolin et al. 1993, Norderyd et al. 1999, Bergström et al. 2000a, Payne et al. 2000, Jansson & Lavstedt 2002, Bergström 2004), and from an increased occurrence of vertical bone defects in cigarette smokers compared with non-smokers (Persson et al. 1998, Baljoon et al. 2004, 2005a, b).

The impact of other forms of tobacco smoking such as cigar and pipe smoking on the periodontal bone has been studied although to a limited extent (Feldman et al. 1983, Krall et al. 1999). Cigar and pipe smokers were at similar risk as cigarette smokers of experiencing periodontal bone loss (Krall et al. 1999).

Water pipe smoking known under different names such as argila, hookah and sheesha, is widely used in Saudi Arabia and in other Middle East countries. Smoking water pipe needs a special device and moist tobacco that is commercially supplied in different fruit flavours that contains 2–4% nicotine (Kiter et al. 2000). The tobacco is placed under charcoal to keep the tobacco burning and with each puff, mainstream smoke passes into water via a stem, enters a rubber tube and is delivered to the smoker via a mouth piece. Even though there are no epidemiological studies regarding the prevalence of water pipe smoking in Saudi Arabia, its popularity seems to be increasing and public toleration to this habit is becoming wider. A key question for health professionals is whether or not water pipe smoking negatively affects the periodontal health in a manner similar to that of cigarette and other forms of tobacco smoking.

We have recently reported on the association of water pipe smoking with the periodontal health in terms of gingivitis and probing depth. The observation suggested that water pipe smokers exhibited lower gingival inflammatory response to plaque compared with non-smokers (Natto et al. 2004). In addition, water pipe smokers exhibited higher mean probing depths and higher periodontal disease prevalence compared with non-smokers (Natto et al. 2005). The purpose of the present study was to further investigate the association between tobacco smoking, in particular water pipe smoking and the periodontal health in terms of radiographic bone height in the same Saudi Arabian population.

Material and Methods

Study population

Saudi residents in Jeddah City, Saudi Arabia were invited to participate in the study by means of announcements in newspapers. To be included potential participants were required to exhibit a minimum of 20 teeth and not to be pregnant. A total of 355 individuals (100 women and 255 men) in the age range 17–60 years fulfilled the inclusion criteria and responded to a standardized questionnaire. All participants had digital panoramic radiographs and 262 (74%) volunteered additionally for clinical examination. The radiographic and clinical examinations were carried out at King Faisal Specialty Hospital and Research Center, Jeddah, Saudi Arabia. Participants were informed individually, verbally and in writing, about the purpose of the study and signed an informed consent form. The study was approved by the local ethical committee of King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia in accordance with the Helsinki Declaration of 1975 and as revised in 1983.

The clinical examiner interviewed each individual as to his/her smoking habits according to a pre-determined questionnaire with fixed alternative answers. According to their responses, participants were classified into water pipe smokers (33%), cigarette smokers (20%), smokers of both water pipe and cigarettes (labelled mixed smokers 19%) and non-smokers (28%). The distribution of the study population according to age, gender and smoking is presented in Table 1. The overall mean (95% confidence interval (CI)) age was 36.9 (35.8; 37.9) years. The age of mixed smokers was significantly lower than that of water pipe smokers, cigarette smokers and non-smokers, respectively ($p < 0.05$). Men predominated in all smoking groups ($p < 0.001$).

The lifetime smoking exposure as found by the product of daily consumption (cigarettes per day or water pipe runs per day) and duration (years of smoking) was expressed in terms of cigarette-years and run-years, respectively. A run is the completion of the water pipe smoking until the tobacco is burnt. The mean (95% CI) lifetime exposure for cigarette smokers and water pipe smokers was 230.4 (193.4; 267.5) cigarette-years and 56.8 (48.0; 65.6) run-years, respectively. The mean (95% CI) lifetime exposure for mixed smokers was 174.0 (141.0; 206.9) cigarette-years and 23.8 (17.9; 29.5) run-years. Dental care habits were revealed by the participant's stated reason for visiting the dentist (regular/irregular). Formal education status was classified on a five-point scale according to highest level the participant achieved in the school system in Saudi Arabia: no formal education, primary school only (6 years), intermediate school (9 years), secondary school (12 years) and university. Details on dental care habits and education levels of the present study population have been presented elsewhere (Natto et al. 2004).

Radiographic examination and bone height assessment

Extraoral digital panoramic radiographs (Planmeca Dimaxis, Planmeca Oy/Ab, Helsinki, Finland) were obtained for all participants. The periodontal bone height was measured from the radiographs using the Image Tool 3.0 program for digital radiographic measurements in pixels (Department of Dental Diagnostic Science, University of Texas Health Science Center, San Antonio, TX, USA). The periodontal bone height was measured mesially and distally to each tooth and expressed as a percentage of the root length. For single rooted teeth, the length of the root was defined as the mean of the mesial and distal distances from the cemento-enamel junction (CEJ) to the root apex. In molars, the root length was defined as the distance from the CEJ to the apex and was determined on the mesial aspect of the mesial root and the distal aspect of the distal root. The height of the periodontal bone was determined as the distance from the apex to a point where the lamina dura became contin-

Table 1. The study population by age, gender, and smoking.

Age (years)	Smokers						Non-smokers		Total	
	Water pipe		Cigarette		Mixed					
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)
17–30	18 (20)	9 (33)	19 (33)	3 (21)	23 (45)	8 (50)	16 (29)	20 (47)	76 (30)	40 (40)
31–40	32 (36)	7 (26)	22 (38)	6 (43)	21 (41)	5 (31)	20 (36)	10 (23)	95 (37)	28 (28)
41–60	40 (44)	11 (41)	17 (29)	5 (36)	7 (14)	3 (19)	20 (36)	13 (30)	84 (33)	32 (32)
Total	90 (100)	27 (100)	58 (100)	14 (100)	51 (100)	16 (100)	56 (100)	43 (100)	255 (100)	100 (100)
Mean	39.3	38.5	36.1	38.4	33.0	32.3	38.4	35.3	37.1	36.1
95% CI	37.2; 41.3	33.9; 43.0	34.0; 38.2	33.9; 43.0	31.0; 35.1	27.7; 36.8	35.5; 41.3	31.8; 38.9	36.0; 38.3	34.0; 38.3

n, number of individuals; CI, confidence interval.

uous with the compact bone of the inter-dental septum. If a vertical bone defect was evident, the bone level was defined as the most apical point of the defect.

A tooth was judged non-measurable, if the CEJ or the bone crest could not be properly identified because of overlapping, caries or restorations. In cases where any one of the dental or bony landmarks could not be identified on one aspect (mesial or distal), the tooth was excluded. A total of 205 teeth (2%), most often maxillary pre-molars, were excluded.

The bone height of the individual was given by the mean across all measured inter-dental bone height values. All teeth except third molars were assessed. However, if a first or second molar was missing, the third molar of the same quadrant if normally erupted was included. Thus, a maximum of 28 teeth of the individual was considered for radiographic assessment. The mean (95% CI) number of retained teeth for the total study population was 25.9 (25.6; 26.3). The difference regarding the number of teeth among smoking categories was not statistically significant ($p>0.05$).

Error of measurement

One observer (S. N.), unaware of the smoking status of the individual assessed all radiographs. The precision of the bone height measurement procedure was estimated from replicate measurements in 40 randomly selected individuals (20 at the beginning and 20 at the end of the assessments period). The reproducibility with regard to mean bone height per person was expressed as the precision (s), i.e. the standard deviation of a single measurement, according to

$$s = \sqrt{\Sigma d^2/2n},$$

where d denotes the difference between duplicates and n the number of duplicates. The estimate of the precision related to a single mean bone height value per person was $s = 0.7\%$. Based on these calculations it can be maintained that, although single data in some individuals may be influenced by measurement error, the influence on the means, in particular group means, is marginal and can be ignored.

Clinical recordings

Clinical measurements based on 'four sites (buccal, mesial, distal, lingual) of all available teeth were performed in 262 individuals (74%) including 80 water pipe, 50 cigarette, 54 mixed and 78 non-smokers. The inflammatory condition of the gingiva and supragingival dental plaque were evaluated according to the gingival index method of Löe & Silness (1963) and the plaque index system of Silness & Löe (1964), respectively. The overall mean (95% CI) plaque index and gingival index was 1.2 (1.1; 1.3) and 0.9 (0.8; 0.9), respectively. The depth of the sulci or pockets was probed using a Hilming probe. Sites with a probing depth of 4 mm or more were measured to the nearest 1 mm whereas sites with a probing depth below 4 mm were set to 2 mm. The clinical variables were registered by either one of two calibrated observers (S. N. and M. B.). Details of the oral hygiene and periodontal health conditions in this population are further described elsewhere (Natto et al. 2004, 2005).

Statistics

The mean bone height per person was used as the dependent variable and presented as means and 95% CI. This variable was approximately normally distributed. Statistical analyses were performed by means of 1- and 2-factor ANOVA, including post-hoc multiple comparisons testing according to Scheffe. Ordinal data were tested with the χ^2-distribution. Lifetime exposure regarding cigarette smoking was stratified into (1) no exposure ($n = 99$), (2) light exposure <170 cigarette-years (mean 102.5 cigarette-years, $n = 37$) and (3) heavy exposure $\geqslant 170$ cigarette-years (mean 330.5 cigarette-years, $n = 35$); life-time exposure regarding water pipe smoking was stratified into (1) no exposure ($n = 99$), (2) light exposure <40 run-years (mean 13.6 run-years, $n = 65$) and (3) heavy exposure $\geqslant 40$ run-years (mean 60.7 run-years, $n = 54$). Multiple linear regression analysis was run with mean bone height as the dependent variable. Smoking was transformed into a dummy variable including water pipe smokers, cigarette smokers and mixed smokers *versus* non-smokers. Logistic regression was used to estimate the relative risk expressed as odds ratio (OR) and 95% CI. The bone height was used as the dependent variable dichotomized ($\leqslant 70\% = 1$, else $= 0$). Age was stratified according to (1) 17–30 years ($n = 116$), (2) 31–40 years ($n = 123$) and (3) 41–60 years ($n = 116$); gingival index into (1) low (0–0.58, $n = 86$), (2) medium (0.59–1.11, $n = 89$) and (3) high (1.12–3.0, $n = 87$); plaque index into (1) low (0–0.69, $n = 83$), (2) medium (0.70–1.30, $n = 86$) and (3) high (1.31–3.0, $n = 93$); mean probing depth into (1) shallow (<2.64 mm, $n = 84$), (2) medium (2.64–3.00 mm, $n = 90$) and (3) deep (>3.00 mm, $n = 88$); education level into (1) low (no formal or primary, $n = 54$), (2) medium (intermediate or secondary school, $n = 147$) and (3) high (university, $n = 154$); dental care habit (1) regular ($n = 46$) and (2) irregular ($n = 309$). The individual contributed the statistical unit. The data were analysed using the STATISTICA (6.0) program. Statistical significance was accepted at $p<0.05$.

Results

Periodontal bone height

The frequency distribution of individuals according to mean bone height per person is shown in Fig. 1. The overall mean (95% CI) was 78.2% (77.4; 79.0); and it statistically significantly decreased with age from 83.1% (82.1; 84.1) in age group 17–30 years to 72.9% (71.4; 74.5) in age group 41–60 years (ANOVA; $F = 67.8$, $p<0.001$, Fig. 2). The mean (95% CI) bone height in men was 77.2% (76.2; 78.1) as compared with 80.8% (79.2; 82.5) in women. The difference was statistically significant (ANOVA; $F = 16.4$, $p<0.001$). In addition, the bone height was positively related to education levels (ANOVA; $F = 15.9$, $p<0.001$).

The mean (95% CI) bone height was 76.2% (74.8; 77.6) for water pipe smokers, 75.8% (74.2; 77.6) for cigarette smokers, 80.2% (78.7; 81.7) for mixed smokers and 80.9% (79.2; 82.6) for non-smokers (Fig. 3). The association between smoking and mean bone height was statistically significant controlling for age (ANOVA; $F(3, 2) = 9.9$, $p<0.001$, Fig. 4), gender (ANOVA; $F(3, 1) = 12.4$, $p<0.001$) or education level (ANOVA; $F(3, 2) = 6.3$, $p<0.001$). Post-hoc testing revealed statistically significant differences between cigarette smokers and water pipe smokers, respectively, and

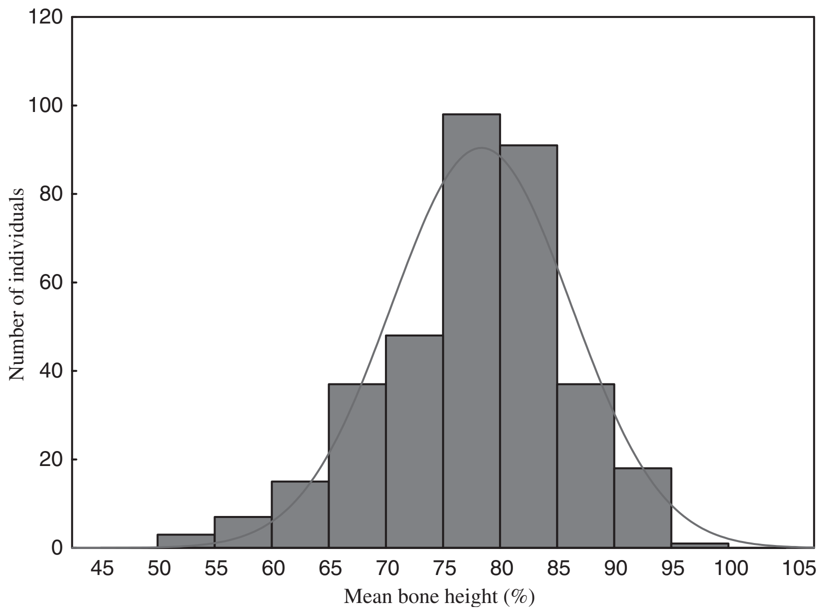

Fig. 1. Frequency distribution of individuals according to mean bone height per person.

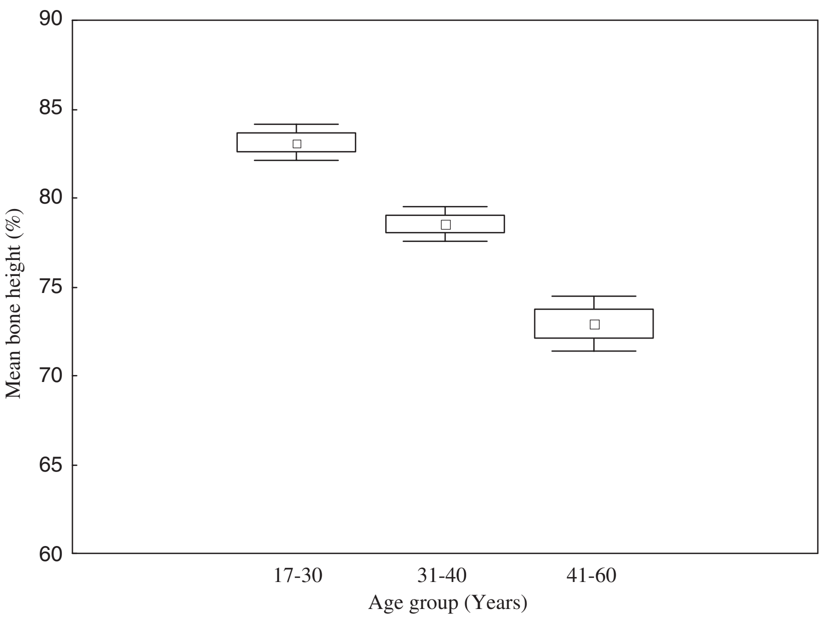

Fig. 2. Mean bone height per person. Mean and 95% confidence interval according to age.

non-smokers (Scheffe test; $p < 0.001$) or mixed smokers (Scheffe test; $p < 0.01$).

The association between lifetime smoking exposure and mean bone height was statistically significant in water pipe as well as cigarette smokers controlling for age (ANOVA; $F = 4.8$ and 11.2, $p < 0.01$, respectively) or education (ANOVA; $F(2, 2) = 22.6$ and $F(2, 2) = 12.7$, $p < 0.001$, respectively). Post-hoc comparisons testing indicated that the difference between heavy and light exposure smokers was statistically significant among water pipe as well as cigarette smokers (Table 2).

Multiple regression analysis

The relation between mean bone height as the dependent variable and the variables age, gender, gingival index, plaque index, mean probing depth, number of retained teeth, education level, dental care habit and smoking (yes/no) as predictors, entered in one block, was analysed by means of multiple linear regression in a subset of the population ($n = 262$). Age, gingival index, education level and smoking were statistically significant predictors explaining 49% of the variance in the dependent variable (R^2(adj) = 0.49, $F(9, 252) = 28.7$, Table 3). The result was confirmed in a forward stepwise approach (R^2(adj) = 0.49 $F(9, 255) = 39.3$, $p < 0.001$).

Periodontal bone loss and risk assessment

Using a bone height level of 70% or less as a cutoff signifying ''bone loss'', the overall prevalence of bone loss in this population was 17.5%. The prevalence of bone loss was 27% in water pipe smokers, 24% in cigarette smokers, 9% in mixed smokers and 6% in non-smokers, respectively, suggesting that the prevalence was significantly dependent of smoking habit ($\chi^2 = 20.8$, $p < 0.001$). The prevalence of bone loss increased from 2% in age group 17–30 years to 33% in age group 41–60 years ($\chi^2 = 33.8$, $p < 0.001$). Throughout all age strata, the prevalence was comparably greater in all categories of active smokers compared with non-smokers. This trend was statistically significant in age group 41–60 years ($\chi^2 = 19.0$, $p < 0.001$).

Logistic regression analysis was run to estimate the relative risk for bone loss using the bone height as the dependent variable dichotomously transformed ($\leqslant 70\% = 1$, else = 0). The relative risk associated with water pipe and cigarette smoking after adjustment for age was 3.5-fold and 4.3-fold elevated, respectively, compared with non-smoking (OR = 3.5, 95% CI 1.6–7.6 and OR = 4.3, 95% CI 1.7–10.9, respectively, $p < 0.01$). After adjustment for age the relative risk of heavy water pipe and heavy cigarette smokers was 7.5-fold and 6.3-fold elevated, respectively, compared with non-smokers (OR = 7.5, 95% CI 3.0–18.3, $p < 0.001$ and OR = 6.3, 95% CI 2.2–17.6, $p < 0.01$). The relative risks run by light water pipe and light cigarette smokers were not statistically significant (OR = 1.0, 95% CI 0.3–3.1 and OR = 1.9, 95% CI 0.4–8.2, respectively, $p > 0.05$).

Discussion

The objective of the present study was to investigate the association between

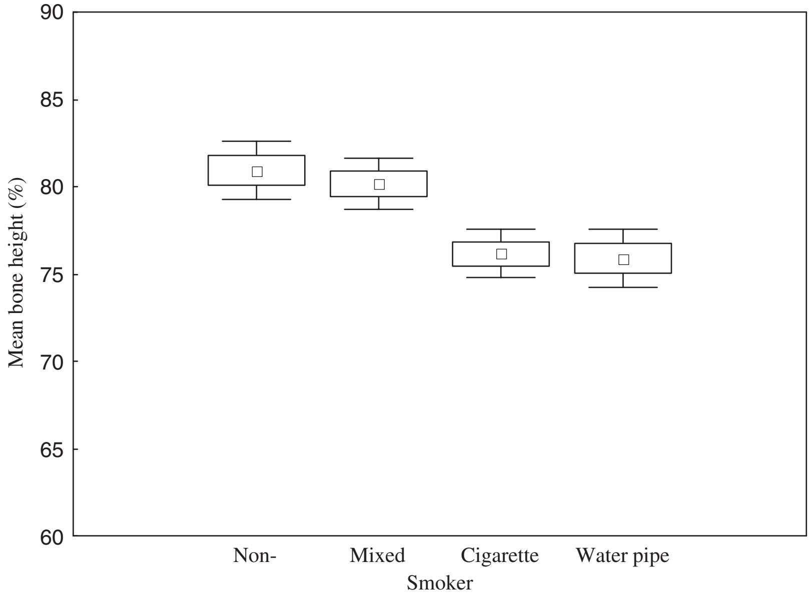

Fig. 3. Mean bone height per person. Mean and 95% confidence interval according to smoking.

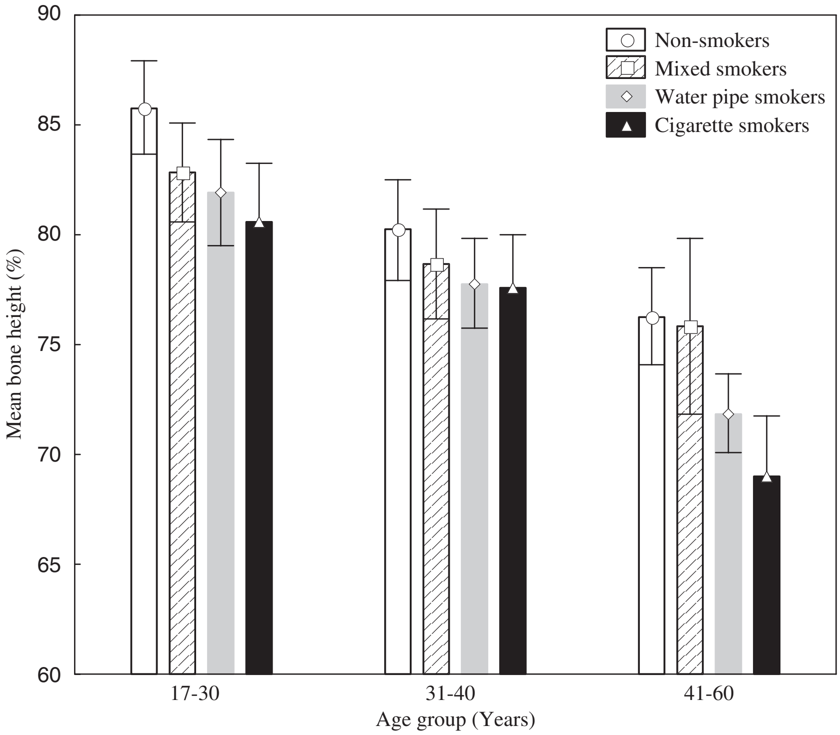

Fig. 4. Mean bone height per person. Mean and 95% confidence interval according to age and smoking.

tobacco smoking, in particular water pipe smoking and the periodontal bone height. Both water pipe smokers and cigarette smokers exhibited a greater bone height reduction than non-smokers, suggesting that both types of tobacco smoking were associated with periodontal bone loss. This is in general agreement with previous studies concerning cigarette smoking and periodontal bone loss of horizontal and vertical patterns (Bergström & Floderus-Myrhed 1983, Bergström et al. 1991, 2000a, b, Grossi et al. 1995, Norderyd & Hugoson 1998, Persson et al. 1998, Norderyd et al. 1999, Payne et al. 2000, Jansson & Lavstedt 2002, Baljoon et al. 2004, 2005a, b).

The estimated risk for bone loss of 30% or more of the root length was about 3.5-fold elevated in water pipe smokers and 4.3-fold elevated in cigarette smokers compared with non-smokers suggesting that the impact of water pipe smoking on the periodontal bone is of the same magnitude as that of cigarette smoking. However, the maximum periodontal bone height of the alveolar bone is not 100%, even under periodontally healthy conditions as determined in young healthy adults (90–95%) (Eliasson et al. 1986). This fact should be considered when the results are evaluated. To our knowledge, the present observations are the first ones to link periodontal bone height with water pipe smoking. It is plausible to assume that water pipe smoking affects the periodontal bone in the same way as cigarette smoking as the inhalation of toxic substances in water pipe smoking is similar to that of cigarette smoking (Shihadeh 2003).

The biological mechanisms responsible for the effect of tobacco smoking on the periodontal tissues are still elusive. Several possibilities have been described, and both locally and systemically induced effects have been suggested. Cytotoxic substances such as nicotine and its major metabolic cotinine have been detected in the saliva, gingival cervicular fluid, serum and urine of water pipe and cigarette smokers demonstrating their absorption and systemic availability (McGuire et al. 1989, Shafagoj et al. 2002). The impact of water pipe smoking on periodontal bone is similar to cigar and pipe smoking (Feldman et al. 1983, Krall et al. 1999) suggesting that water pipe smoking is another form of tobacco smoking that is detrimental to periodontal health.

With the currently used cutoff signifying bone loss, the relative risk associated with heavy smoking was about 7.5-fold elevated in water pipe smokers and sixfold elevated in cigarette smokers suggesting an exposure–response effect of largely the same magnitude in both smoking categories. The association between light smoking exposure for water pipe smoking as well as for cigarette smoking was not significant in this study. A relationship between the degree of bone loss and amount of tobacco smoked has been showed in other studies concerning cigarette smoking (Bergström et al. 1991, 2000a, b,

Table 2. Two-factor ANOVA with mean periodontal bone height as the dependent variable and smoking exposure as independent variable together with age as co-factor

Exposure	Water pipe smokers			Cigarette smokers		
	Mean	95% CI		Mean	95% CI	
No	80.8	79.4; 82.1		80.8	79.4; 82.1	
Light	79.2	77.5; 80.8	†	78.3	75.8; 80.8	†
Heavy	75.8	72.9; 78.7	†	74.0	71.4; 76.5	†

†$p < 0.001$.

Post-hoc tests in water pipe and cigarette smokers. Means and 95% confidence intervals (CI) according to smoking exposure.

Table 3. Multiple regression analysis with mean periodontal bone height per person as dependent variable (R^2 (adj) = 0.49, F (9, 252) = 28.7)

Variable	Parameter	Standard error	t	p
Age	− 0.324	0.041	− 7.9	0.000
Gingival index	− 2.225	0.800	− 2.7	0.006
Plaque index	− 1.154	0.615	− 1.8	0.062
Smoking	− 3.626	0.988	− 3.6	0.000
Gender	1.363	0.809	1.7	0.093
Teeth (n)	0.222	0.142	1.6	0.119
Probing depth	− 0.956	0.593	− 1.6	0.108
Education level	3.668	1.079	3.4	0.001
Dental care habit	1.026	0.727	1.4	0.159

Haber & Kent 1992, Haber et al. 1993, Norderyd & Hugoson 1998, Baljoon et al. 2004, Bergström 2004, Baljoon et al. 2005b).

The covariation with tobacco smoking on the mean bone height of gingival index, plaque index, mean probing depth, number of retained teeth and other determinants such as age, gender and education, was studied by means of multivariate regression analyses. As is evident from Table 3, beside smoking, age, gingival index and education level were significant predictors for a reduction in bone height, whereas gender, mean probing depth, plaque index, retained teeth and dental care habits were not significant factors in the multivariate analyses.

Age – as expected – in the present study, was negatively associated with bone height. Elderly individuals are, by virtue of their age, potentially exposed for longer periods to tobacco products than younger individuals. Interestingly, however, as seen from Fig. 4 the bone height level of water pipe and cigarette smokers largely equalled that of non-smokers in the next older age stratum.

Women seemed to have a higher bone height than men. However, this gender effect disappeared in the multiple regression suggesting that other determinants, particularly smoking, were responsible for this effect.

It might be speculated that water pipe smoking, as traditionally a predominantly male habit, would be associated with a comparably low socioeconomic standard. However, as we controlled for education as a surrogate for socioeconomic standard and other variables in the multiple regression, the association between water pipe smoking and bone height remained statistically significant. Clearly, socioeconomic standard had an impact on the periodontal health as measured by bone height level in the population studied, but that did not obscure the impact of smoking.

Participation in the present study was limited to individuals who responded to newspaper announcements that were designed to attract individuals with various smoking habits. This resulted in a higher smoking prevalence than in the Saudi population at large (25–35%) (Saeed 1991, Saeed et al. 1996). Regarding the prevalence of cigarette smoking, however, the present population is similar (Siddiqui et al. 2001). Another limitation of the present study is the fact that assignment of individuals to different smoking groups was based on interview that may have caused some misclassification. However, the reliability of self-reported smoking habits is considered high (Petitti et al. 1981). An alternative approach to self-reports that will accurately estimate tobacco exposure is to assess tobacco metabolites such as cotinine in salivary samples (Persson et al. 2003). Nevertheless, a similar smoking prevalence has been estimated when self-reports have been compared with salivary cotinine measures in cigarette smokers (Dolcini et al. 2003).

Panoramic radiography is a rapid and reliable method that is used for the visualization and measurement of the marginal bone height (Michalowicz et al. 1991). To represent the mean bone height per individual, the ratio of the periodontal bone height to the root length was selected as the measure of choice. This method has the advantage of minimizing the effect of shortening or elongation of the radiographic image compared with measurement in millimetres (Bergström & Eliasson 1987).

In conclusion, the present observations have provided convincing evidence to support the role of tobacco smoking as a factor associated with periodontal bone height reduction. The impact of water pipe smoking is of the same magnitude as that of cigarette smoking.

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Clinical Relevance

Scientific rationale: While cigarette smoking is recognized as detrimental to periodontal health, studies concerning water pipe smoking and periodontal health are scant. Water pipe smoking is common in the Middle East the popular belief being that it is less harmful than cigarette smoking. A key question is whether or not water pipe smoking negatively affects the periodontal health in a manner similar to cigarette smoking.

Principal findings: Water pipe smoking like cigarette smoking had a negative impact on the periodontal bone height. The association between both types of smoking and bone loss was exposure dependent, suggesting a dose–response effect.

Practical implications: Various tobacco smoking habits should be considered in the diagnosis and treatment of periodontal disease.