PERIODONTAL CONDITIONS AMONG TWO NORWEGIAN PATIENT GROUPS. A STATISTICAL ANALYSIS OF THE RELATION OF PROBING POCKET DEPTH TO SEX, AGE, PLAQUE, RESIDENCE AND TORUS MANDIBULARIS

by

Svein Eggen, Bent Natvig and Jørund Gåsemyr
Eggen S, Natvig B, and Gåsemyr J. Periodontal conditions among two Norwegian patient groups. A statistical analysis of the relation of probing pocket depth to sex, age, plaque, residence and torus mandibularis.

Abstract. Probing pocket depth and other variables, such as "soft deposits" (plaque) and torus mandibularis, were investigated in the middle of the 1950s among 1451 consecutive adult patients residing in two different parts of Norway: 867 individuals indigenous to the Lofoten Islands and 584 having their home in the Gudbrandsdal Valley area. Pocket depths revealed an increase in men compared to women \( P << 0.001 \) and an increase with age \( P << 0.001 \). This corresponds to well known patterns for bone loss. Furthermore, pockets were deeper in Gudbrandsdal than in Lofoten \( P << 0.001 \). The presence of plaque showed similar patterns: it was more frequent among men than among women \( P << 0.001 \), and more frequent in Gudbrandsdal than in Lofoten \( P < 0.001 \), indicating a close relationship between plaque and pocket depth. The increase of plaque with age, however, did not reach the 5% level of significance \( P < 0.1 \) indicating that even other factors, such as the process of aging, may have had an influence on the increase of pocket depth with age. The population of Lofoten was placed at a great disadvantage as regards access to professional dental care compared with Gudbrandsdal, and was not presumed to practice more adequate oral hygiene. The more frequent presence of plaque and the deeper pockets observed in Gudbrandsdal, therefore, seemed enigmatic and remain unexplained. It is suggested, however, that factors related to the high consumption of saltwater fish in Lofoten may have had some beneficial effect. Finally, periodontal conditions appeared to be more favorable, in terms of shallower pockets, among individuals possessing torus mandibularis than among those lacking the trait. This is analogous with recent data revealing more favorable marginal alveolar bone heights among subgroups with torus mandibularis than among those without the hyperostosis. It is hypothesized that future disclosure of the molecular mechanisms underlying the development of torus mandibularis at the same time might shed some light on the factors that contribute to increase the periodontal resistance since these two parameters seemed to be genetically correlated.
A series of clinical variables was recorded among 2010 patients over 10 yr of age living in two different parts of Norway, the Lofoten Islands and the Gudbrandsdal Valley area (Fig.1). The variation of torus mandibularis (TM), a bony outgrowth on the lingual surface of the mandible, was described elsewhere (1,2). The subject of the present study is periodontal conditions.

Periodontal diseases involve a row of symptoms such as gingival color and texture alterations and bleeding on probing to the base of the pocket. The decisive threat to the tooth, however, is destruction of the periodontal ligament fibers and the bone into which they are inserted. The depth of the gingival pocket was presumed to be a reasonably good estimate of such destruction in general. This presumption has been sustained by Glass and coworkers (3), computing the correlation coefficients between marginal alveolar bone loss and five other components of periodontal disease among 635 male veterans; that is, plaque, gingivitis, calculus, pocket depth and mobility. Tooth mobility showed the greatest correlation with actual bone loss (0.72), followed by pocket depth (0.65). The correlation between bone loss and gingivitis appeared to be low (0.28).

In the above patient material (1,2), omitting individuals below 20 yr of age, the purpose of the present study was to analyse the variation of pocket depth as related to sex, age, plaque, residence and TM.

STUDY POPULATIONS AND METHODS
Consecutive patients reporting for dental treatment were examined by one observer (S.E.) during the second half of 1954 and the first half of 1955 (Lofoten), and during the second half of 1955 and the first half of 1956 (Gudbrandsdal). Virtually, none of the patients complained about subjective problems related to periodontal conditions or was seeking treatment for such problems. It therefore seemed to be no particular reason to believe that the study groups were systematically different from corresponding sex and age blocks in the resident populations with regard to the periodontal status.
Selection of teeth for study

Different teeth may be differently affected by periodontal breakdown (4). In order to reduce the number of decisions the principle of using selected index teeth for measurement has been introduced; for example 6 teeth representing the 6 segments of the dentition (5,6,7), or teeth restricted to the frontal segments (8).

In comparative studies it is pertinent that the preselected teeth are present, so that like can be compared with like. During the 1970's there was a substantial decrease in caries and extractions in Norway, ascribable to many factors but essentially to improved supply of dentists, organized fluoride brushing or rinsing, and availability of fluoridated dentifrice without prescription (9). However, the present investigation was performed prior to this new era, and loss of teeth was considerable. From experience with similar populations it was presumed that the lower front teeth had the longest standing, so the 4 lower incisors, being morphologically similar, were preselected for measurements.

Fig. 2 illustrates the actual loss rate of teeth in the entire patient groups. Approximately 80% of first molars were lost before the age of 39 yr in both jaws. Furthermore, it appears that maxillary teeth would not have lent themselves to selection at all since approximately 50% of premolars and incisors were lost before the age of 49 yr. The loss rate of the lower incisors (together with the lower canines) was to a predominant degree smaller than that for each of the other tooth types in all age classes. Altogether 1451 patients appeared to have all or some of the lower incisors present. Out of the possible number \(-1451 \times 4 = 5804\) only 160 (2.7%) were missing. There was no significant difference in loss between the 4 individual teeth. In conclusion, the mandibular incisors actually appeared to be a suitable selection for the present comparative study.

There seems to be a general agreement that the mandibular incisors are the more disadvantaged teeth with regard to alveolar marginal bone loss (4,10). The longer standing of these teeth (Fig.2) therefore may seem selfcontradictory. The likely explanation is that periodontal disease was not the principal cause of tooth loss. This is in agreement with investigations of many populations indicating that - even if breakdown of the periodontal
support is responsible for loss of many teeth - individuals at risk are confined to subfract-
tions representing 7-15% of the populations (11,12,13).

Pocket measurements

Gingival pocket depth was measured to the nearest millimetre on three points at each
incisor using a graduated probe: mesio-labially, disto-labially, and at a labial point midway
between the mesial and distal surfaces. The mesial and distal registrations were made so
close to the contact point as possible with the probe held parallel to the long axis of the
tooth. The precision of the measurement procedure based on 216 double determinations
was 0.38 mm expressed as the standard deviation of a single measurement, using the
formula $SD = \sqrt{\frac{\sum d^2}{2n}}$ where $d$ is the difference between and $n$ is the number of
double determinations. This estimate is virtually identical with that obtained by Glavind
& Løe (14), 0.36 mm, when performing double measurements on all surfaces of 6 teeth
representing all 6 segments, indicating that pocket depth is a well defined parameter and
that the millimetre is an appropriate unit for measurements.

Table 1 gives an outline of average pocket depths in the entire patient material. It ap-
pears that proximal and labial pockets were of two different kinds behaving systematically
differently, the former being 1-1.2 mm deeper than the latter ones.

This is in accordance with other evidence (15). During the analysis only estimates of the
deeper proximal pockets were considered. Mean and standard deviation were computed
separately for each of the 8 surfaces in 4 age classes, both sexes and both localities.

Torus mandibularis (TM)

TM was assessed by visual inspection and digital palpation and scored in 4 categories
previously defined (16): absent, small, medium, and large. Because of low frequencies
of the large and medium expressions (2) TM was considered as either present or absent
during the analysis. Comparison of 72 double determinations made at intervals of more
than 7 days revealed no statistically significant difference (1).
Soft bacterial deposits (plaque)

Soft deposits were scored in 4 classes: 0) absent, 1) deposits covering not more than one third of the labial tooth surface, 2) deposits covering more than one third but less than two thirds, and 3) deposits covering two thirds of the tooth surface or more. The categories 2) and 3) appeared to be infrequent, and soft deposits were considered as either absent or present during the analysis. It is presumed that the expression "soft deposits" used during the examinations is synonymous with the current term "plaque", defined as "the soft tenacious bacterial deposit which forms on the surface of a tooth" (17), and the word plaque is being used in the sequel.

Table 2 gives the distribution of the patients participating in the study by residence, sex, and age, with prevalence rates for plaque.
STATISTICAL METHODS

Pocket depth

The material was divided into 8 surface-tooth blocks corresponding to the distal and mesial surfaces of the teeth 42, 41, 31 and 32. Hence each person is contributing with only one measurement of pocket depth within each block making an assumption of independence of measurements from a fixed block realistic. To describe the statistical method we will first consider the block corresponding to the distal surface of 42.

Let within this block \( X_{ijklm} \) denote the pocket depth of the \( i \) th person with torus status \( j \) of sex \( k \) from place \( l \) and within age class \( m \). Here \( j=1 \) \((j=2)\) corresponds to absent \((\text{present})\) torus, \( k=1 \) \((k=2)\) to men \((\text{women})\), \( l=1 \) \((l=2)\) to Lofoten \((\text{Gudbrandsdal})\) whereas \( m=1,2,3,4 \) correspond to the age classes 20-29, 30-39, 40-49 and 50-70 respectively. We assume the \( X_{ijklm} \)'s to be independent and normally distributed with expectation \( \mu_{ijklm} \) and common variance \( \sigma^2 \).

To analyze the effect of torus, sex, age and place on pocket depth we used analysis of variance (18). The models were fitted using the statistical package GLIM (19). More specifically, we first used a model which relates the expectation \( \mu_{ijklm} \) to the factors via the linear function:

\[
\mu_{ijklm} = \mu + \alpha_j + \beta_k + \gamma_l + \delta_m \quad , j = 1, 2; k = 1, 2; l = 1, 2; m = 1, 2, 3, 4
\]

Omission of any of the addends \( \alpha_j, \beta_k, \gamma_l \) and \( \delta_m \) gave a statistically significant poorer fit in the goodness of fit statistic.

We were also looking for significant interaction effects between the factors above. This led to \((P < 0.05)\) a linear function of the form

\[
\mu_{ijklm} = \mu + \alpha_j + \beta_k + \gamma_l + \delta_m + \varphi_{km} \quad , j = 1, 2; k = 1, 2, l = 1, 2; m = 1, 2, 3, 4
\]

having the interaction term \( \varphi_{km} \) between sex and age.
When considering the block corresponding to the mesial surface of 41, we ended up with exactly the same linear function as above. Correspondingly for the mesial surface of 42 and the distal surface of 32 we ended up with this linear function except for a slight modification of no significant difference between the age classes 30-39 and 40-49, and for the distal surface of 31 no significant difference between the age classes 30-39, 40-49 and 50 ~ 70. For the distal surface of 41 the linear function was as above except for a significant interaction term $\varphi_{lm}$ between place and age instead of between sex and age. For the mesial surface of 31 there were significant interaction terms $\phi_{km}$ and $\phi_{jm}$ between sex and age and between torus status and age. Finally for the mesial surface of 32 there were significant interaction terms $\phi_{km}, \phi_{jl}$ and $\phi_{lm}$ between sex and age, torus status and place and between place and age.

**Plaque**

The method is identical to the one applied in (2). The material was divided into 16 sex-place-age blocks as shown in Table 2. Let $X_{klm}$ denote the number of persons of sex $k$ from place $l$ and within age class $m$ with plaque out of the total number $n_{klm}$ of persons within this block. Here $k = 1 (k = 2)$ corresponds to men (women), $l = 1 (l = 2)$ to Lofoten (Gudbrandsdal) whereas $m = 1, 2, 3, 4$ correspond to the age classes 20-29, 30-39, 40-49 and 50 ~ 70 respectively. Furthermore, let $p_{klm}$ be the probability of having plaque for a person of sex $k$ from place $l$ and within age class $m$. We assume $X_{klm}$ to be binomially distributed $(n_{klm}, p_{klm})$ for all 16 blocks.

To analyze the effect of sex, place, and age on the prevalence of plaque we used logistic regression (20). The models were fitted using the statistical package GLIM (19). More specifically, we used a model which relates $p_{klm}$ to the factors via the logit function:

$$\text{logit}(p_{klm}) = \log\left(\frac{p_{klm}}{1 - p_{klm}}\right) = \mu + \beta_k + \gamma_l + \delta_m$$

$k = 1, 2; l = 1, 2; m = 1, 2, 3, 4$

Omission of any of the addends $\beta_k, \gamma_l,$ and $\delta_m$ gave a statistically significant poorer fit in the goodness of fit statistic.

We were also looking for significant interaction effects between the factors above. This led
to \( P < 0.05 \) a logit function of the form

\[
\logit(p_{klm}) = \mu + \beta_k + \gamma_l + \delta_m + \phi_{kl} + \phi_{lm}
\]

\( k = 1, 2; l = 1, 2; m = 1, 2, 3, 4 \)

having the interaction term \( \phi_{kl} \) between sex and place and \( \phi_{lm} \) between place and age.

**RESULTS**

**Pocket depth**

By calculating the various \( \chi^2 \)-statistics with the appropriate number of degrees of freedom we arrive at the \( P \) values corresponding to the significant factors for the 8 surface-tooth blocks presented in Table 3. Pockets were significantly deeper among individuals without torus than with torus in all 8 surface-tooth blocks except possibly for the mesial surface of 41. Furthermore, for all blocks pockets were significantly deeper in Gudbrandsdal than in Lofoten and significantly deeper among men than women. Finally in all blocks pocket depth increased significantly with age. The most important interaction term between sex and age revealed that the relation of deeper pockets in the higher age classes was more dominant among men than women.

**Plaque**

The prevalence of plaque was significantly greater among men than among women, the \( \chi^2 \)-statistic with 2 degrees of freedom being 62.00 \( (P < 0.001) \). Furthermore, it was greater in Gudbrandsdal than in Lofoten on a level of significance \( P < 0.001 \). Finally the prevalence increased with age on a level of significance \( P < 0.1 \). Analysis of the interaction effect between sex and place revealed that the increased prevalence of plaque among men compared to women was stronger in Lofoten than in Gudbrandsdal. Correspondingly the interaction effect between place and age revealed that the increased prevalence of plaque with age was mainly due to such an increase in Lofoten.
DISCUSSION

Pocket depth as related to age and sex

Recently Salonen et al. (4) investigated a strict random sample of adult individuals living in Älvsborg County, Sweden, situated close to the Norwegian border. Bone levels were examined mesially and distally at all teeth on radiographs obtained with the standardized paralleling technique proposed by Eggen (21). Mean values of bone loss revealed a gradual increase with age. The present distribution of mean proximal pocket depths at the lower incisors showed the same pattern: an increase with age in both localities and both sexes (Table 3). Furthermore, the study Salonen et al. (4) revealed that men had a significantly greater loss of alveolar bone than women when adjusted for age. Once again, alveolar bone loss exhibited the same population pattern as that emerging from pocket depth in the present population groups (Table 3). The most important interaction term between sex and age revealed that the relation of deeper pockets in the higher age classes was more dominant among men than women.

The validity of the parameter pocket depth in epidemiologic research has been questioned, and Ramfjord (5) suggested that the base of the pocket should be recorded in relation to the CEJ. However, although the gingiva may be subject to recession or hyperplastic changes in individual cases, the present observations on the variation of mean pocket depth showed the same population patterns as have been described for alveolar bone loss, both with regard to sex (4) and age (3,4). Consequently, the present approach seemed to be suitable for comparison of the periodontal state between groups and subgroups.

Plaque

Plaque received little attention at the time of the present investigation, the middle of the 1950s. The classic experiments of Løe and his coworkers published in 1965, and later evidence have, however, demonstrated the close association between the formation of plaque and the development of periodontal diseases (22,23). From the present analysis it appeared that presence of plaque was more frequent among men than women ($P << 0.001$). This quite agrees with the deeper pockets in men as compared to women ($P << 0.001$).
The analysis of the interaction effect between sex and place revealed that the increased prevalence of plaque among men compared to women was stronger in Lofoten than in Gudbrandsdal.

Furthermore, the prevalence of plaque was greater in Gudbrandsdal than in Lofoten ($P < 0.001$), corresponding to the deeper pockets in Gudbrandsdal ($P << 0.001$).

Finally, the prevalence of plaque increased with age, particularly in Lofoten. However, this age increase did not reach the 5% level of significance, indicating that even other factors than plaque, such as the process of aging, may have contributed to the significant increase of pocket depth with age ($P << 0.001$).

**Lofoten versus Gudbrandsdal**

Liability to almost every common character that varies in size, or disease that varies in degree such as periodontal destruction, is multifactorial in etiology; that is, influenced both by genes and environmental factors (24). In other words, any phenotypic value $P$ is composed of the genetic component $G$ and the environmental deviation $E$; or symbolically $P = G + E$ (25).

The present groups belonged to the same Caucasian stock (2) and were therefore presumed to carry similar genetic predispositions to periodontal disease. Consequently, differences were likely to be due to environmental factors.

The Lofoten area is made up by a row of islands piercing the Norwegian Sea at 68° latitude (Fig.1). Fishing and fish manufacturing provided important sources for the income. Lofoten is the domicile of the annual *Lofot-fisket* (the spawning cod fishery), and agricultural workers and operators of small farms pursued fishing as a seasonal activity. The dentist-to-population ratio was inadequate, with one dentist per approximately 3500 inhabitants (1). The inter-island traffic and even much of the intra-island traffic involved the use of motorboats or scheduled vessel transport, making a visit to the dentist dependent on fairly good weather conditions.

The Gudbrandsdal Valley area was defined as the Lillehammer trade district; that is,
the urban municipality Lillehammer and the neighboring rural municipalities, an inland region in the south-eastern part of the country situated at 61° latitude. Agriculture, cattle breeding and forest work were important sources for the income in the rural districts. The area had also considerable income from the tourist trade. The dentist-to-population ratio was fair with one dentist per approximately 1300 inhabitants (1). Communication problems did not exist. On the whole, there were considerable environmental differences between the groups, the population of Lofoten being placed at a great disadvantage as regards the possibility of regular professional dental care. It does not seem plausible that oral hygiene habits were more adequate in Lofoten than in Gudbrandsdal in general. On these grounds the more frequent presence of plaque and the deeper pockets in Gudbrandsdal (Table 2 and 3) may seem paradoxical.

An additional environmental variable was discussed elsewhere (2): the groups appeared to be extremes with regard to the two main food items selected for hot meals, fish versus meat. People in the coastal areas of North Norway had the highest fish-to-meat ratio in the whole country, nearly 3 to 1, whereas the ratio was inverted in inland districts of south-east Norway, 3 to 1 in favor of meat (2). As to the proportional contribution of most nutrients from food items other than fish and meat the calculations made by Ögrim & Homb (26) revealed marked similarities among different groups of the people. The main reason was that milk, cereals, margarin and potatoes - the consumption of which being fairly equal in all groups - together accounted for a large supply of all nutrients covered by the survey (26). Consequently, it does not seem unlikely that the more favorable values of plaque and pocket depths in Lofoten could be attributable to the high consumption of salt-water fish in that area.

To our knowledge, the question about whether a diet chiefly consisting of meat is more liable to enhance plaque accumulation or retention than a diet characterized by fish, or if fish has particular constituents that are favorable to the periodontal health, has not been evaluated. It has been established that fluorides have an antimicrobial effect, and that topical application of high concentrations of acidulated phosphate fluoride has a reducing effect on plaque and gingivitis scores (27). However, whether mechanisms related to fluo-
rides had come into play is not known, and the difference between the two patient groups with regard to plaque and pocket depth remains unexplained.

**Pocket depth and torus mandibularis**

Periodontal diseases can no longer be regarded as a universally prevalent condition to which all members of a population are at equal risk if they fail to practice good oral hygiene (11, 24). The relative importance of heredity versus environment (the "heritability") has recently been estimated for different components of periodontal disease (28), and even for TM (16).

Suppose that the phenotypic variable periodontal destruction has an underlying continuity in the population, customary called *liability* in the context of human diseases (25). Liability is defined as being influenced by many factors, both genetic and environmental, so the shape of the continuous distribution may conveniently be thought of as being normal (25). Most individuals are positioned around the mean, whereas high-risk (susceptible) individuals will be situated towards the upper (right) extreme and resistant individuals towards the lower extreme of the distribution.

Several studies have sought an association between susceptibility and different laboratory markers (8, 11, 24). The study Amer et al. (29) supported the involvement of the histocompatibility antigen HLA-A9 in susceptibility, but indicated that HLA-A10 seemed to play a role in resistance to the disease.

The present clinical approach to the study of the parameter periodontal resistance was based on the phenomenon that, on the level of morphogenesis, gene effects are characterized by pleiotropy (30), meaning having more than one phenotypic outcome and thus producing correlated characters. The analysis revealed a more favorable periodontal condition, in terms of shallower pockets, in individuals with TM than in those without the hyperostosis (Table 3). Since this association did not seem to be affected by the significant factors sex and age, nor by variables related to residence such as plaque, it seemed likely to have a genetic background. This observation is analogous with recently published findings (31) revealing more favorable alveolar marginal bone heights among subgroups of a population
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possessing TM than among those lacking the trait. On this basis it was suggested that the complex concept periodontal resistance seemed to include genetic mechanisms underlying bone formation (31).

The genetic determinants for the development of any osseous character, such as the alveolar bone and TM, do not reside in the cells forming the bone but in the soft tissues with which they interact (32). The program for bone morphogenesis is instituted by bone morphogenetic protein (BMP) that induces differentiation of mesenchymal-type cells into osteoprogenitor cells (33). Bone-derived growth factors (BDGF) are secreted by and for osteoprogenitor cells and stimulate DNA synthesis; during bone generation and regeneration BMPs and BDGFs act in concert (33). Four BMPs have been purified from bovine bone and their amino acid sequences have been determined (34). Human cDNA clones were isolated corresponding to the isolated BMP polypeptides, and their recombinant proteins have been studied; three of the BMPs were found to be members of the transforming growth factor-beta (TGF-β) family of growth factors (34). This class of proteins acts on target cells during embryogenesis and at various times throughout life to stimulate or inhibit cell division and differentiation (35). Differentiation is a process integrated with supracellular controls, physiologic processes, and organismal functions, including positive and negative feedback reactions, growth homeostasis, and the like (33). In the case of the development of TM functional forces in terms of occlusal stresses seem to be of significant importance (2,16). One of the encoded BMP proteins did not belong to the TGF - β supergene family, but appeared to be a novel regulatory molecule (34).

It is hypothesized that further investigation on bone morphogenesis may contribute to explain the hyperostosis TM and, at the same time, to shed some light on the parameter periodontal resistance too, since previous (31) and the present observations indicated that these two variables seemed to be genetically correlated. As many growth factors or cytokines have activities distinct from those for which they were originally identified (34), it will also be of interest to assess the role of the BMP proteins in periodontal tissues other than bone.
REFERENCES


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Table 1. Mean interproximal and labial pocket depth (mm) at the lower incisors among 1451 patients, residence and sexes combined

<table>
<thead>
<tr>
<th>Age</th>
<th>Interproximal</th>
<th>Labial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of sites</td>
<td>Number of sites</td>
</tr>
<tr>
<td></td>
<td>Mean (mm)</td>
<td>Mean (mm)</td>
</tr>
<tr>
<td>20-29</td>
<td>4936 2.43</td>
<td>2468 1.23</td>
</tr>
<tr>
<td>30-39</td>
<td>3152 2.70</td>
<td>1576 1.50</td>
</tr>
<tr>
<td>40-49</td>
<td>1768 2.85</td>
<td>884  1.70</td>
</tr>
<tr>
<td>50 ~ 70</td>
<td>1432 2.72</td>
<td>716  1.77</td>
</tr>
</tbody>
</table>
Table 2. 1451 patients by residence, sex, and age, with prevalence rates for plaque.

### Lofoten

<table>
<thead>
<tr>
<th>Age, yr</th>
<th>Men n</th>
<th>With plaque %</th>
<th>Women n</th>
<th>With plaque %</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>166</td>
<td>45.2</td>
<td>237</td>
<td>24.5</td>
</tr>
<tr>
<td>30-39</td>
<td>121</td>
<td>51.2</td>
<td>119</td>
<td>31.9</td>
</tr>
<tr>
<td>40-49</td>
<td>71</td>
<td>60.6</td>
<td>60</td>
<td>25.0</td>
</tr>
<tr>
<td>50-70</td>
<td>68</td>
<td>66.2</td>
<td>25</td>
<td>32.0</td>
</tr>
<tr>
<td>Total</td>
<td>426(49%)</td>
<td>52.8</td>
<td>441(51%)</td>
<td>27.0</td>
</tr>
</tbody>
</table>

### Gudbrandsdal

<table>
<thead>
<tr>
<th>Age, yr</th>
<th>Men n</th>
<th>With plaque %</th>
<th>Women n</th>
<th>With plaque %</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>86</td>
<td>53.5</td>
<td>131</td>
<td>48.9</td>
</tr>
<tr>
<td>30-39</td>
<td>63</td>
<td>58.7</td>
<td>93</td>
<td>37.6</td>
</tr>
<tr>
<td>40-49</td>
<td>48</td>
<td>54.2</td>
<td>54</td>
<td>35.2</td>
</tr>
<tr>
<td>50-70</td>
<td>50</td>
<td>60.0</td>
<td>59</td>
<td>42.4</td>
</tr>
<tr>
<td>Total</td>
<td>247(42.3%)</td>
<td>56.3</td>
<td>337(57.7%)</td>
<td>42.4</td>
</tr>
</tbody>
</table>
Table 3. Observed P values for pocket depth in the 8 surface-tooth blocks corresponding to the factors TM, sex, place and age.

<table>
<thead>
<tr>
<th>Block</th>
<th>α_j</th>
<th>β_k</th>
<th>γ_l</th>
<th>δ_m</th>
<th>ϕ_{ij}</th>
<th>ϕ_{jm}</th>
<th>ϕ_{km}</th>
<th>ϕ_{lm}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal 42*</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>n.s.</td>
<td>&lt; 0.05</td>
<td>n.s.</td>
<td></td>
</tr>
<tr>
<td>Mesial 42</td>
<td>&lt; 0.05</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
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* Tooth codification according to the FDI's two-digit system.
Fig. 1 Domicile of the study populations.
Fig. 2 Loss rates for first molars, first premolars and lateral incisors in the entire study groups.