Prevalence of Deep Periodontal Pockets in New Mexico Adults Aged 27 to 74 Years*

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Abstract

The purpose of this study was to describe the distribution of advanced periodontal destruction (pocket depth equal to or deeper than six mm) in continuous residents, aged 27 to 74 years, of Lordsburg and Deming, New Mexico. The distance from the free gingival margin to the base of the gingival crevice or pocket was measured on the facial and mesiofacial sides of six index teeth. The presence of supragingival calculus, subgingival calculus, and plaque, as well as gingival bleeding around the index teeth, also were evaluated. Of the 372 examinees, only 46 individuals (12.4 percent) had at least one deep pocket equal to or deeper than six mm on at least one site on the six index teeth. Age was significantly associated with prevalence of deep pockets, although about 80 percent of those aged 47 to 74 years did not have deep pockets. Of those with deep pockets, 89.1 percent had fewer than four tooth sites (out of 12) affected. The only significant risk factor of the presence of deep pockets, other than age, was the number of teeth with plaque accumulations. Age and the number of teeth with plaque explained only 10.5 percent of the variability in the prevalence of deep pocketing, suggesting that risk factors other than those included in this study may be important. The results of this study indicate that destructive periodontal disease occurs at selected sites within the mouth, and that about 87 percent of the adults over age 27, in this population, do not have deep pockets in the six index teeth examined.

Key Words: gingivitis, periodontal disease, periodontic pockets, epidemiology, oral hygiene

Introduction

A number of recent studies have shown that from 1 percent to about a third of adults older than 20 years may have advanced periodontal disease (1–6). In the 1980 Iowa Survey of Oral Health (1), where pocket depth measurements were obtained from the six index teeth used by Ramfjord (7), 20.5 percent of the 84 examinees aged five to 65 years had one or more pockets 4.0–5.0 mm deep, and only 1.3 percent had at least one deep pocket. This finding concurs with a recent study (2) of a selected group of 71 adults (of unreported race) aged 15 to 100 years, residing in a high-fluoride (2.0–3.0 ppm F) village in South Africa. Out of 1,658 pocket measurements obtained from the mesial, facial, and lingual surfaces of the six index teeth of Ramfjord, only eight percent were in the range of 4.0–5.0 mm, and just 0.5 percent were deep pockets. Other studies conducted with random samples of adults from the Netherlands (3), Sweden (6), and Finland (5) also have shown that the prevalence of deep pocketing is only about 10, eight, and 25.6 percent, respectively. Moreover, the few studies available on deep pocketing may indicate that if deep pocketing is present it usually affects only a few teeth (8).

This brief review of the literature suggests that the majority of adults may not have deep pocketing, and that when deep pocketing is present in the mouth it may only affect a few teeth. In this study, pocket-depth data collected from 372 adults aged 27 to 74 years residing in Lordsburg and Deming, New Mexico, will be used to test this hypothesis.

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Even after correction for the possible underestimation, about three-fourths of the adults in the two communities remain without advanced periodontal destruction.
and others (3). Data on loss of periodontal attachment measured from the cementoenamel junction to the base of the pocket (7) will not be presented in this study.

The measurement of the four oral conditions was carried out as follows:

**Dental plaque**
For measuring the presence or absence of plaque, the examiner first observed the index tooth. If plaque was obvious, the tooth was given a positive score (one). If plaque was visible when the cervical margin was contacted by an explorer, a positive score was given. If these procedures did not reveal the presence of plaque, a zero score was awarded to the tooth.

**Gingival bleeding**
Assessment of the presence of gingival bleeding was carried out by running a Hu-Friedy no. 11 periodontal probe in the gingival crevice of the index teeth. The examiner first checked the upper index teeth and returned to check whether there was bleeding at the midpoint of the facial surface and the mesiofacial line angle of the gingival margin. The procedure was then repeated on the lower arch. If bleeding was noticed, the examiner awarded the tooth site a positive score, while if no bleeding was noticed, a score of zero was ascribed.

**Calculus**
In assessing the presence of calculus, the examiner first probed using a no. 17 explorer for subgingival calculus on each index tooth. Subgingival calculus was defined as dense hard accumulations below the free gingival margin. If any subgingival calculus was detected, a score of two was called and the examination moved to the next index tooth. If subgingival calculus was not detected, then the examiner proceeded with the visual and tactile inspection for supragingival calculus. Supragingival calculus was defined as hard accumulations coronal to the gingival margin, white or yellow in color and of hard, clay-like consistency.

**Pocket depth**
A Hu-Friedy no. 11 periodontal probe was used to measure to the nearest mm the distance from the free gingival margin to the base of the pocket or gingival crevice. The examiner first identified the index tooth (starting with the maxillary right first molar); then the probe, held in a pencil grip, was placed against the enamel surface coronal to the margin of the gingiva so that the angle formed by the working end of the probe and the long axis of the crown of the tooth was approximately 45 degrees. A minimal force was used to pass the probe in an apical direction maintaining contact with the tooth. The angle between the probe and the tooth was decreased slightly when the probe touched the gingiva to avoid pressure on the gingiva. When the probe was inserted in the gingival crevice the angle of insertion was changed to maintain contact with the root surface. The probe was always pointed toward the apex of the tooth or the central axis of a multirooted tooth. When the examiner, while still maintaining the light grasp, felt resistance to the apical movement of the probe he recorded the distance the probe had been inserted using the free gingival margin as a landmark.

The correlation coefficients between pocket depth at each tooth site and loss of periodontal attachment at the site were between 0.65 and 0.82. All of the shallow or deep pockets identified in this analysis were associated with actual loss of periodontal attachment. Findings of the analysis of the association between pocket depth and loss of periodontal attachment can be obtained from the authors.

**Statistical analysis.** Two sets of summary data were computed for the purpose of this analysis. The first represented the number of teeth (six in all) or tooth sites (12 in all) with supragingival calculus only, subgingival calculus, plaque, gingival bleeding, and with shallow or deep pockets. The second set of summary data was computed using a simple procedure: each individual was classified according to whether or not he or she had the condition under study.

Comparisons between ages, gender, race, and education groups, and residence in the two cities were first carried out using the mean number of teeth or tooth sites with the different oral conditions. Testing whether the differences observed were due to chance or not was carried out using Student’s t-test or analysis of variance with Scheffe’s confidence intervals. Comparisons were also carried out on the prevalence data. Testing for statistical significance was assessed using the chi-square test or Fisher’s exact probability test (13).

To test the combined effects of several risk factors associated with the probability of concurrently having at least one tooth site with a deep pocket, the logistic regression model was used (14). The regression coefficients from this model estimate the increase in the odds ratio (14), which estimates the increase in the probability of concurrently having deep pockets given the presence of one or more of the risk factors. Statistical significance of the logistic regression coefficients was assessed by comparing the ratio of the coefficient to its standard error with a standard normal distribution (14).

**Results**

**Mean number of pockets by pocket depth.** No differences were found between the residents of the two cities in the mean number of tooth sites with pockets of different depths and in the distribution of adults according to pocket depth (Table 1). Therefore, pocket depth data of the residents of both cities were combined during analysis.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Mean Number of Tooth Sites per Person (Out of 12 Sites in All) by City of Residence and Pocket Depth, for Those Ages 27 to 74 Years, * Lordsburg and Deming, New Mexico, 1984†</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>Pocket Depth in mm</td>
</tr>
<tr>
<td></td>
<td>0–3</td>
</tr>
<tr>
<td>Lordsburg, NM</td>
<td>186</td>
</tr>
<tr>
<td>Deming</td>
<td>186</td>
</tr>
</tbody>
</table>

*For a description of the method of selection of residents, see the section “Recruitment of subjects.”
†When p-values are not presented, the differences are not statistically significant.
‡n = Number of individuals.
The mean number of tooth sites (out of 12 tooth sites) by age and pocket depth are presented in Table 2. About 90 percent of the tooth sites had pockets between zero and three mm in depth. The mean number of tooth sites with no pockets significantly decreased with increasing age, while the mean number of tooth sites with shallow or deep pockets increased with increasing age. The increase was significant only for deep pockets.

The mean numbers of tooth sites by pocket depth and education are presented in Table 3. Those with a formal education less than grade nine had a higher mean number of tooth sites with deep pockets than those who had completed high school or attended college, but the difference was not statistically significant. The number of sites with no pocketing increased significantly with advanced education, while the mean number of tooth sites with shallow pockets decreased significantly with increased education status.

Those who considered themselves Hispanic in both cities did not have a significantly different mean number of tooth sites with deep pockets than other residents. Females did have a significantly lower number of tooth sites with deep pockets.

**TABLE 2**

Mean Number of Tooth Sites per Person (Out of 12 Sites in All) by Age and Pocket Depth, for Those Ages 27 to 74 Years, Lordsburg and Deming, New Mexico, 1984

<table>
<thead>
<tr>
<th>Age Group in Years</th>
<th>Pocket Depth in mm</th>
<th>Mean No. of Tooth Sites Examined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-3</td>
<td>4-5</td>
</tr>
<tr>
<td>27-46</td>
<td>252</td>
<td>10.83</td>
</tr>
<tr>
<td>47-74</td>
<td>120</td>
<td>9.85*</td>
</tr>
<tr>
<td>Total</td>
<td>372</td>
<td>10.52</td>
</tr>
</tbody>
</table>

*Mean Number of 0-3 pockets was significantly higher in those aged 27-46 years, p<0.0001.
†Mean number of deep pockets was significantly higher in those aged 47-74 years, p<0.013.

**TABLE 3**

Mean Number of Tooth Sites per Person (Out of 12 Sites in All) by Education Status and Pocket Depth, for Those Ages 27 to 74 Years, Lordsburg and Deming, New Mexico, 1984

<table>
<thead>
<tr>
<th>Education by Grade Completed</th>
<th>Pocket Depth in mm</th>
<th>Mean No. of Tooth Sites Examined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-3</td>
<td>4-5</td>
</tr>
<tr>
<td>1-8</td>
<td>37</td>
<td>9.37</td>
</tr>
<tr>
<td>9-11</td>
<td>73</td>
<td>10.26</td>
</tr>
<tr>
<td>12</td>
<td>165</td>
<td>10.60</td>
</tr>
<tr>
<td>College</td>
<td>94</td>
<td>11.09*</td>
</tr>
<tr>
<td>Total</td>
<td>369</td>
<td>10.53</td>
</tr>
</tbody>
</table>

*The mean number of 0-3 mm pockets in those with low formal education (less than grade nine) was significantly lower than in those who completed high school or attended college based upon Scheffe’s 95 percent confidence interval.
†The mean number of 4-5 mm pockets in those with low formal education was higher than in those who attended college (Scheffe’s 95 percent confidence interval).

**TABLE 4**

Number and Percent of Individuals by Pocket Depth and Age,* Lordsburg and Deming, New Mexico, 1984 (n = 372)

<table>
<thead>
<tr>
<th>Age Group in Years</th>
<th>At Least One Shallow Pocket†</th>
<th>At Least One Deep Pocket‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>27-46</td>
<td>87</td>
<td>34.5</td>
</tr>
<tr>
<td>47-74</td>
<td>53</td>
<td>44.2</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>37.6</td>
</tr>
</tbody>
</table>

*Categories are not mutually exclusive.
†4-5 mm deep.
‡Equal to or deeper than 6 mm.

**Distribution of the examined individuals by pocket depth.** Of the 372 examinees included in this analysis, only 46 individuals (12.4 percent) had one or more deep pockets (Table 4). Only 2.1 percent of all pocket measurements demonstrated deep pockets. Shallow pockets were present in 37.6 percent of the examinees, with only seven percent of all pocket measurements demonstrating a depth between 4.0 and 5.0 mm. The percentage of deep pockets significantly increased with increasing age from 8.3 percent between 27 and 46 years, to 20.8 percent in those over 46 years of age.

The distribution of the number of tooth sites in those individuals with at least one deep pocket is presented in Figure 1. Of the 46 individuals with such pockets, 28 had only one tooth site equal to or deeper than 6.0 mm. About 89 percent of those with deep pockets had fewer than four such pockets. Only one individual had 11 of the 12 tooth sites examined with deep pockets.

The mean numbers of 0.0-3.0 and 4.0-5.0 mm pockets are presented in Figure 2. In those with less than four tooth sites with deep pockets, over half of the tooth sites were not affected by pocketing.

Deep pockets, calculus, and plaque. The mean numbers of teeth without calculus, the number with supragingival calculus alone, those with subgingival calculus, and those with plaque are presented in Table 5. About 98 percent of the examinees had supragingival calculus on more than one of the six index teeth, and 20.1 percent had at least one tooth with only supragingival calculus. Dental plaque accumulations were found in 67.6 percent of the examinees. Those with deep pockets had a significantly higher mean number of teeth (out of six index teeth) with plaque accumulations. They also had a significantly lower mean number of teeth without calculus.

Deep pockets and gingival bleeding. A significantly higher percentage of those with deep pockets had tooth sites with gingival bleeding than those without such pockets (p = 0.04, Fisher’s exact probability test) (Table 6). Of the 46 individuals with deep pockets, 38 individuals (82.6 percent) had at least one tooth site with gingival bleeding, while 69.9 percent of those without deep
FIGURE 1
Number of Individuals with Deep Pockets by Number of Tooth Sites Affected

FIGURE 2
Mean Number of 0-3 and 4-5 mm Pockets in Those with at Least One Deep Pocket
TABLE 5
Mean Number of Teeth per Person (Out of Six Index Teeth) with No Calculus, with Supragingival Calculus Only, with Subgingival Calculus, and with Plaque, by Pocket Depth, Lordsburg and Deming, New Mexico, 1984

<table>
<thead>
<tr>
<th>Presence of Deep Pockets</th>
<th>None</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>No calculus</td>
<td>0.22</td>
<td>0.06</td>
</tr>
<tr>
<td>Supragingival calculus only</td>
<td>0.42</td>
<td>0.06*</td>
</tr>
<tr>
<td>Subgingival calculus</td>
<td>5.20</td>
<td>5.40</td>
</tr>
<tr>
<td>Number of teeth with plaque</td>
<td>1.93</td>
<td>3.82t</td>
</tr>
</tbody>
</table>

*Mean number of teeth with only supragingival calculus is higher in those without deep pockets, p<0.04.
†Mean number of teeth with plaque is higher in those with deep pockets, p<0.001.

pockets had gingival bleeding. The mean number of tooth sites for those with deep pockets was 4.28, while for those without deep pockets it was 2.21 (difference was statistically significant, p<0.0001).

Findings from the logistic regression model. The results of logistic regression model, which associates the probability of concurrently having deep pockets with different risk factors, are presented in Table 7. The significant correlates with presence of deep pockets were age and the number of teeth with plaque. Presence of supragingival and subgingival calculus and gingival bleeding all failed to remain significantly associated with the probability of having deep pockets when age and the number of teeth with plaque were accounted for. Age and the number of teeth with plaque only explained 10.5 percent of the variability in the prevalence of deep pocketing.

Discussion

The target population in this study was all residents of Lordsburg and Deming, New Mexico, who were born and lived for at least the first six years of their lives in their respective communities. It was estimated from US Census data, and estimates of the local organizers, that more than 200 residents over 30 years of age may have been eligible to participate. Selection of these individuals was achieved using local recruiters who contacted all known eligible residents in both communities.

As might be expected, the results of this study should be interpreted with the caveat that data were collected from individuals who may not represent any other population group outside their own communities.

The use of six index teeth to estimate the mean loss of periodontal attachment or Periodontal Disease Index scores has been reported to represent validly the status of the mouth (15,16). But the limited data presented to support this argument did not consider that deep pocketing may only be present around a few teeth and, thus, when index teeth are used rather than all teeth present in the mouth in an analysis similar to the one presented here, the prevalence of deep pocketing may be underestimated. Unpublished analysis of loss of periodontal attachment data collected in 1958 from 1,976 New Mexicans aged 17 to 46 years indicates that the percentages of individuals with advanced loss of periodontal attachment (greater than six mm) could be underestimated by about 50 percent in those aged 17-46. (Results of the analysis can be obtained from the authors.) These findings are similar to those of Ainamo and Ainamo (17).

TABLE 6
Number and Percent of Individuals with One or More Pockets Greater than Six mm by Status of Gingival Bleeding on Facial and Mesiofacial Sites of Six Index Teeth of Ramfjord (5). Residents of Lordsburg and Deming, New Mexico, 1984.

<table>
<thead>
<tr>
<th>Gingival Bleeding (GB)</th>
<th>None of the Index Teeth had GB</th>
<th>At Least One Index Tooth Site Had GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of Deep Pockets</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>None</td>
<td>98</td>
<td>30.1</td>
</tr>
<tr>
<td>At least one tooth site with a deep pocket</td>
<td>8</td>
<td>17.4</td>
</tr>
</tbody>
</table>

TABLE 7
Logistic Regression Coefficients (± SEM) of the Probability of Having at Least One Pocket Deeper than Six mm Associated with Residence, Gender, Education Status, Age, Number of Teeth with Plaque, and Number of Tooth Site With Gingival Bleeding, Lordsburg and Deming, New Mexico, 1984.

<table>
<thead>
<tr>
<th>Variable name</th>
<th>B</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>0.27</td>
<td>0.39</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.53</td>
<td>0.34</td>
</tr>
<tr>
<td>Education</td>
<td>-0.10</td>
<td>0.18</td>
</tr>
<tr>
<td>Age†</td>
<td>1.04</td>
<td>0.36*</td>
</tr>
<tr>
<td>Race‡</td>
<td>0.40</td>
<td>0.45</td>
</tr>
<tr>
<td>Number of teeth with plaque**</td>
<td>0.30</td>
<td>0.09*</td>
</tr>
<tr>
<td>Number of tooth sites with gingival bleeding**</td>
<td>0.12</td>
<td>0.06</td>
</tr>
</tbody>
</table>

*Significantly different from zero with more than five percent confidence.
†Age in years was coded into groups: 1 = 27-46 and 2 = 47-74.
‡Race was coded: 1 = Hispanic, 2 = other.
**Total number of teeth was six; tooth sites was 12.
Hence, an inflation of the figures presented in this paper will result in a prevalence of deep pocketing of 25 percent instead of 12.4 percent, and a mean number of tooth sites with deep pocketing equal to 0.50 instead of 0.25. Even after this correction for the possible underestimation, about three-fourths of the adults in the two communities still remain without any advanced periodontal destruction.

The results of the study reported here show that only 8.3 percent and 20.8 percent of the adults aged 27-46, and 47-74, respectively, had at least one deep pocket, and 89.1 percent of those with deep pockets had fewer than four tooth sites affected. These percentages are higher than those reported by Beck and colleagues (1) for similar age groups, Reddy and others (2) for South Africans over the age of 15, and approach those reported by Markkanen and colleagues (5) in Finnish adults aged 30 years and over. Similar data on prevalence of deep pocketing in residents of the southwestern region of the United States could not be found. The Sheiham and Striffler (18) analysis of data, gathered from 1,976 young adults residing in New Mexico in 1958, showed that Hispanics and American Indians had more severe periodontal disease (based upon loss of periodontal attachment measurements) than others and that the number of years of schooling was positively associated with the severity of periodontal disease. The data presented in this study may suggest that the relatively higher prevalence of deep pocketing, when compared to the data from Beck and colleagues (1), may be because of the higher prevalence of plaque, calculus, and gingival bleeding in the examinees. In the Iowa survey (1), about 63-76 percent of those examined had at least one index tooth with calculus, and about 38-47 percent had teeth with gingival bleeding after probing (prevalence of plaque was not reported) (1). In the study reported here, 67 and 98 percent of those examined had at least one tooth with plaque and calculus, respectively. Despite this high percentage of persons with plaque and calculus, about 80 percent of those aged 47 to 74 years had no demonstrable deep pockets.

In 60 percent of those with deep pockets, only one tooth site was affected and about 50 percent of the tooth sites in those individuals had no pockets. The data depicted in Figure 2 may support the thesis suggested by Socransky and others (19) that deep pocketing occurs at specific tooth sites within the mouth while other tooth sites within the same mouth are either free from periodontal disease or mildly affected.

An important correlate with the presence of deep pocketing in this study was the presence of plaque, while the presence of supragingival or subgingival calculus was not associated with deep pocketing. Presence of plaque alone only explained 8.3 percent of the variability in the prevalence of deep pocketing; plaque and age together explained only 10.5 percent of the variability. This analysis shows that while the presence of plaque was an important risk factor for deep pocketing, about 90 percent of the variability in the prevalence of deep pocketing remained unexplained.

The planning of public health programs to prevent and control periodontal disease will require answering a number of yet unanswered questions about the distribution and risk factors associated with periodontal disease. What is needed first is the precise definition and measurement of each condition (gingivitis; shallow, medium, and deep pockets). The use of measurement criteria that lump gingivitis and periodontitis together may provide useful data for planning and estimation of treatment needs. The most important issue that public health programmers need to answer is just when a periodontal condition (gingivitis or periodontitis) is to be considered a health problem that will require commitment of personnel and funds. This limited study has shown that deep periodontal destruction will be found in one-fourth of the population and on average will affect one to two teeth per individual. If these affected teeth are more prone to be lost as a result of loss of periodontal support, then it will be necessary to include screening for presence of deep pocketing in a public health program. Identification and referral for treatment could be one of the objectives of a public health program to control and prevent periodontal disease.

Conclusions

The results of this analysis show that only 12.4 percent of those over age 27 years had deep pocketing on one or more of the six index teeth; when present, the deep pockets usually involved only one or two of the index teeth, rather than presenting a generalized condition. Only five persons had deep pockets on four or more of the 12 sites measured. These findings were in a population that had received little dental care, and where oral hygiene status and gingival conditions were extremely poor.

About seven percent of all tooth sites examined had shallow pockets (4.0-5.0 mm in depth); these pockets occurred in 37.6 percent of persons examined. About 2.1 percent of all tooth sites examined had deep pockets and were clustered in 12.4 percent of the adults. Presence of plaque was the most important risk factor associated with deep pocketing; however, about 90 percent of the variability in the prevalence of deep pocketing was not explained by presence of plaque, calculus, age, education status, gender, ethnic group, or residence in either an optimally fluoridated or a high fluoride (3.8 ppm) community.

Acknowledgments

The authors thank Dr. Edith C. Morrison, Department of Periodontics, School of Dentistry, the University of Michigan, for assistance in training the examiners to measure pocket depth and loss of periodontal attachment measurements.

... when index teeth are used rather than all teeth present in the mouth in an analysis similar to the one presented here, the prevalence of deep pocketing may be underestimated.
tal attachment. The local coordinators, Ms. Maura Rico in Lordsburg, and Mrs. Lucretia Jones in Deming, New Mexico, along with numerous others in each community, performed magnificently in the critical task of identifying and recruiting the subjects for the study. Without their considerable effort and organizational skills, the study would have been impossible. They also thank Mr. Juan Garcia and Mr. John Trumbull of the New Mexico Health and Environment Department for their help during the project.

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