CHAPTER 6: DISCUSSION

6.1 OVERVIEW

The study was designed as a cross-sectional population-based study. This design complied with the aims and scope of the study related to evaluating the current periodontal disease status and to assessing smoking as a risk indicator for the disease. The multistage stratified random selection process used in the study design was appropriate. The study sites were randomly selected within each step with probability proportional to their population size, giving all residents in those two provinces an equal chance of being selected. Subjects’ selection was achievable; however, it was time consuming and labour intensive.

The present study had a large number of participants, all in the 35–44-year-old age group. This feature significantly improved the preciseness of the estimates and statistical power especially when inferential statistics were employed. The associations between a range of variables of interest could be tested with higher certainty.

Examiners used in the study were trained and calibrated and the assessment of examiner reliability indicated good agreement. The level of reliability achieved in observing gingival recession and pocket depth was similar to that in several other studies using the same method (Beck et al., 1990; Baelum et al., 1988). However, reliability of bleeding on probing was relatively low, but this measure might be affected by even a short time period between the original and repeat examinations.

The associated social survey gathered a wide range of valuable information necessary to identify demographic, socio-economic and behavioural factors that may be related to the periodontal disease process. Most factors that have been identified in the literature as related to the disease were targeted in the survey. The SES and behavioural characteristics of the sample were collected in a manner that was appropriate to
in Vietnam. Furthermore, information on smoking exposure as the main factor of interest was gathered in detail. That was essential for evaluating the association between factors and for developing multivariate models of the disease in various ways.

One of the main rationales of the study was to study outcomes of the disease and their contributory factors in an environment minimally confounded by professional dental care. This desired characteristic has been fulfilled. Respondents generally were not frequent users of the dental service. Furthermore, the care received was mainly symptomatic consisting of extractions and fillings, whereas very few preventive measures, especially in terms of periodontal disease, had been performed. The findings of the disease among the sample therefore can be regarded as that of the natural disease process and thus useful in understanding the disease status.

The disease status observed in the study was representative for the targeted population; that is, middle-aged adults in the selected provinces. It may reflect the disease status of the middle-aged population of the whole country because the study provinces were randomly selected from the set of representative provinces and it included typical urban and rural populations. The same may not be true in extrapolating to the whole adult population since age groups may have different disease expression due to accumulation of the disease over time. The prevalence, extent and severity of periodontal destruction can differ markedly between age groups.

The second aim of the study to evaluate smoking exposure as a major risk indicator for periodontal destruction has also been fulfilled to a large extent. Since a cross-sectional study is not able to establish the nature of a risk factor in terms of time sequence, the findings of the study can be used to assess other criteria of risk, such as consistency of association, strength of association and degree of exposure. Cross-sectional studies like the present one can be used in determining factors that are associated with the disease.
and to develop multifactorial models of the possible interaction of those factors (Beck, 1998).

In summary, the process of study design and sample selection complied with the requirements of the study. The findings of the study can be used for understanding the disease processes and identifying factors that may be important for initiation and progression of the disease.

6.2 THE LIMITATIONS OF THE STUDY

Owing to lack of time and personnel, the list of primary selected subjects provided only subjects’ names, age and sex. No information was collected on SES status and smoking history of the primary selected subjects. This made it impossible to compare between respondents and non-respondents in terms of SES status and smoking exposure. However, the distribution of SES factors in the sample as well as smoking exposure was not different from the information available on the general population. Further, there were consistencies in reporting the distribution of smoking exposure observed in this study and the previous smoking study by Jenkins et al. (1997), which was conducted in the two largest cities and two rural districts of Vietnam.

Some selection biases might have occurred as population groups might have responded differently. For example, females tended to have more a favourable attendance rate compared to male subjects. These irregularities might have affected the comparison between sexes in terms of indicators of the disease. An attempt was made to correct for selection bias by a data re-weighting procedure according to the sex distribution of the population.

The number of sites examined per tooth may underestimate the prevalence and extent of the true disease distribution. The system of examining two sites per tooth used in this study was more limited compared to three sites per tooth used by Slade and Spencer.
Discussion

(1995), Thomson, Hashim & Pack (2000) and four sites per tooth used by Baelum, Fejerskov and Karring (1986), Baelum (1987) and Baelum et al. (1988). This scoring system was similar to the study of the elderly in the United States (Beck et al., 1990). Two recent major studies in the United States also recorded disease at two sites per tooth (Brown, Oliver & Löe, 1990; Brown, Brunelle & Kingman, 1996); however, they examined half the mouth only. Thus, there are no directly comparable studies, which have used the same methodology relating to number of sites as was used in this study.

The high prevalence of calculus among the population might increase a chance of inaccurate measurement due to probe being obstructed by calculus. This situation was discussed during the training and calibration course and some practice was conducted. The high inter- and intra-examiner reliability showed that this sort of measurement error was not common.

Another potential limitation of the study was the unequal distribution of smokers among the sexes with the dominance of male subjects in the current and former smoking groups. This reflected a similarity with other Asia–Pacific countries where social norms preclude women from smoking. These same norms, however, might have prevented some women from reporting about their smoking habit, which might bias the results. This issue was considered in interviewing females in the field. Several measures were arranged, such as use of female interviewer and use of separate interviewing room for females. Therefore, the number of females who might misreport their smoking habit could be expected as low.

There might be an argument that the analysis of smoking exposure could be heavily confounded by sex. Further, the number of females in the current and former smoking groups was so small that it effectively eliminated any statistical test of the associations among females and reduced the power of overall analyses. Therefore, the results must be treated with care in terms of sex and smoking. Nevertheless, the results of Two-way
ANOVA between sex and smoking in terms of the extent and severity of the disease showed that smoking was a significant factor in determining the disease irrespective of sex, that sex was not significant and no significant interaction existed between smoking and sex.

Measurement of some potential putative risk factors was more exploratory. The criteria of identifying salivary dysfunction among the sample were designed in detail. However, there were no similar schemes that had been previously developed, so it was not possible to evaluate the accuracy and the effectiveness of the present criteria. There was no individual identified as having low salivary flow during the examinations, leaving some uncertainty whether the criteria were effective or not. Thus, salivary flow as one important oral risk indicator could not be assessed in the study.

One common problem in studies of periodontal disease is the skewed distribution of the measures of the disease. Periodontal destruction is confined into a minority of individuals and sites. In particular, the severity score is a mean of sites with LOA ≥ 2 mm only. Thus, the collected data are highly positively skewed and may create problems for using some analytical methods. However, most of parametric statistical analyses are robust and are not substantially affected when the assumption of data being normally distributed is slightly violated (Munro, 1994; Varma, 1984). Further, the sample size of the study was large enough to increase the normality of the distribution of sample’s means, according to the central limit theorem (Munro, 1994). Another strength of the study was that the possible effects of smoking were tested with various statistical analyses, which strongly and consistently indicated significant associations. Thus, those associations may be indeed real, as stated by McDonald and Pack (1990).
Discussion

6.3 DENTITION STATUS OF THE SAMPLE

The dentition status of the sample measured by Decayed, Missing and Filled Teeth Index (DMFT) was relatively good. The observed DMFT was much lower than that of the Australian 35–44-year-old adults (AIHW Report, 1993) (5.25 versus 17.23). On the other hand, the caries status of the sample was similar to that reported from some other developing countries (Lo and Schwarz, 1994; Adegbembo, el-Nadeef & Adeyinka, 1995). The findings would suggest the low level of caries experience and, thus, emphasises the importance of periodontal disease among the sample.

6.4 ORAL HYGIENE STATUS OF THE STUDY POPULATION

Despite the fact that tooth brushing is definitely a social and personal hygiene norm in this population, the oral hygiene status was far below standards accepted in developed countries. The vast majority of the sample had some accumulation of plaque. Male subjects had much poorer oral hygiene status reflected in a higher percentage with a worst plaque score 2 and higher mean percentages of sextants with score 2. The level of plaque accumulation was dependent on subjects’ SES status. Subjects with lower education level tended to have significantly higher worst plaque scores and higher percentage of sextants with plaque score 3. Groups with higher household income, more specialised occupation and subjects living in urbanised areas had significantly better oral hygiene status. Dental visiting was associated with improved oral hygiene status through a lower percentage of sextants with plaque score 2.

The percentage of sextants with plaque score 3 (that is, abundant accumulation of plaque) was lower among groups with higher education status and more specialised occupations but not were dependent on other SES indicators. This may be explained by the fact that the prevalence of crowded or dislocated teeth is high among the
Vietnamese population as reported in study by Ngo et al. (1995). Thus, many sextants which presented with plaque score 3 might have specific features, which create difficulties for brushing or cleaning by other means. In that situation, more educated subjects can better deal with teeth cleaning techniques. Thus, education in oral hygiene technique may improve the oral hygiene level among the population.

The oral hygiene level in the present sample was intermediate between that reported from developed countries and other developing countries. The oral hygiene status observed in the present population was much better than that of the Sri Lankan tea labourers (Anerud et al., 1979). The latter sample might not represent the general population and might have much poorer living conditions as well as oral hygiene practice, so that the comparisons with the present sample may not be appropriate.

Similar to findings from other studies conducted among developing countries, almost all subjects had at least one site with a calculus deposit. More than a half of examined sites (52.6%) were observed to have some calculus. The mean percentage of sites with calculus among the sample was lower compared to that of the Tanzanian sample (van Palenstein et al., 1998), and that of the Kenyan population (Baelum et al., 1988). It was similar to the extent of sites with calculus reported in a Chinese sample of the same age group (Baelum et al., 1997). Compared with studies from developed countries, the prevalence and extent of sites with calculus were higher than that of the United States sample of the same age, who presented with about one-third of sites with calculus (Brown, Brunelle & Kingman, 1996).

Male subjects presented with significantly more sites with calculus than females. This tendency was noted in most studies reviewed. Although access to professional dental care was low, the population may have benefited from their relatively higher literacy level and better oral hygiene behaviour as compared with some other samples from developing countries (Baelum et al., 1988; van Palenstein et al., 1998). However, the
Discussion

Technique and means of oral hygiene used were not adequate to achieve good oral hygiene levels for the present population.

Dental visiting history was not significant in relation to calculus deposits. It is clear that the periodontal status of the sample presented was minimally confounded by the professional dental care. Thus, the findings and conclusions derived from the study reflect the natural outcomes of the disease.

6.5 PERIODONTAL DISEASE DISTRIBUTION AMONG THE POPULATION

6.5.1 Gingival condition

Two-thirds of the sample had at least one site with bleeding on periodontal probing (BOP), but only about 10% of the sites were observed with BOP. Males had significantly fewer sites with BOP, and this may be owing to the vasoconstrictive effect of tobacco smoking, which was prevalent among over 60% of male subjects in the sample.

The prevalence of sites with bleeding on probing was much lower than that reported in Kenyan and Chinese populations (Baelum et al., 1996). The mean number of sites with BOP was somewhat similar to that of the Chinese sample, while much lower than that of Kenyans. This may be explained by the fact that the present sample mostly consisted of the urban population who can have more adequate oral hygiene behaviour and alert to symptoms of disease.

The prevalence and the extent of sites with BOP were even lower than that reported on a younger New Zealand cohort (Thomson, Hashim & Pack, 2000). That may be owing to the scoring system of two sites per tooth compared to three sites per tooth in the latter study. The prevalence and the extent of sites with BOP were similar to those of the
NHANES III report of the same age group (Brown, Brunelle & Kingman, 1996). The two studies recorded BOP on two sites per tooth so that the extent score was comparable but not the prevalence, which might be underestimated in the United States study where only two quadrants were examined.

Thus, gingival inflammation expressed in terms of BOP was prevalent among the population, which may be related to an overall low level of oral hygiene. However, the extent of sites with BOP was not high. The possible association with other factors such as smoking also must be considered.

### 6.5.2 The prevalence, extent and severity of the disease

#### 6.5.2.1 The prevalence of periodontal destruction

Almost all dentate subjects presented with some pocket depth and loss of periodontal attachment. When a threshold of 2 mm was taken into account, 99.8% and 100% of subjects had at least one site with pocket depth and LOA. Nevertheless, the prevalence of pocketing was sharply reduced when higher thresholds were used. Fewer subjects presented with periodontal pocket of 4 mm or more, which can be of some clinical importance. Just more than half of the sample had 1+sites with PD≥4 mm and fewer than 10% of subjects had 1+sites with PD≥6 mm. The prevalence of subjects with 1+sites with PD≥4 mm was considerably lower than that of the Kenyan sample Baelum et al. (1988) but much higher than that of the United States and New Zealand samples (Brown, Brunelle & Kingman, 1996; Thomson, Hashim & Pack, 2000), which were 30% and 15.2% respectively.

Gingival recession was widespread among the sample. More than 65% of subjects presented with at least one site with GR≥2 mm, which was twice as high as the same age group of the United States sample (Albandar, Brunelle & Kingman, 1999) and more
than two times higher than the younger New Zealand sample (Thomson, Hashim & Pack, 2000). Corresponding data were not available from other studies.

The prevalence of LOA was higher than that of pocket depth. LOA≥2 mm was universal and more than one-fifth of the sample was having at least one site with LOA≥6 mm, which is quite remarkable. The prevalence of LOA≥4 mm was similar to that of the Chinese sample but considerably lower than that of Kenyans of the same age. Sites with LOA≥3 mm were twice as prevalent and those with LOA≥5 mm were three time more prevalent among the present sample compared to the United States civilian sample (Brown, Brunelle & Kingman, 1996).

The prevalence of moderate-to-severe periodontitis was comparatively high (52.4%). One-fifth of the population was considered as severe cases. The comparison with other studies was not easily made since no previous study has used identical criteria in defining cases. Despite the approach in defining disease was similar to that of the study by Beck et al. (1990) the comparison could not be made owing to the different age range of the two populations.

LOA was used as the primary outcome measurement in determining the disease because of its potential correlation with the histologic definition of periodontitis reflecting apical migration of the junctional epithelium with loss of connective tissue support and alveolar bone loss. Another outcome measurement, periodontal pockets can be considered as the indicator of periodontal treatment need, however, may suffer from some limitations. Firstly, a pocket may result from gingival oedema or hyperplasia with formation of pseudo-pockets. Secondly, a true pocket may be minimised or masked by concomitant gingival recession. On the other hand, LOA measurement may consist of some non-diseased components such as dehiscence of bone or gingival recession by excessive tooth brushing. Hence, the combination of LOA and PD in the determination of the disease helps to increase the sensitivity and specificity of the measurement.
6.5.2.2 The extent of periodontal destruction

Although periodontal destruction was prevalent among the sample, most of the subjects had only few sites with severe loss of periodontal attachment. The extent of sites with small loss of periodontal attachment was large but it reduced sharply when higher thresholds were taken into account. Buccal sites tended to have more sites with some gingival recession, and mesial sites were more likely to have deepened periodontal pockets. Mesial sites were more likely to have LOA ≥ 2 mm. However, this difference was less evident in the maxilla and when sites with higher amount of loss of attachment were counted.

The extent of sites with GR among the present sample was slightly higher than that of the United States sample of the same age (Albandar, Brunelle & Kingman, 1999) and much higher compared to the younger New Zealand sample. On the other hand, it was half of that of the Tanzanian sample of the same age (van Palenstein et al., 1998). Similar to those studies, buccal surfaces had more sites with recession and there was tendency of higher extent in lower buccal sites.

Periodontal pockets were more prevalent in mesial sites, especially at higher thresholds. There were slightly more sites with PD in the mandible than in the maxilla, and this difference was also more obvious for sites with deeper pockets. The percentage of sites having deep pockets was low, with 5% of sites having PD ≥ 4 mm. This proportion dropped ten-fold when only sites with PD ≥ 6 mm were counted.

Upper molar buccal and lower incisor mesial sites were more likely to have periodontal pockets of 4 mm or more and 6 mm or more. Upper incisor buccal sites were the least likely to have periodontal pockets of some depth.

The extent of sites with PD ≥ 4 mm among the sample was lower than that of the Kenyan sample (Baelum et al., 1988). The extent of sites with PD ≥ 6 mm was lower than that of
both Kenyans and Chinese (Baelum et al., 1996). Compared to the United States population, the extent of sites with PD≥4 mm was higher in the present sample but not remarkably (Brown, Brunelle & Kingman, 1996).

The extent of sites with LOA across the mouth was similar to the extent of sites with GR and PD but it had higher values. It is evident that using only PD as the measurement of the disease may underestimate the extent of true level of periodontal destruction in the population with high prevalence of gingival recession. This phenomenon was more obvious in buccal sites and when higher levels of destruction were considered. Thus, this issue needs to be considered in using pocket depth as the main clinical indicator for periodontal status. Using pocket depth alone in a clinical situation may underestimate the true loss of periodontal supporting tissues.

There were considerably more mesial sites presenting with loss of periodontal attachment at any level. That can be explained by the higher extent of mesial sites with periodontal pockets of some depth. This is consistent with findings from other studies indicating that mesial sites are more favourable places for accumulation of disease-inducing factors. Those sites may be more difficult to clean. On the other hand, there may be some overestimation of the true destruction owing to measurement error, since mesial sites more commonly have gingival oedema and may be recorded as deep pocket when negative recession can be difficult for the examiner to measure.

### 6.5.2.3 The severity of periodontal destruction

The mean of LOA of sites with LOA≥2 mm was severely positively skewed. The vast majority of sites had LOA of 2 mm, contributing heavily to the severity score of 2.51 mm. Male subjects and subjects with lower SES status expressed significantly higher mean LOA. However, the actual differences were not large between groups. Since the score did not account for the number of sites contributing to its mean and
might be dependent on extreme values in some individuals when a small number of sites were left, it may not reflect the true clinical importance.

The severity of LOA observed in the present population was higher by 0.1 mm than that of the United States population of the same age (Brown, Brunelle & Kingman, 1996). Similar data were not available from other studies conducted in developing countries. Baelum et al. (1996) reported mean loss of attachment of all sites examined. Thus, this difference could be accounted for as the considerable number of sites with LOA 0 and 1 mm could reduce the overall mean.

### 6.5.2.4 Site and teeth specificity of periodontal destruction

The extent and severity of periodontal destruction seemed to be different between sites and jaws. Gingival recession was more likely to be observed in buccal rather than mesial sites. On the other hand, periodontal pocketing was more prevalent at mesial sites in both jaws while LOA was equal between sites in upper jaw and higher at mesial sites in lower jaw. Furthermore, there was a tendency for a higher extent of sites with PD in the mandible in both mesial and buccal sites but there were no clear differences in the extent of sites with recession. Mandibular sites may harbour more plaque and calculus than maxillary sites and thus may have more sites with deeper pocket depth. The higher GR observed at buccal sites may be owing to many factors other than periodontitis, such as dehiscence of malaligned teeth or longstanding calculus. However, a more accurate explanation of this unequal distribution between jaws and sites would need to consider whether there was a true difference in disease expression or whether some other factors may account for the observation.

The unequal distribution of periodontal destruction between teeth was obvious, especially when the extent of sites with PD and LOA were considered (figures 5.7, 5.8, 5.9). The extent of sites with deep pockets was highest in lower anterior teeth, whereas
the extent of sites with LOA was highest in the maxillary molars. In terms of LOA, maxillary incisors seemed to have the fewest number of sites affected and maxillary molars and mandibular incisors had the highest extent of sites with LOA. This was similar to findings from other studies using a different methodology of measurement (Anerud et al., 1983; Baelum, 1987; Baelum et al., 1988). Thus, there may be the higher extent of diseased sites in lower incisors compared to other lower teeth.

However, those studies did not count for the differential loss of teeth (and sites) among tooth types. Mandibular molars may accumulate more disease than other teeth and may have been extracted more frequently. If that is true, the survival phenomenon may take place resulting in retained molar teeth appearing to have less disease and thus, altering the true distribution of disease across the mouth. In the present sample, mandibular molars had the highest mean number of missing teeth: 0.7 versus less than 0.1 for mandibular incisors. Consequently, the observed unequal distribution of periodontal destruction across teeth may be biased by the differential tooth loss.

Thus, a number of factors need to be considered in evaluating the site and teeth specificity of periodontal destruction. There may be some true differences in terms of distribution of the disease across populations owing to differences in access to care and oral hygiene practice when teeth and/or sites may respond differently to these interventions. Discrepancies in methodology and measuring technique may also exist in observing disease between teeth and sites. Finally, the unequal distribution of tooth loss across the mouth can confound the teeth and site specificity of the disease to some unknown extent.

6.5.3 Case definition of established periodontitis

Reviewing previous literature indicated an absence of a uniform case definition of the disease. Several clinical and/or laboratory signs of the disease have been used in a very
Discussion

inconsistent manner that makes the comparison between studies difficult. The situation creates a need for appropriate criteria to define cases using testable and comparable indicators.

The two case definitions used in the present study were shown to be appropriate in assessing the prevalence of the disease among the population. The combined system of loss of attachment as histological true loss of periodontal support and pocket depth as the clinical indicator of periodontal status seemed to be able to classify an acceptable percentage of subjects as cases among the sample. Case definitions defined subjects who positively and unequivocally exhibit adult periodontitis in this population. Further, these case definitions were used in assessment of putative risk factors for the disease in the study sample.

The use of the two most important clinically detectable indicators (LOA and PD) of the disease defined a number of individuals who presented with significantly higher accumulation of loss of periodontal attachment and clinically important pocket depths as shown in the comparisons between cases and non-cases (table 5.38). Thus, it was reasonable to suggest that the cases determined by these case definitions had periodontitis.

In addition, multivariate models for the cases defined in the study showed consistent association between the disease and well-known risk indicators for the disease. This fact further indicated that the case definitions had high creditability in determining disease status among this study sample.

The case definitions used in this study may or may not be appropriate to assess the disease status among other age groups or other populations. Also, the sensitivity and specificity as well as predictive value of these case definitions have yet to be calculated because such calculations require an irrefutable ‘gold standards’ classification of the
disease. However, these case definitions proved to be highly useable and useful for the present study.

6.5.4 Summary of the epidemiology of the disease

The oral hygiene status of the Vietnamese population was intermediate to that of other developing countries on one side and several populations from developed countries on the other. This may be explained by their relatively high literacy level compared to other developing populations. On the other hand, the use of dental services was very low and most treatment that had been received in the past was extraction. Preventive measures, especially periodontal care, were received by only a small number and did not significantly improve periodontal status. Thus, the periodontal status of the population was not significantly affected by the professional dental care.

Periodontal destruction measured by the means of gingival recession, pocket depth and calculated loss of attachment was highly prevalent. Most of the sample presented with at least some periodontal pockets or LOA. This finding was consistent with reports from other studies conducted in developed and developing countries and supports one of the main characteristics of periodontal disease (Baelum, 1998).

On the other hand, the extent of sites with more disease and the severity of those sites are highly positively skewed, indicating that the main burden of the disease is confined to a minority of the population. Further, only a small number of sites in those susceptible individuals presented with severe disease. As seen from the results, one-fifth of the sample had 1+sites with \( \text{LOA} \geq 6 \text{ mm} \), representing just 2.47% of all sites.

Thus, the findings of this study support the main characteristics of adult periodontitis as reported from other studies.
6.6 SOCIOECONOMIC INDICATORS FOR THE DISEASE AMONG THE STUDY POPULATION

The study of the social distribution of periodontal health among the population has several potential implications in public health practice. First, it can describe the distribution of the disease among socioeconomic groups. Second, in addition to the study of other contributing factors, it can help to identify groups at high risk for the disease in the society.

A number of demographic, socioeconomic and behavioural factors were considered in the study. Some immutable demographic factors such as sex and age were significantly related to poorer oral hygiene status and more severe disease in bivariate analyses. However, these factors were not as important in determining periodontal status in conjunction with other factors such as smoking and low income.

Among the other socioeconomic factors, a poorer financial situation presented the stronger association with the disease across the bivariate analyses and in the multivariate models. Low income was related with poorer oral hygiene status and, maybe, with more financial strain, both of which can have a direct relationship with the disease. Education and occupation did not show a strong association with the disease expression.

6.7 TOBACCO SMOKING AS A MAJOR RISK INDICATOR FOR PERIODONTAL DISEASE AMONG THE STUDY POPULATION

6.7.1 Smoking exposure among the sample

The smoking rate among the sample of the present study does not differ to that of the study conducted five years earlier by Jenkins et al. (1997). Both studies revealed a
uniformly high rate of smoking among male subjects and a very low rate among females. The percentage of current smokers and non-smokers was slightly lower in the present study, whereas the proportion of former smokers was higher. However, these discrepancies were small and may be simply owing to differences in study sites and sampling scheme. In addition, the previous study included subjects smoking less than one cigarette per day in the calculation, which might have resulted in an increased rate of smokers. The increase in the proportion of former smokers may be the result of anti-smoking campaigns and smoking bans in many government workplaces.

The prevalence of smoking for each sex was slightly lower in the present study with 65.2% of males and 2.8% of females smoking, compared to 72.8% and 4.3% in the previous study. Current smokers in both studies reported similar mean number of cigarettes smoked per day (about ten), which is much lower than that from developed and other developing countries (MMWR CDC, 1996; Yang et al., 1999). Also, similarity was found in reported mean numbers of years smoked. Therefore, the findings of the two studies can be considered as consistent in reporting smoking prevalence and patterns of smoking among the Vietnamese population.

In comparison with other studies using the same approach, the mean calculated pack-years was lower than that from studies by Grossi et al. (1994) and Paidi, Pack & Thomson (1999). The pack-year calculation is dependent on both amount of tobacco and number of years smoked, which is related to subjects’ age. Vietnamese smokers may take up smoking at a later age and smoke lesser amounts of tobacco (Jenkins et al., 1997). Also, the sample’s age was limited to 35–44-year olds, so that the pack-years calculations were expected to be lower than that of the other two samples where subjects up to more than 70 years of age were included.

The classification system by level of smoking used in the present study showed that the light smoking group had the same lower and upper bounds, and thus was comparable to
the occasional smoking group in the study by Grossi et al. (1994). The heavy smoking group in the present study could be comparable with the light and moderate smoking groups in the United States study since it had the same range of those two groups combined. The number of cigarettes per pack is 20 in Vietnam, but the calculation used in the study was made using 25 cigarettes per pack to enable comparison with other foreign studies using pack-year calculations. Thus, the pack-year calculation is lower than the actually reported packs of cigarettes consumed, and it must be used with some qualification in describing smoking among the Vietnamese population.

Vietnam has the highest reported male smoking prevalence rate in the world. Therefore, the tobacco epidemic is a major concern for Vietnamese health status. Unless effective measures are taken to reduce the smoking prevalence among men and prevent the uptake of smoking by the youth and women, Vietnam will face a heavy health and economic burden in the near future. Joint efforts involving comprehensive tobacco control based on international regulations and health promotion based on scientific evidence will be the keys to eradication of the tobacco epidemic in Vietnam and other developing countries.

6.7.2 Smoking as a major risk indicator for periodontal destruction

6.7.2.1 Smoking exposure and gingival condition

There were no differences between smoking groups in terms of oral hygiene practice and use of dental care. However, some discrepancies in expressing gingival condition were observed. Current and former smokers had a significantly higher extent of sites with calculus deposit. On the other hand, the proportion of sites with bleeding on probing was lower among those subjects compared to non-smokers. This difference,
though, was not significant. The lower extent of sites with BOP among smokers may be explained by the localised effect of nicotine in reducing blood flow.

The above finding was similar to that reported by Preber and Bergström (1986) who also indicated the tendency of a lower level of gingival inflammation observed among smokers and it had dose-response effect. This finding must be taken into consideration owing to the clinical importance of bleeding on probing as one of the primary signs of the disease, which could hinder early diagnosis of the periodontal breakdown. Also, BOP is normally used as the criterion for periodontal treatment planning. Therefore, if the reduced tendency to bleed on periodontal probing among smokers is not taken into appropriate consideration, there can be an underestimation of periodontal disease and, consequently, inappropriate treatment approaches among smokers.

6.7.2.2 Smoking exposure and periodontal destruction

Numerous bivariate statistical analyses were done to test the possible association between smoking and periodontal destruction. Depending on types of outcome variables, the tests can be non-parametric or parametric. The hypothesis testing used subjects as the fundamental experimental unit for statistical analysis since risk factors were measured at individual levels. Site-based response outcomes can be correlated within subject (Fleiss, Park & Chilton, 1987) allowing the pooling of recorded measurements of sites as subject-based value to reduce to chance of having Type-I error compared with the use of separate site measurements. Moreover, the whole mouth mean of LOA measurement, the main outcome measure in the study, can be more precise than the whole mouth mean of pocket depth measurements (Fleiss et al., 1990).

Smoking significantly increased the chance of having moderate-to-severe and severe periodontitis among the sample. Smoking a mean of more than five pack-years can double the chance of having moderate-to-severe disease and result in nearly eight times
the likelihood of being in the group with severe periodontitis. A decreased percentage of former smokers had the disease compared with current smokers, indicating the benefit of smoking cessation on periodontal health.

Despite the fact that the mean severity score of LOA is positively skewed owing to the selection of sites with LOA ≥2 mm only, the results of the ANOVA test between groups by smoking can be accepted. The ANOVA test can be seen as fairly robust even if some assumptions such as normal distribution of the variable are not met. Heavy smokers presented with significantly higher mean severity score, followed by light smokers, whereas non-smokers and former smokers had similar mean severity of LOA. Studying the 95% confidence intervals for mean severity of LOA indicates that current and non-smoking groups are mutually exclusive to each other in terms of this indicator, which further supports the strength of the test in identifying a statistically significant difference between groups.

Overall, the bivariate associations between smoking and the prevalence, extent and severity of periodontal destruction were straightforward. Without controlling for other putative contributing factors, smokers presented with a statistically significantly higher accumulation of destruction of the periodontal connective tissues. The dose-response effect of smoking was clear, with heavy smokers always presenting the highest accumulation of the disease irrespective of indicators used. Former smokers and light smokers presented with intermediate position between non-smokers and heavy smokers. Despite the fact that smokers in this study smoked a lower amount of tobacco compared to that of other populations, the effects of smoking on periodontal tissues were still apparent.

The MANOVA statistic comparing the effects of smoking on sites may still be hampered (for example, the assumption of normality of the data not being met as a result of skewness); however, it can be of high interest. The test conducted in the
present study can still be considered as powerful because of its large size (171 cases satisfied the conditions of the test and were included). According to the results, smoking may affect sites differently due to some still unknown factors. References from the literature were not available so that a comparison could not be made. The fact that incisors in both jaws were significantly affected by smoking may be explained by the local effect of tobacco smoke, such as the heat of smoke, which may be higher at the front part of the mouth. Nicotine accumulating in saliva, which is pooled in the mouth floor, may explain the fact that mandibular sites were more frequently affected than the maxillary ones. Thus, smoking can exert deleterious effects on sites and teeth differently, but these explanations need further investigation.

Sex heavily biased the distribution of smoking among the sample. Two-thirds of the male sample were smokers, whereas only a small proportion of females was a smoker. There may be an argument that the association between smoking and the disease could actually be a sex effect. However, this argument can be contested from the results of Two-way ANOVA of sex and smoking in terms of the extent and severity of LOA. Sex was not statistically significant in determining the level of loss of attachment within smoking groups or in interaction with smoking. This result further supports the strength of the association between smoking and the disease.

6.7.2.3 Multivariate models for periodontal destruction

The multivariate models investigating factors that may have associations with periodontal disease have revealed several main factors significantly related to the disease. Smoking, poor financial situation and a high prevalence of calculus deposit are consistently significantly associated with the prevalence of moderate-to-severe and severe periodontitis. The logistic regression models had sensitivity and specificity from 60 to more than 70%. That is, the models can be applicable in identifying the cases among the population.
The reported use of professional dental care was not significantly related with the disease in the bivariate analyses. However, it was still included in the multivariate models in order to evaluate the associations between the disease and other factors in the presence of dental care. There was an interesting issue when individuals who had their last dental visit more than two years ago appeared to have a significantly higher extent of sites with disease compared to never-users. Dental visit *per se* may not be a factor for poorer disease status (Brown & Garcia, 1994). There might be an explanation for this fact that most dental care users among the sample visited a care provider when they already had one or another dental problem. Also, these individuals utilised care on a very infrequent basis, which could not improve their oral health status. On the other hand, a number of never-users might be persons who had less clinical signs of oral disease and, thus, might have relatively better oral condition than infrequent users.

Older age could be an explanation for some proportion of the moderate-to-severe disease observed. However, age was not a significant factor in determining severe periodontitis in the presence of other more important contributory factors.

Income was significantly associated with the prevalence of moderate-to-severe disease, but not severe disease. The association was consistent in the models with and without calculus as a major intermediate factor. In addition, lower income significantly increased the extent of sites with LOA≥3 mm. Thus, this socio-economic variable can explain a proportion of the variation in periodontal destruction among the population.

Smokers consistently had high adjusted OR of having moderate-to-severe or severe periodontitis, indicating the strong association between this factor and the presence of the disease. Sex, a strong modifying factor for smoking, was not statistically significant in any models, further supporting the strength of the link between smoking and periodontal destruction.
Smoking presented with clear dose-response effects on the disease in the models. Heavy smokers always have higher OR of having the disease compared to light smokers and former smokers. Probability values presented in the models can significantly enhance the strength of the conclusion of the association. Smoking variables were significant at very low p value in all models used. Therefore, the chance of having Type-I error was relatively low.

The OR of observing established periodontal destruction among smoking groups were considerably high. Direct comparison with other studies, however, cannot be made due to different criteria for case definition and different levels of smoking consumption. Other risk assessment studies have reported OR of having the disease within a range from 2.0 to 14.0 among smokers (Tonetti, 1998). So that the OR observed in this study are consistent with findings from other previous studies.

In comparison with the United States study, which used the same categorical variable of smoking (Grossi et al., 1994), smokers in the present study showed higher OR of having the disease. This comparison, however, is somewhat superficial because of different case definitions used and different age span. Nevertheless, there was a fact that smoking showed significant association with the disease status at such a relatively lower level of consumption as presented in this study.

Inclusion of calculus as a factor in the multivariate models has presented an interesting issue. Calculus can be considered as a potential risk factor for the disease. Calculus deposition can be a retentive factor for plaque accumulation, and, consequently, potential pathogens can be found at higher rate at sites with calculus. Calculus has also been reported as a risk indicator for gingival recession (Van Palenstein et al., 1998). The recession, however, can be argued as destruction not solely due to periodontal disease processes.
The debate for inclusion of calculus in the multivariate models is that calculus is not an outcome measure of the disease. Furthermore, numerous factors can contribute to higher accumulation of calculus. Hence, calculus can be considered as an intermediate interaction between several true explanatory factors and the disease. In addition, in a population with low level of dental care as the present one, calculus deposition is widespread and can be considered as reflecting an upstream explanatory factor that can contribute to the disease processes. This fact satisfies the rationale of the study to investigate the model for the disease among a population with a more natural disease process.

The argument against consideration of calculus as a factor in the models can be that calculus may be related to and confound other factors of importance. More prevalent calculus deposition may be related to smoking history, males or lower SES status. Calculus may be on the aetiological pathway between those factors and periodontal destruction. Inclusion of calculus in models may inappropriately reduce the underlying aetiological association. In addition, some individuals are more likely to build calculus than others owing to some specific oral characteristics, such as crowding of teeth.

Several previous studies have reported a positive relationship between calculus deposit and periodontal disease in various populations (Beck, 1988; Carlos et al., 1988; Baelum, Manji & Fejerskov, 1991; Mumghamba, Markkanen & Honkala, 1995). The methodologies and age span of those studies, though, were not comparable. Carlos et al. (1988) indicated that calculus might mask some effects of *B. intermedius* among adolescents in the multivariate model. Baelum, Manji & Fejerskov (1991) also reported a correlation coefficient (r=0.70) between the proportion of sites with subgingival calculus and the proportion of sites with ‘severe’ loss of attachment. Calculus was significantly related to higher gingival recession among a sample with virtually no dental care (van Palenstein et al., 1998). Therefore, calculus deposit may be a
contributory factor for the disease in several populations with low or virtually no dental care.

Results of the multivariate models in the study showed that calculus might be associated with and therefore confound the effects of some other risk factors to some extent. Several factors presented with higher OR in the models with calculus removed. Further, plaque accumulation became statistically significant in the models when calculus was removed, indicating that plaque can be dependent on calculus deposit. This primary etiological factor, however, showed less pronounced association with the prevalence of disease cases. This is consistent with the previous findings of a relatively low contribution of plaque accumulation to the pathogenesis of the disease (Beck et al., 1990; 1992).

Calculus showed a stronger association with the disease compared to smoking in the model for moderate-to-severe disease, which was widespread among the present population. But the reverse was true in the models for the more clinically important severe disease, which was confined to a smaller proportion of the population who might be really at high risk. Thus, the aetiological role of smoking in the pathogenesis of severe disease is much more overwhelming compared to other factors.

Calculus can act as a retentive factor for plaque, and hence, increases the chance of being infected. However, calculus may cause a proportion of gingival recession, which is a measuring component of loss of periodontal attachment. Attachment loss formed by gingival recession may have different characteristics from the true disease because of issues such as toothbrush abrasion or vigorous flossing (Beck & Koch, 1994). However, gingival recession is a common feature among populations with very limited oral hygiene practice (Baelum, Fejerskov & Karring, 1986; Baelum et al., 1993b). The results of the present study also showed high prevalence and extent of gingival recession, which were much higher than that found among the United States and New
Zealand populations (as discussed elsewhere in this chapter). Therefore, some other factors must influence the formation of gingival recession in those populations with a low level of oral hygiene practice and dental care. On the other hand, calculus was significantly related to the extent of sites with disease measured by either LOA or pocket depth. Thus, calculus may explain some proportion of the disease measured in this population as well as a non-disease component of LOA.

The lack of clear biological plausibility of a direct pathological relationship between calculus and periodontal disease suggests that calculus may currently be considered as a risk marker for the disease in this particular population, where oral hygiene technique was inadequate and access to care was low. An in-depth research approach such as that outlined by Beck and Koch (1994) should be employed to further explore the question.

Smoking remains the most significant factor related to either the extent of sites with LOA, which is necessary for determining the presence of disease, and the extent of sites with PD, which indicates treatment needs. Irrespective of models studied, smoking presents the most consistent association with the disease measurements.

6.7.2.4 Conclusion of smoking as a major risk indicator for periodontal destruction

This study has provided convincing evidence of the pathological association between smoking and periodontal destruction. Among the representative sample of population in the selected provinces, smokers showed significantly higher prevalence, extent and severity of gingival recession, pocket depth and LOA as well as case definitions for moderate-to-severe and severe periodontitis than former and non-smokers. The association remains consistent after controlling for other contributing factors and background characteristics. The strength of association between smoking and the
disease outcome measures has been expressed in high OR and significance levels in statistical tests.

The dose-response effect of smoking on the disease outcomes was well expressed in bivariate and multivariate statistics. Heavy smokers always presented with the highest level of disease expression, whereas light smokers and former smokers were in between heavy and non-smokers.

Furthermore, the observed effects of smoking can be well explained in the light of the current understanding of the disease processes. Thus, smoking is significantly related to poorer periodontal status in the studied population.

The evidence of the association between smoking and periodontal disease found in the present study is consistent with findings from other studies using similar or different approaches to the problem. As quoted in chapter 3, most studies using LOA as criteria of measurement reported the pathogenic association between smoking and the disease. The findings of this study further contribute to the evidence of this association.

The cross-sectional nature of the study cannot determine the time sequence of the association between smoking and periodontal disease initiation, and thus cannot conclude the causality of the link. It fails to comply with one criterion of a causal relationship, that is time sequence of the association (Hill, 1965). Therefore, the study is not able to conclude that smoking is the true risk factor for periodontal destruction for the present population.

However, the findings of this study comply with several other main criteria supporting a causal interpretation of smoking effects. They are the consistency of association, strength of association and degree of exposure (or dose-response effect) (Beck, 1998). Based on these observations, it is possible to conclude that smoking is a significant risk
indicator for the disease among representative samples of the Vietnamese middle-aged population.

6.8 RISK ASSESSMENT IN PERIODONTOLOGY

As discussed above, the present study provided evidence that cigarette smoking is a significant factor associated with an increased probability of periodontal disease. The study also contributes to the discussion of some methodological issues regarding assessment of a risk associated with smoking, which have not been resolved at this point.

The study evaluated the risk associated with smoking when the exposure was assessed as both a categorical and continuous variable. The use of a continuous variable for smoking exposure can have pre-eminence in assessing a dose-response effect of smoking. Also, the continuous nature of the risk associated with smoking more closely indicates the relationship between the exposure and the outcome. However, this relationship may not be a linear one and current knowledge is insufficient to indicate a clear cut-off point where the increase in exposure can have a discernible effect on the risk. Further development of risk assessment requires a discrimination of low, intermediate and high levels of risk for a particular population. The comparison made between this study and another study (Grossi et al., 1994) showed that a similar exposure to smoking may have different levels of risk. The comparison, however, is hampered by the difference in case definitions used and age range of the study samples.

Regarding whether smoking should be evaluated as a cumulative exposure (pack-years) or current exposure (number of cigarettes per day), there are still discrepancies depending on the research questions to be answered in a particular situation. Cumulative exposure, as in this present study, can be useful in evaluating the prevalence and extent of destruction, which has occurred in the subjects of an
Discussion

epidemiological study. This estimation can help to predict the likelihood of the long-term trend of the disease in a population. On the other hand, current exposure can help an evaluation of the short-term prediction of disease activity or treatment outcomes to a particular individual.

The unit of assessment is another interesting issue. The development of risk assessment in periodontology suggests three levels of attention: individual, tooth and site levels. The current understanding of the nature of the effect of smoking shows that the exposure to risk involves whole individuals and can consist of many systemic effects. Thus, it emphasises the importance of the individual as a unit in assessing the risk. However, this factor should also be put in appropriate proportion with other local factors to determine the risk for individual teeth or sites. The present study concentrated on assessment of individual risk, but it also included an effort to evaluate the risk at site level. The result of the statistical analysis suggested that some local factors might have a significant role in the pathological pathway between smoking and periodontitis. Actually, the scope of assessment in this study did not allow for accurate determination of those local factors. It may only give some suggestions for deeper research in defining the process. Despite these limitations, these findings may contribute to deeper understanding of the process and suggest further investigation of these ‘risk factors within risk factors’ for the development of the disease, which would contribute to understanding the site-specificity of the disease.

The study findings further support the concept of multi-causality of periodontal disease. The previous well-known literature suggests that the multifactorial nature of the disease should be considered in attempting to develop effective risk assessment and predictive models (Beck et al., 1990; Beck, 1994; Tonetti, 1998). In this respect, despite smokers from the study sample being an apparently high-risk group, the risk for the disease among them should be considered in the proportion with other risk factors in order to better predict outcomes of the disease and the future disease trend among the
population. The importance of this issue should be emphasised in planning epidemiological research and in developing risk models for the disease among populations.

6.9 SIGNIFICANCE OF THE STUDY

The present study has provided valuable information on patterns of periodontal disease among the Vietnamese middle-aged population. The findings of the study are enhanced by the representativeness of its sample and the preciseness of the methods of disease measurement. Being the first large-scale population-based study in Vietnam investigating the epidemiology of periodontal disease, it has provided an essential background for further research of the disease in Vietnam.

The social survey of the study has collected thorough information on smoking exposure among the population. It contributes to the understanding of the situation concerning smoking patterns in Vietnam. It has confirmed findings from the previous major smoking study of the alarmingly high rate of smoking in Vietnamese males.

The observation of the pathological association between smoking and periodontal disease contributes to further identification of smoking as a major risk factor for periodontal disease. More importantly, the contribution comes from a representative population in a developing country. The developing countries comprise two-thirds of the world population and much less research has been conducted on the distribution and determinants of oral diseases in these populations. Moreover, the investigation is creditable as it took place where the disease process is either not or minimally confounded by factors such as professional dental care.

Besides the main objective of examining smoking as a risk indicator for the disease, the study also discovered social gradients of periodontal disease. People with lower socio-economic status appear to have a higher risk of having poorer periodontal health. These
findings can be significant in identifying groups of individuals at risk. Further, it supports the importance of the social context of oral health.

6.10 POSSIBLE IMPLICATIONS FOR ORAL HEALTH AND HEALTH POLICY

The study identifies several implications for improving oral health in particular and health in general. Pack (1998), analysing the situation of dental services and needs in terms of periodontal disease in developing countries, emphasised the importance of relevant research in those countries. The study provides evidence for, and can assist the government in determining appropriate strategies for disease prevention.

The study provides reliable and up-to-date data on the prevalence, extent and severity of periodontal disease among the Vietnamese middle-aged population. In addition, the study indicates the distribution of the disease among socio-economic groups of the population. The findings can have application in understanding the current situation of oral diseases in Vietnam. Further, they can be used to evaluate the effects of the dental care system.

The findings of the study show the picture of the main oral diseases among Vietnamese middle-aged adults. Similar to the situation in many other developing countries, dental caries was at a relatively low level whereas periodontal disease had higher impact on the oral health status of the adult population. This fact indicates that an appropriate approach for the oral health care system should place greater emphasis on improving the periodontal health of the population. The question of implementation is important in a situation where dental health care resources are extremely limited. A population strategy with an orientation to the common risk factor approach and a high-risk strategy integrated among all health-related sectors are relevant and important policies in improving general health and oral health of the population.
Some valuable information on risk indicators for the disease would suggest that a population strategy should be developed in controlling the determinants of the disease, in lowering the level of risk factors and in shifting the exposure to the risk in a more favourable direction. Oral health education, including teaching means of oral hygiene practice and providing information on factors influencing oral health, can help to improve oral hygiene level and, hence, to lower the prevalence of periodontal disease in particular and oral diseases in general. An approach outlined by Sheiham (1990) and Bartold et al. (1998), aiming to reduce the population plaque level as well as exposure to other risk factors, is highly appropriate in managing and controlling the disease among the population where severe disease is prevalent.

By using multivariate models in evaluation of the disease, the study identifies the possible risk indicators among the Vietnamese population. Some important links between socio-economic indicators and the disease expression were uncovered. A common risk factor approach as analysed by Sheiham and Watt (2000) contributes an initiative toward effective improvement of the population health at lower cost. This approach focuses on improving health conditions for the whole population as well as for groups at high risk. Integrating all health sectors, this approach targets a number of conditions and a number of common causative factors at one time. In the particular situation of Vietnam, adopting common risk factor approach in controlling tobacco use would improve general health and periodontal status of the population.

A high-risk strategy is also an important component of public health policy in Vietnam. Pursuing a high-risk approach helps to direct the preventive measures to populations who may have higher risk for the disease. This procedure will help to improve the efficacy of periodontal disease prevention, especially in the Vietnam situation where dental care resources are extremely scarce.
One of the appropriate directions in improving general health and oral health is counselling on smoking based on scientific evidence of the pathological effects of smoking. The study updates information on the detrimental effects of smoking on periodontal destruction for dental professionals and the public. The knowledge of the association between smoking and the disease can be used in implementing smoking cessation interventions by dental professionals. Public health policy makers will be able to encourage dental professionals in advising patients to stop smoking and to provide necessary materials to develop anti-smoking programs. There is good evidence showing high effectiveness of anti-smoking interventions in dental settings (Macgregor, 1996; Christen & Christen, 1992). Such programs would be effective in reducing the burden of smoking for general health and periodontal disease.

A scientific rationale could be provided for informing smokers, who are unable or willing to quit the habit, that the progression of the disease and the clinical improvement of periodontal therapy would largely depend on their habit. In such situations, informative professional advice from dental care personnel can make a significant impact on a smoker’s behaviour to quit.

Based on evidence of the detrimental effects of smoking, the health care sector should act decisively to prevent and reduce tobacco use. The anti-smoking program should aim to prevent the starting of smoking among youths and women who more and more are becoming the targets of tobacco companies. Also, actions should be developed in promoting smoking cessation programs. Since physicians and dental professional in particular can play an active role in these tasks, they should take a collaborative and leading role in implementing anti-smoking programs.

The population often perceives health care professional to be a highly credible source of information on tobacco and other health issues. The health professionals and dental
personnel in particular can take advantages of the opportunity to practice systematic clinical tobacco interventions, which may include:

- routinely counselling children and youth against starting to smoke while doing school dental services, for example;
- taking advantages of ‘teachable moments’ such as treating gum’s inflammation, halitosis or cleaning tobacco stains, to empathically motivate smokers to quit;
- collecting smoking history of the patient and readiness to quit (this can be important in planning treatment programs), and;
- offering personalised care to smokers.

At this point, however, there is a lack of direct experimental evidence (that is, evaluation of the periodontal outcomes of smoking intervention) indicating that smoking cessation, or reducing the habit, will significantly reduce the risk of developing and progressing periodontitis. However, counselling on smoking in dental practice can rely on the fact that smoking exposure has a dose-response effect, and the periodontal status among former smokers is significantly better compared to current smokers. Also, using the enormous amount of evidence of effects of smoking cessation on general health can be useful for dental professionals practising tobacco counselling. Nevertheless, further specific research in the effects of smoking cessation on periodontal health is feasible and highly desirable.

In such a population where smoking is widespread and is contributing a large component to the burden of periodontal disease, and where dental resources are limited, counselling on smoking by the dental professional and other health providers should be cost-effective and highly efficacious. Also, it may provide substantial health benefits to individual patients and groups.
Yet, the tobacco counselling in Vietnam and other developing countries may still be hampered by the low utilisation of dental care by the populations, leading to an argument that such counselling on smoking would be available to only a small proportion of the population. This gives emphasis to the participation of dental authorities in wider smoking control as part of a common risk factor approach. Nevertheless, given the economic growth and increasing awareness toward oral health observed in most of populations of developing countries, the utilisation of dental care is growing and counselling on smoking will be of greater importance in the near future. It is better to take the first essential step in preventing the development and progression of this health and economic burden rather than delaying dealing with its consequences to the future.