# Determinants of dental status and caries among adults in southern Thailand

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This study describes the tooth mortality and the prevalence and severity of dental caries among 30- to 39- and 50- to 59-year-old rural Thais from the Province of Songhkla, Thailand. Three hundred and sixty-three persons were given a clinical examination, including assessment of dental status, dental caries, and periodontal recordings. Information on religious faith, smoking, and betel use was obtained by means of an interview. The prevalence of edentulism was low (<2% among 50- to 59-year-olds). The mean number of teeth present was high, 29.4 among the 30- to 39-year-olds and 24.3 among the 50- to 59-year-olds. The prevalence of caries was high (91% among 30- to 39-year-olds and 84% among 50- to 59-year-olds). The mean DFT values were 5.7 and 5.8, respectively, and a substantial part of the DFT consisted of deep dentin lesions. The results did not corroborate the hypothesis that persons of Muslim faith have worse dental conditions than do Thai Buddhist or that dental disease levels are higher among the Thai population than among other Southeast Asian populations. □ *Caries; epidemiology; tooth loss*

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Epidemiological information on the dental status and the prevalence and severity of dental caries among adult Southeast Asian populations is relatively scarce. A comprehensive review of dental caries among different Southeast Asian populations (1) indicates that, whereas the prevalence of caries in Southeast Asian populations may be quite high (45%–98%), the mean DMFT values observed among 30- to 35- and 35- to 44-year-old age groups are considerably lower than observed among, for example, U.S. adults (2). Tewari et al. (1) indicated, however, that major regional differences exist also within these populations and that the levels of dental caries are increasing. The 1984 national data from Thailand showed that the mean DMFT among 35- to 44-year-old Thais varied between 3.0 in the northeastern region and 8.7 in the region of Bangkok, with an overall mean DMFT of 5.4 and a prevalence of 80%, and for all regions these estimates were considerably higher than those observed approximately 25 years earlier (1). According to the 1994 National Oral Health Survey, the mean DMFT among the 35- to 44-year-olds was 6.5, and the prevalence 86% (3). However, assessment of the trends in dental caries among the adult Thai population is difficult because major regional variations in the caries experience indicate that stability of the sampling frame for the studies compared is crucial for a valid interpretation of possible trends (4). The regional variations observed have been ascribed to factors such as regional differences with regard to the water fluoride concentrations and the availability of and access to dental health care services (1).

During the course of an oral health care development project in rural southern Thailand the contention arose that the levels of dental diseases could be substantially higher in this population than is the case for other East Asian populations. Moreover, the impression was presented by local dental professionals that dental disease levels are much higher among the Muslim communities than among the Thai Buddhist communities. Whereas a recent study of 2- to 6-year-old children has shown that Muslim children have a higher risk of caries in the labial and lingual surfaces of the deciduous incisors but not in the deciduous dentition as a whole (5), data to support these contentions are sparse. It was therefore decided to conduct an epidemiological study of the dental disease levels in two age cohorts in rural southern Thailand, with a view to address this hypothesis. The purpose of the present paper is to describe the prevalence and severity and some determinants of dental caries and the dental status observed among 30- to 39- and 50- to 59-year-old adults from rural southern Thailand.

## Materials and methods

### *Population*

The population under study was defined as all 30- to

Table 1. The distribution of the subjects eligible for the study and actually examined, on the basis of age and sex. Also given is the frequency of smoking, betel use, and Muslim religion on the basis of age and sex

| | 30–39 years | | | 50–59 years | | |
|---|---|---|---|---|---|---|
| | Men | Women | All | Men | Women | All |
| No. eligible | 206 | 199 | 405 | 129 | 122 | 251 |
| No. examined | 97 | 112 | 209 | 78 | 76 | 154 |
| Smokers, % | 81 | 3 | 39 | 73 | 16 | 45 |
| Betel users, % | 13 | 10 | 12 | 12 | 38 | 25 |
| Muslims, % | 43 | 28 | 35 | 40 | 32 | 36 |

39- and 50- to 59-year-old persons living in Songkhla Province, southern Thailand. Songkhla Province, which is located about 1000 km south of Bangkok, is inhabited by 1.1 million persons (1994 data), most of whom live in rural areas, and is subdivided into 16 districts. Most of the population earn their living as farmers, growing rice, vegetables, or rubber trees, whereas a few are factory employees. Most of the population in Songkhla Province belong to the Thai Buddhist faith (80%), whereas a few are Muslims (<20%). The availability of and access to dental health care services is limited for the rural population of Songkhla Province. The concentration of fluoride in the drinking water is low, around 0.1 ppm, but many people drink bottled water, which occasionally may have fluoride contents as high as 0.5–0.7 ppm.

### *Sampling*

Persons eligible for inclusion in the present study were identified by means of a random cluster sampling as follows. The first step was the selection of one district among the 15 rural districts in the Province: the district of Kaun-Niang, which has a population (1994 data) of 32,022 persons. Kaun-Niang district has 45 villages, relatively many of which are inhabited by people of the Muslim faith, and by means of random permutation an ordered list was prepared of all the villages in the district. A target sample size had been set, which included 75 men and 75 women in each of the 2 age groups. Using the ordered list of villages, all men and women aged 30–39 and 50–59 years in the villages were listed, and, on the basis of these lists eligible persons were contacted by the local primary health care officer and invited to participate in a dental and microbiological examination. A total 363 subjects in 4 villages consented to participate and were given a clinical examination, which took place in 1996. Table 1 shows the distribution of the subjects eligible for the study and the distribution of those actually examined on the basis of age and sex.

### *Clinical examinations*

The examinations were carried out using a portable dental unit equipped with artificial light, mouth mirrors, and dental and periodontal probes. All teeth were examined for dental status by using the following coding system: 0 = present, 1 = missing, 2 = tooth remnant only (crown completely destroyed), 3 = tooth is a bridge abutment, 4 = missing and replaced by denture, 5 = tooth crowned, and 6 = missing and replaced by pontic. All surfaces of all teeth present were examined for dental caries by using the following criteria: 0 = sound, 1 = enamel lesion only, 2 = dentin lesion, 3 = dentin lesion with definite or suspected pulp involvement, 4 = filled, 5 = filled and an associated caries lesion, 6 = root surface lesion, and 7 = both coronal and root surface caries lesion. The diagnostic criteria underlying these diagnoses have been described elsewhere (6). In addition to these recordings, assessments were also made of pocket depths, attachment levels, bleeding on probing and plaque and calculus deposits. Results pertaining to these factors will be presented elsewhere. All the clinical recordings were made by the same examiner. The percentage agreement in the diagnosis of caries was 98%, corresponding to an unweighted kappa value of 0.68. In addition to the clinical

Table 2. Mean number of teeth present, root remnants, and teeth replaced by denture on the basis of age and sex. Parentheses indicate the 95% confidence interval for the mean. Based on 360 dentate individuals

| | 30–39 years | | | 50–59 years | | |
|---|---|---|---|---|---|---|
| Variable | Men | Women | All | Men | Women | All |
| Teeth present | 30.2 (29.7; 30.6) | 28.7 (28.1; 29.3) | 29.4 (29.0; 29.8) | 24.6 (22.6; 26.6) | 23.9 (22.0; 25.9) | 24.3 (22.9; 26.7) |
| Root remnants | 0.9 (0.5; 1.2) | 1.5 (1.0; 1.9) | 1.2 (0.9; 1.5) | 1.5 (1.0; 1.9) | 3.7 (2.7; 4.7) | 2.6 (2.0; 3.1) |
| Teeth replaced by denture | 0.1 (0.0; 0.1) | 0.4 (0.2; 0.6) | 0.2 (0.1; 0.4) | 0.9 (0.1; 1.8) | 0.7 (0; 1.7) | 0.8 (0.2; 1.4) |

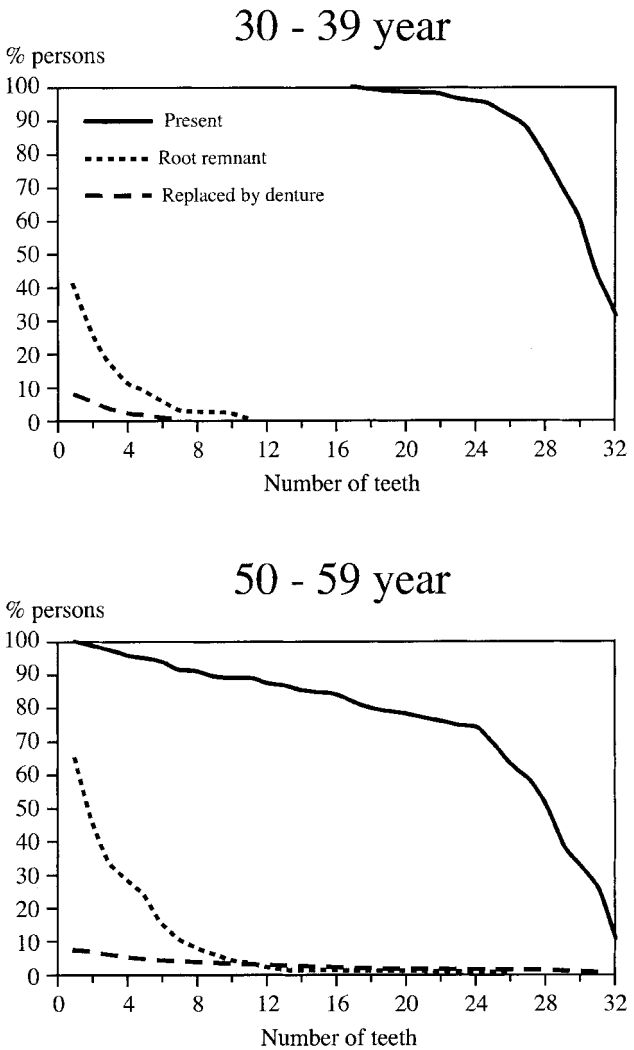


Fig. 1. The cumulative frequency distribution of persons in accordance with the number of teeth present, the number of root remnants present, and the number of teeth replaced by dentures.

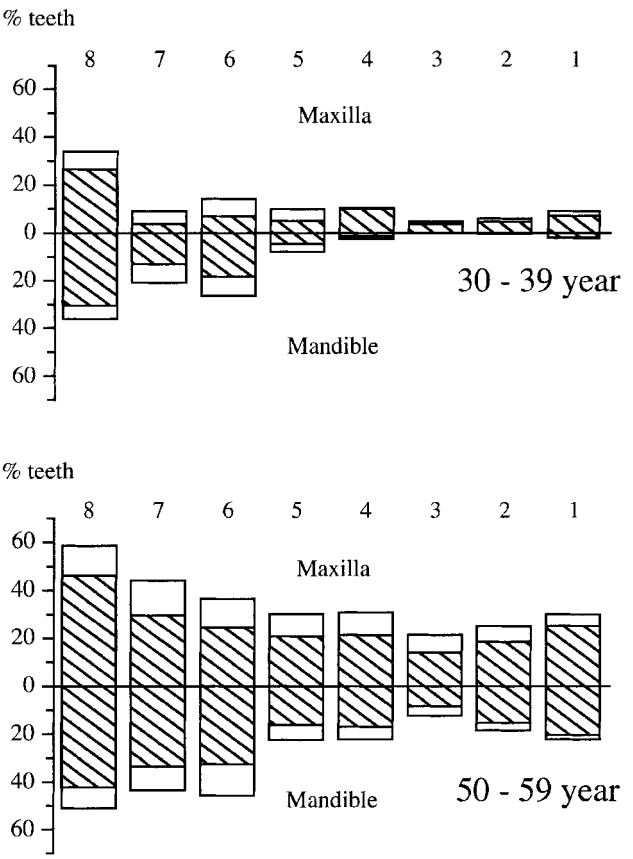


Fig. 2. The intraoral distribution of the percentage teeth missing (diagonally hatched areas) and percentage teeth remaining as root remnants only (white areas).

data, data were also collected on smoking habits, use of betel, and religious faith, by means of an interview.

In the analysis tooth-based caries scores were obtained on the basis of the site-based caries recordings by selecting the most severe caries score, as determined by the following hierarchical sequence: sound, enamel lesion, filled, filled and an associated caries lesion, dentin lesion, dentin lesion with definite or suspected pulp involvement, and root lesion. If, in a given surface, both a coronal and a root surface lesion were seen, the root surface diagnosis would take precedence over the coronal lesion when generating the tooth-based caries score.

*Statistical analysis*

Statistical analysis of the association between dental status or dental caries and the religious faith was carried out by means of logistic regression analyses, using the variables age, sex, smoking habits, and betel use as possible confounding variables. Three outcome variables were considered: number of teeth present, number of DFT, and percentage DFT (number of DFT/number of teeth present). Two sets of analyses were carried out: one in which the outcome variables were dichotomized by using the median value for the population as the threshold value, and one in which the 75% percentile was used as the threshold value for dichotomization.

## Results

Table 1 shows that smoking was very prevalent among men but relatively rare among women. Betel was used by 10%–38% of the study group, most frequently by 50- to 59-year-old women. About 35% of the study group belonged to the Muslim faith (Table 1).

Among the 363 persons examined, 3 persons, 2 men and 1 woman, all 50–59 years old, were completely edentulous at the time of examination. Among the 360 dentate persons the mean number of teeth present ranged

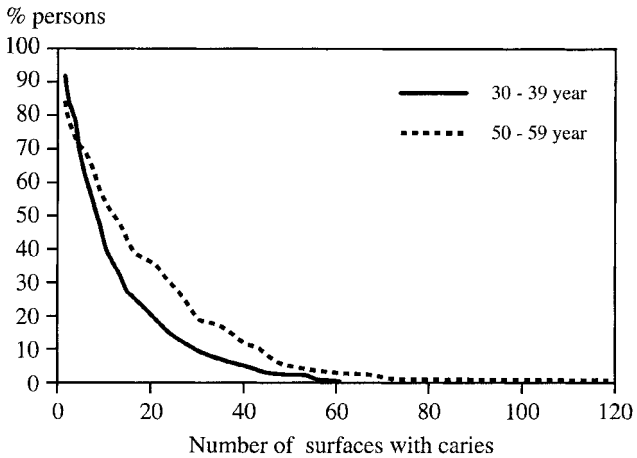


Fig. 3. The cumulative frequency distribution of persons on the basis of the number of decayed and filled (DFS) surfaces (enamel lesions included).

between 23.9 and 30.2 (Table 2). Among 30- to 39-year-olds the minimum number of teeth present was 17, whereas the corresponding figure among dentate 50- to 59-year-olds was 1 tooth present (Fig. 1). More than 40% of the 30- to 39-year-olds and more than 65% of the 50- to 59-year-olds had at least 1 tooth remnant (tooth crown completely destroyed), and the mean number of such tooth remnants ranged between 0.9 and 3.7, being higher among women than among men (Table 2). Dentures were seen in less than 10% of the study groups. Fig. 2 shows that the tooth type most frequently missing was the third molar. Among the 30- to 39-year-olds the second most frequently missing tooth type was the lower first molar, whereas among the 50- to 59-year-olds the lower second molar was missing as frequently as the first lower molar. Complete destruction of the tooth crown followed the same pattern of intraoral distribution as missing teeth (Fig. 2).

The prevalence of dental caries (DFS > 0) was 91% among the 30- to 39-year-olds and 84% among the 50- to 59-year-olds (Fig. 3), and the distribution of individuals on the basis of number of DFS surfaces showed positive skewness in both age groups. The mean number of DFS surfaces ranged between 9.0 and 24.2 (Table 3). The main components of the DFS were deep dentinal lesions and enamel lesions (Table 3). Fillings and root surface lesions were rarely observed.

The mean DFT ranged between 3.5 and 8.2 (Table 4). This corresponded to a mean percentage DFT in the range of 15.2% to 37.3%. In the 30- to 39-year-olds teeth with enamel lesions constituted the major single component of the DFT, whereas teeth with deep dentin lesions were the main component of the DFT in the 50- to 59-year-olds. The distribution of individuals in accordance with the number of DFT showed positive skewness in both age groups, and less than 25% of the subject had more than 10 DFT (Fig. 4). When enamel lesions were excluded from the diagnosis of caries lesions, the prevalence was 76% in both age groups, and the mean DFT was 3.3 and 4.5, respectively. When enamel lesions were excluded and the missing component was included, the prevalence of caries was 90% among the 30- to 39-year-olds and 98% among the 50- to 59-year-olds, and the mean DMFT values were 5.9 and 12.2, respectively.

The third molars were the teeth most frequently affected by caries, closely followed by the second and first molars, whereas the lower anterior teeth were the teeth least frequently affected in both age groups (Fig. 5). About 50% of the third molars among the 30- to 39-year-olds had caries lesions, and in this age group a substantial portion of the caries experience consisted of enamel lesions. Among the 50- to 59-year-olds the predominant type of lesion in all tooth types was deep dentin lesions (Fig. 5).

When the population median value was used as the threshold for dichotomization of number of teeth present,

Table 3. Mean number of sound surfaces and surfaces with enamel lesions, with dentin lesions, with deep dentin lesions, with root lesions, or filled, on the basis of age and sex. Figures in parentheses indicate the 95% confidence interval for the mean

| | 30–39 years | | | 50–59 years | | |
|---|---|---|---|---|---|---|
| | Men | Women | All | Men | Women | All |
| Sound | 128.7 (125.3; 132.0) | 117.2 (113.0; 121.4) | 122.5 (119.7; 125.4) | 101.7 (92.5; 111.0) | 81.7 (71.8; 91.6) | 91.8 (84.9; 98.7) |
| Enamel lesion | 2.4 (1.9; 2.9) | 3.6 (3.1; 4.0) | 3.0 (2.7; 3.4) | 1.1 (0.7; 1.5) | 2.4 (1.8; 3.0) | 1.7 (1.4; 2.1) |
| Dentin lesion | 1.8 (1.3; 2.2) | 1.8 (1.4; 2.2) | 1.8 (1.5; 2.1) | 0.9 (0.6; 1.3) | 2.2 (1.7; 2.8) | 1.6 (1.2; 1.9) |
| Deep dentin lesion | 4.7 (2.9; 6.5) | 7.9 (5.7; 10.2) | 6.4 (4.9; 7.9) | 7.6 (5.4; 9.9) | 18.9 (14.2; 23.6) | 13.2 (10.5; 15.9) |
| Root lesion | 0.1 (0.0; 0.2) | 0.2 (0.0; 0.3) | 0.1 (0.1; 0.2) | 0.3 (0.2; 0.5) | 0.7 (0.4; 1.0) | 0.5 (0.3; 0.7) |
| Filled surface | 0.1 (0.0; 0.2) | 0.7 (0.3; 1.1) | 0.4 (0.2; 0.6) | 0.1 (0.0; 0.2) | 0 | 0.0 (0.0; 0.1) |
| DFS | 9.0 (6.8; 11.2) | 14.1 (11.6; 16.6) | 11.7 (10.0; 13.5) | 10.1 (7.5; 12.7) | 24.2 (19.2; 29.1) | 17.1 (14.1; 20.1) |

Table 4. Mean number of teeth on the basis of the most severe caries lesion observed in any surface on the tooth, on the basis of age and sex. Also given is the mean percentage DFT (DFT/teeth present). Figures in parentheses denote the 95% confidence interval for the mean

| | 30–39 years | | | 50–59 years | | |
|---|---|---|---|---|---|---|
| | Men | Women | All | Men | Women | All |
| Enamel lesion | 1.9 (1.6; 2.3) | 2.9 (2.5; 3.3) | 2.4 (2.2; 2.7) | 0.8 (0.6; 1.1) | 1.8 (1.4; 2.2) | 1.3 (1.1; 1.6) |
| Dentin lesion | 1.4 (1.1; 1.8) | 1.5 (1.2; 1.8) | 1.4 (1.2; 1.7) | 0.6 (0.4; 0.9) | 1.4 (1.1; 1.8) | 1.0 (0.8; 1.3) |
| Deep dentin lesion | 1.0 (0.6; 1.4) | 1.8 (1.3; 2.3) | 1.4 (1.1; 1.8) | 1.7 (1.2; 2.1) | 4.3 (3.3; 5.4) | 3.0 (2.4; 3.6) |
| Root lesion | 0.1 (0.0; 0.1) | 0.2 (0.0; 0.3) | 0.1 (0.1; 0.2) | 0.3 (0.2; 0.5) | 0.6 (0.4; 0.9) | 0.5 (0.3; 0.6) |
| Filled tooth | 0.1 (0.0; 0.2) | 0.4 (0.2; 0.6) | 0.3 (0.1; 0.4) | 0.0 (0.0; 0.0) | 0 | 0.0 (0.0; 0.0) |
| Missing | 1.8 (1.4; 2.3) | 3.3 (2.7; 3.9) | 2.6 (2.2; 3.0) | 7.4 (5.4; 9.4) | 8.1 (6.1; 10.0) | 7.7 (6.3; 9.1) |
| DFT | 4.5 (3.8; 5.3) | 6.7 (5.9; 7.5) | 5.7 (5.1; 6.3) | 3.5 (2.7; 4.3) | 8.2 (6.8; 9.5) | 5.8 (5.0; 6.7) |
| % DFT | 15.2 (12.6; 17.8) | 24.2 (21.2; 27.1) | 20.0 (17.9; 22.1) | 16.5 (12.2; 20.8) | 37.3 (31.1; 43.4) | 26.8 (22.7; 30.9) |

number of DFT, or percentage DFT, as the outcome variables religious faith did not associate with any of the three outcome variables. Higher age was positively associated with a low (≤29) number of teeth present (odds ratio (OR) = 3.2), whereas male sex was negatively associated (OR = 0.5) (Table 5). The only significant predictor of a high DFT (≥5) or a high percentage DFT (≥20%) was sex, such that male sex was negatively associated (OR = 0.2 and 0.3, respectively). When the 75th percentile was used as the threshold for dichotomization of the outcome variables, higher age (OR = 5.0) was found to be positively associated with a low (≤26) number of teeth present, whereas Muslim faith was negatively associated (OR = 0.4) (Table 6). A high DFT and a high percentage DFT were both positively associated with higher age (OR = 1.7 and 2.9, respectively), whereas male sex was negatively associated (OR = 0.3 and 0.2, respectively) (Table 6).

## Discussion

The frequency of edentulism observed in the present study was quite low (<2% of the 50- to 59-year-olds) but corroborates findings among rural Chinese (7). The mean number of teeth present was substantially higher than commonly observed for populations in industrialized countries (8–10) and slightly higher than observed among rural Chinese (7). The frequency of dentures among the 30- to 39-year-olds in the present study appears to be slightly higher than among rural Chinese (7), whereas the reverse was the case for the 50- to 59-year-olds. Crown and bridge work was rarely seen, just as filled teeth were rare, owing to the fact that the availability of and access to dental health care services is extremely low for this population.

The prevalence of caries was quite high, and many teeth presented with deep dentin lesions. A substantial part of the total caries experience was related to the posterior teeth, most notably the third molars. Although great care should be exercised when comparing our findings with the 1984 estimates of an 80% prevalence and a mean DMFT of 5.4 provided by Tewari et al. (1) and with the 1994 estimates of a prevalence of 86% and a mean DMFT of 6.5 (3) among 35- to 44-year olds, they seem to corroborate previous national findings. In the two national surveys the caries diagnostic criteria used were those of the WHO (11, 12), which implies that pre-cavitation stages would have been excluded from diagnosis. Moreover, the age groups considered are not exactly the same, just as the national estimates might cover large regional variations.

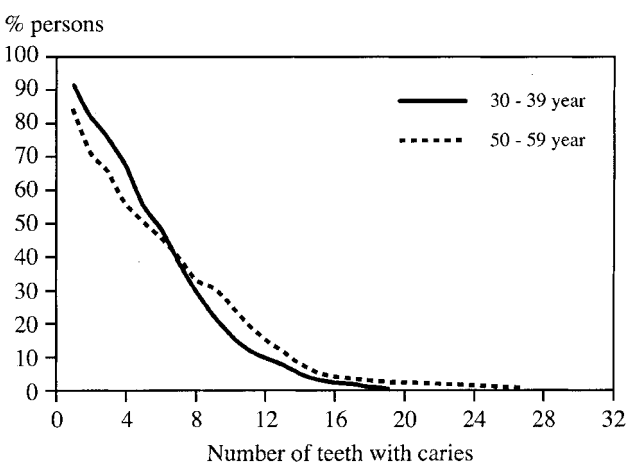


Fig. 4. The cumulative frequency distribution of persons on the basis of the number of decayed and filled (DFT) teeth (enamel lesions included).

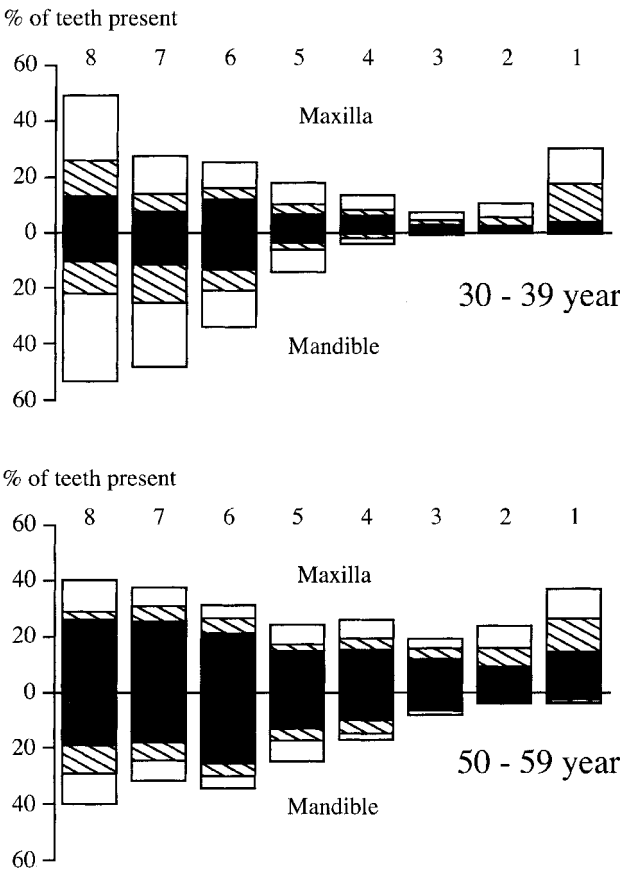


Fig. 5. The intraoral distribution of the percentage teeth present that have deep dentin lesions (black areas), dentin lesions (diagonally hatched areas), or enamel lesions (white areas).

Nonetheless, the 90% prevalence and the mean DMFT (excluding enamel lesions) of 5.9 among the 30- to 39-year-olds observed in our study corroborate the national estimates.

The caries diagnostic criteria used in the present study were the same as used for rural Chinese (6), among whom the prevalence of one or more DFT (excluding enamel lesions) was found to be 75% and 90%, respectively, among 30- to 39- and 50- to 59-year-olds, and the mean DFT values (excluding enamel lesions) were 3.2 and 5.0, respectively. The prevalence figures estimated in the present study (76% in both age groups) were similar for the 30- to 39-year-olds but lower for the 50- to 59-year-olds. However, the mean DFT values (excluding enamel lesions) observed among the Chinese were similar to the estimates of 3.3 and 4.5 observed among 30- to 39- and 50- to 59-year-olds, respectively, in the present study. When comparisons are based on mean DMFT values (excluding enamel lesions), our findings indicate slightly lower mean DMFT values among the present Thai population (5.9 and 12.2, respectively) than among rural Chinese of the same age (9.4 and 13.8, respectively) (6). Our finding that women have higher DFT values than men corroborates our findings among rural Chinese.

The logistic regression analyses carried out showed that higher age (50–59 years) and female sex were the most important predictors of a low number of teeth present, defined as ≤29 teeth (population median value). Only when a low number of teeth present was defined as belonging to the lower 25th percentile (≤26 teeth present) did religious faith appear as a important predictor, such that Muslims were less likely than Thai Buddhists to have such a low number of teeth present. Irrespective of whether the caries outcome variable considered was the absolute DFT or the percentage DFT, the logistic regression models were similar. Hence, when a high caries experience was defined by using the population median values as the cut-points for dichotomization, both logistic regression analyses showed that female sex was the only important positive predictor of a high caries experience. Only when the upper 25th percentile was used to define a high caries experience did higher age appear as an important positive predictor of a high caries experience. The reasons for the sex difference with regard to caries experience remain speculative. However, the socioeco-

Table 5. Logistic regression analysis of age, sex, smoking habits, religious faith, and betel use as predictors of a low number of teeth present, a high DFT, and a high percentage DFT. Low and high were defined by using the population median value as the cut-point

| Predictor | Teeth present ≤ 29, OR (95% CI) | DFT ≥ 5, OR (95% CI) | % DFT ≥ 20%, OR (95% CI) |
|---|---|---|---|
| Age (ref = 30–39 years) | 3.2 (2.0; 5.0) | – | – |
| Sex (ref = woman) | 0.5 (0.3; 0.8) | 0.2 (0.2; 0.4) | 0.3 (0.2; 0.4) |

Table 6. Logistic regression analysis of age, sex, smoking habits, religious faith, and betel use as predictors of a low number of teeth present, a high DFT, and a high percentage DFT. Low and high were defined by using the population 25th and 75th percentile, respectively as the cut-point

| Predictor | Teeth present ≤ 26, OR (95% CI) | DFT ≥ 9, OR (95% CI) | % DFT ≥ 33%, OR (95% CI) |
|---|---|---|---|
| Age (ref = 30–39 year) | 5.0 (2.9; 8.4) | 1.7 (1.0; 2.8) | 2.9 (1.8; 4.9) |
| Sex (ref = woman) | – | 0.3 (0.2; 0.5) | 0.2 (0.1; 0.4) |
| Religion (ref = Thai Buddhist) | 0.4 (0.2; 0.8) | – | – |

nomic position of Thai women, being housewives and caretakers, may make them more exposed to cariogenic challenges and less exposed to preventive means, such as dental health care and fluoride tooth paste, than Thai men. Our observation that Muslims had greater odds for having a large number of teeth present than did Thai Buddists should be seen in the light of the caries levels being similar in the two groups. Hence, a combination of a lower socioeconomic position of the Muslims, making dental services more inaccessible, possibly combined with a more defeatist attitude to the presence of caries lesions, may explain why Muslims had higher odds for having a high number of teeth present.

Taken as a whole, the results of the present study did not confirm the notion that people of Muslim faith have higher dental disease levels than do persons belonging to the Thai Buddhist faith. Moreover, the data provide no evidence that the levels of dental disease, as judged from tooth loss and caries experience, would be higher in the present Thai population than is the case for other rural Southeast Asian populations.

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