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Alveolar Bone Loss in Leprosy— A Clinical and Radiological Study*

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Alveolar bone loss in 47 patients with lepromatous, borderline or tuberculoid leprosy was studied clinically and radiographically. Alveolar bone loss was greater in the maxillary anterior region than in other areas. Alveolar bone loss around maxillary central incisors, measured on periapical radiographs, was significantly greater in patients with lepromatous leprosy. No changes in alveolar bone loss could be detected over 6 months. These results were compared with measurements of alveolar bone loss from 56 patients without leprosy who sought dental treatment. These data are interpreted to mean that bone loss between maxillary anteriors is a characteristic manifestation of leprosy, particularly of the lepromatous type.

Introduction

Oral manifestations of leprosy have been well documented. Lighterman *et al.* (1962) have described nerve and soft tissue involvement in patients with lepromatous and tuberculoid leprosy. While oral lesions usually develop late in the disease, they can be present soon after onset or without systemic involvement (Sala, 1957).

Skeletal manifestations of leprosy are characteristically resorptive in nature and their incidence and treatment in the upper and lower extremities have been studied (Paterson, 1961). Resorption of the anterior nasal spine and maxillary alveolar process were first noted by Møller-Christensen (1952, 1953) in skeletons from a leper cemetery from medieval Denmark. Michman and Sagher (1957), studying these changes in a group of patients with leprosy in Jerusalem, noted that resorption of the anterior nasal spine and maxillary alveolar process tended to occur together, varied directly with the duration of the disease, and correlated with other skeletal changes in the nose, hands and feet.

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The objectives of the present report were to measure alveolar bone loss in patients with different types of leprosy and to determine if alveolar bone loss is different among the types. Furthermore, we assessed the periodontal condition of these patients to determine if alveolar bone loss could be attributable to advanced periodontal disease or to leprosy. We have found that alveolar bone loss is greatest in the maxillary incisor region and that patients with lepromatous leprosy have a significantly greater loss of alveolar bone in this location than do patients with borderline or tuberculoid leprosy.

Materials and Methods

Forty-seven patients with anterior teeth were selected from the patient population at the National Leprosy Control Centre, Sungei Buloh, Malaysia. The type of leprosy was determined by smears and clinical examination (Jopling, 1971). All patients were under treatment. The oral condition of each patient was evaluated clinically by noting the gingival condition, by measuring periodontal pocket depth at 3 buccal and 3 lingual positions on each tooth, and by periapical and occlusal radiographs.

The gingival condition of each patient was classified as good (stippling present without inflammation), fair (inflammation limited to marginal gingiva) or poor (inflammation extending beyond marginal gingiva to include other parts of the periodontium). Pocket depths were measured with a periodontal probe and recorded to the nearest millimetre (Glavind and Löe, 1967).

Radiographs were taken with a Siemens Heliosphere machine (60 kV, 10 mA) using the paralleling long-cone technique where possible (Lang and Hill, 1977). For occlusal radiographs, the angle between the film and X-ray beam was individually adjusted between 50°–60° for each patient. In 10 patients representing each type of disease, intra-oral periapical radiographs were taken of the entire mouth. In the other patients, radiographic studies were confined to the maxillary anterior region. Alveolar bone support was measured on radiographs by a modification of the method of Schei *et al.* (1959). The modified method expresses the height of alveolar bone, from root apex to alveolar crest, as a percentage of the distance between the root apex and the cemento-enamel junction on that side of the tooth (see Fig. 5). Measurements of these distances on periapical radiographs were made to the nearest 0.1 mm using an adjustable fine-point compass and an engineer's calipers (micrometer). Measurements were expressed as the mean of determinations made on the mesial and distal of each tooth. In several patients we were unable to make these measurements because of overlapping teeth, or difficulties in locating landmarks. Measurements were not affected by our inability to standardize X-ray beam angles because most measurements were made in the maxillary anterior region where variations of up to 10 degrees have little effect on the calculation of alveolar bone support using this method (Schei *et al.*, 1959). Data were converted to percentage alveolar bone loss by subtracting these values from 100. Statistical evaluation of results was by the Student's *t*-test.

After the initial evaluation, some patients received a thorough scaling and polishing. All patients were instructed in oral hygiene and given toothbrushes and toothpastes for maintenance. Thirty patients who received scaling and polishing and 17 who did not were followed on a monthly basis for up to 6 months. Each month, radiographs and clinical examinations were repeated and scaling and polishing were continued on those patients in whom they had been done initially.

Results

Characteristics of our patient population are summarized in Table 1. The proportion of patients with lepromatous leprosy in our study is the same as that in the leprosy population in Malaysia. We increased the proportion of patients with borderline leprosy in our study primarily for statistical reasons and did this at the expense of patients with the tuberculoid type of the disease. The distribution of patients by ethnic group is similar to that in the leprosy population in Malaysia. The known duration of leprosy in these patients by disease type is shown in Fig. 1. These data underestimate the duration of the disease in many cases. The range of duration of disease is similar among the 3

TABLE 1
Characteristics of patient population

(a) *By Disease Type*

	Lepromatous	Borderline	Tuberculoid
Number of patients	20	14	13
Percentage of patient population	43	30	27
Percentage of diagnosed leprosy population in Malaysia*	44	15	38

(b) *By Ethnic Group*

	Indian	Malay	Chinese
Number of patients and age range	6 26–76 yr	10 15–54 yr	31 15–80 yr
Percentage of patient population	13	21	66
Percentage of diagnosed leprosy population in Malaysia*	14	35	50
Percentage of general population in Malaysia*	9	56	34

*Data taken from the 1976 Annual Report of the National Leprosy Control Centre, Sungei Buloh, Malaysia.

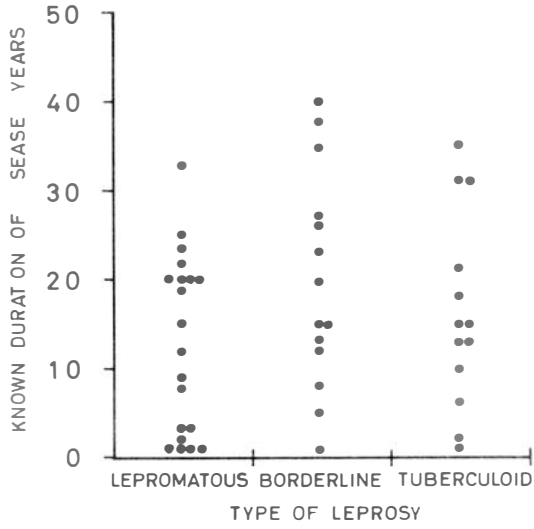

Fig. 1. Distribution of patient population by type and known duration of leprosy.

types. The duration of untreated leprosy in each patient was unknown and not obtainable from the data to which we had access. Notice that 7 patients with lepromatous leprosy and 2 patients in each of the other 2 groups had the disease for 5 years or less. The mean age of patients with lepromatous, borderline and tuberculoid leprosy was 40, 48 and 47 years respectively.

The periodontal condition in the majority of these patients was healthy. Of the 18 patients with lepromatous leprosy, 15 had either good or fair gingival condition and pocket depths of less than 3 mm. In the remaining 3 patients, the gingival condition was poor, and one or more periodontal pockets greater than 3 mm were present. In 14 of 16 patients with borderline leprosy, the gingival condition was good or fair. All 16 had pocket depths less than 3 mm. In 10 of 13 patients with tuberculoid leprosy the gingival condition was fair or better and only 1 of the 3 remaining patients with poor gingival condition had any periodontal pockets greater than 3 mm.

Alveolar bone loss was evaluated clinically and radiographically in 10 patients representing each of the 3 types of leprosy. In all of these patients, bone loss, measured radiographically and by clinical examination, was greater around anterior teeth than posterior teeth. In 9 of them, bone loss was greater around maxillary anteriors and in 1 around mandibular anteriors. As a consequence of these observations, we focused the rest of our investigations on the maxillary anterior region.

Clinical intra-oral photographs of representative patients with lepromatous, borderline and tuberculoid leprosy are shown in Figs 2, 3 and 4 respectively. Notice that gingival recession around maxillary incisors is greater in the patient with lepromatous leprosy (Fig. 2) than in those with borderline (Fig. 3)

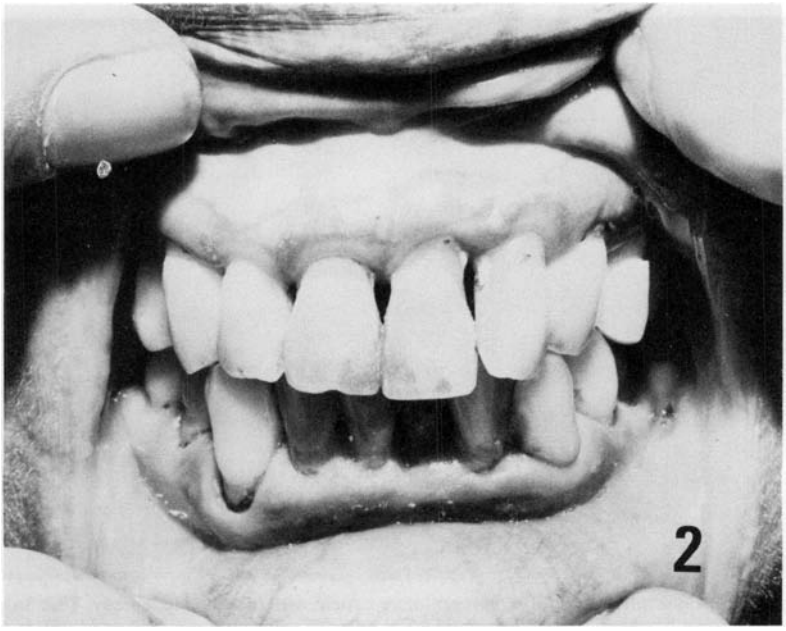

Fig. 2. Intra-oral photograph of the dentition and gingiva of a representative patient with lepromatous leprosy. This 53-year-old Malay male has been treated for leprosy for over 32 years.

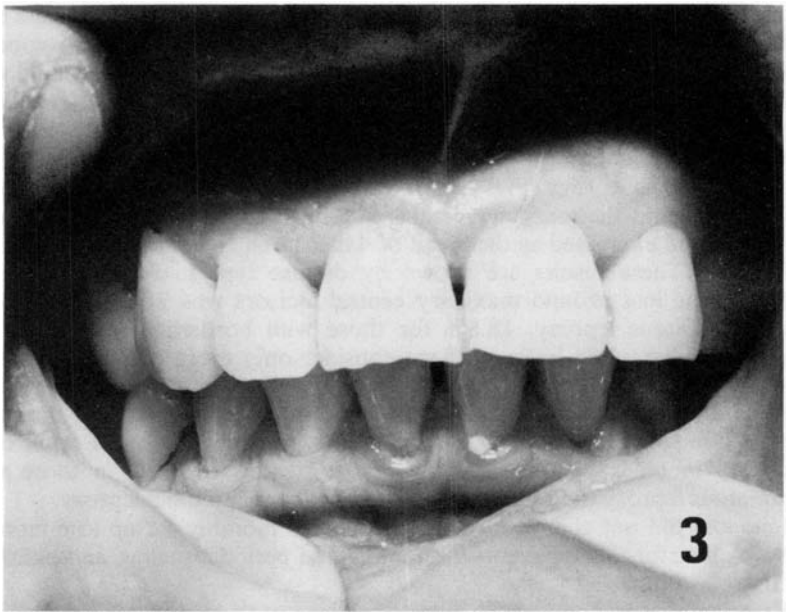

Fig. 3. Intra-oral photograph of a representative patient with borderline leprosy. This 40-year-old Chinese male has been treated for over 27 years. Gingival condition is very good.

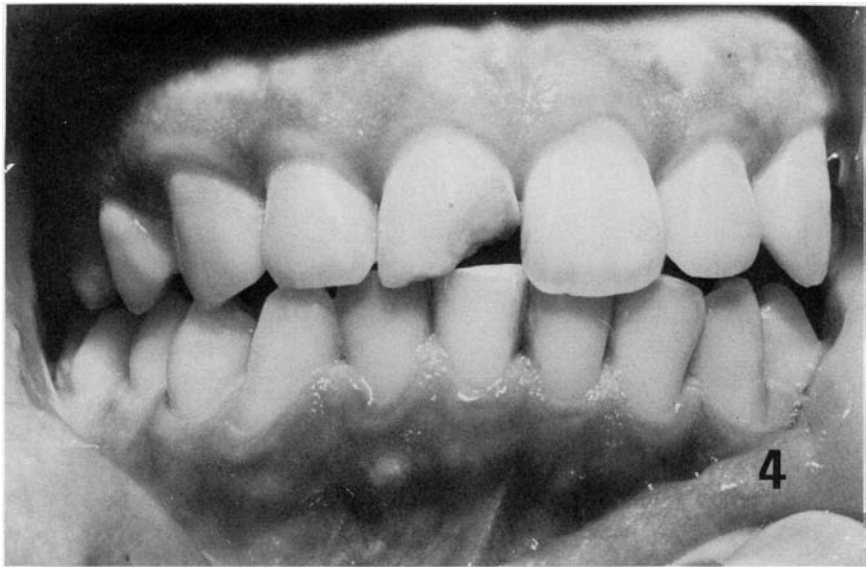

Fig. 4. Intra-oral photgraph of a representative patient with tuberculoid leprosy. This 36-year-old Malay male has been treated for leprosy for over 20 years. His gingival condition is much better than the patient shown in Fig. 2.

or tuberculoid (Fig. 4) leprosy. Pocket formation in all 3 patients was less than 2 mm. While the patient with tuberculoid leprosy (Fig. 4) is much younger than the patient with lepromatous leprosy (Fig. 2), the periodontal condition of older patients with tuberculoid leprosy was similar to that of the patient shown in Fig. 4.

A periapical radiograph of the maxillary central incisors from the patient with lepromatous leprosy (Fig. 2) is shown in Fig. 5. Measurements of alveolar bone loss around the maxillary central incisors were made from radiographs like Fig. 5 and expressed as the mean of 4 measurements, mesial and distal on each tooth. These results are shown by disease type in Fig. 6. The mean alveolar bone loss around maxillary central incisors was 26.1% for patients with lepromatous leprosy, 18.8% for those with borderline and 18.5% for those with tuberculoid leprosy. If we consider only those patients known to have leprosy for more than 5 years (shown in "O" column above lepromatous and less 2 patients each for the borderline and tuberculoid types), the mean alveolar bone loss is 31.8%, 19.4% and 19.9% respectively. In the latter case, bone loss in older patients is significantly greater ($t < 0.01$) in those with lepromatous leprosy than those with borderline or tuberculoid leprosy.

Bone loss did not change in patients followed monthly for up to 6 months. This was true for those patients with initial and periodic scaling and polishing and those without.

We attempted to compare alveolar bone loss in these patients with leprosy to that in patients without leprosy from the general population. Similar

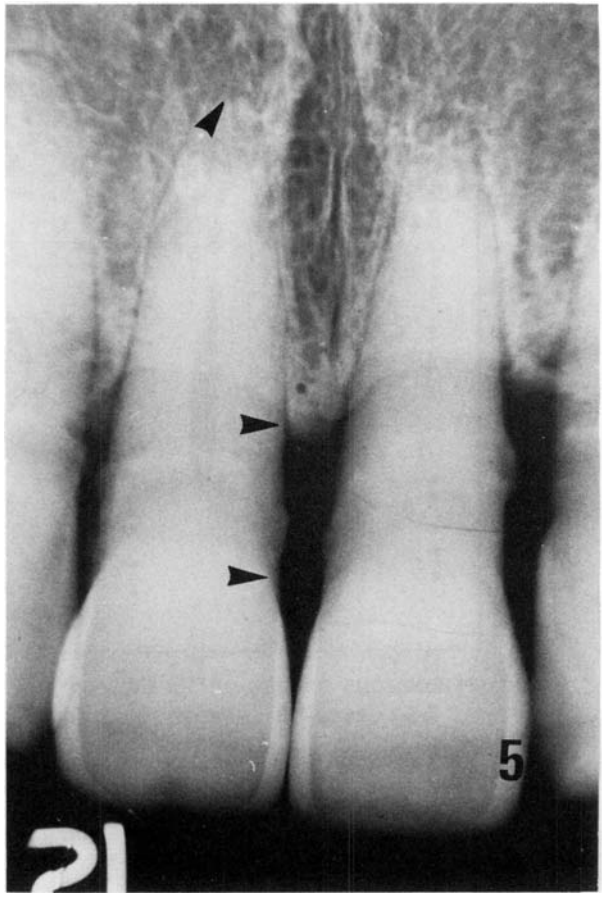

Fig. 5. Periapical radiograph of maxillary central incisors from the patient with lepromatous leprosy shown in Fig. 2. The landmarks used to measure alveolar bone loss are indicated by arrows. Alveolar bone loss in this patient was 32.5%.

measurements were made on periapical radiographs of 56 randomly selected patients who had presented at the University of Malaya Faculty of Dentistry for evaluation of maxillary incisors. Data from these patients were subdivided by age group. Mean alveolar bone loss for patients without leprosy was 18.2% in the 3rd decade, 23.2% in the 4th, 30.1% in the 5th and 32.8% in the 6th.

Discussion

The relative effectiveness of radiographs and clinical examination for evaluating periodontal condition and bone support have been recently reviewed (Lang and Hill, 1977). Because periapical radiographs and clinical

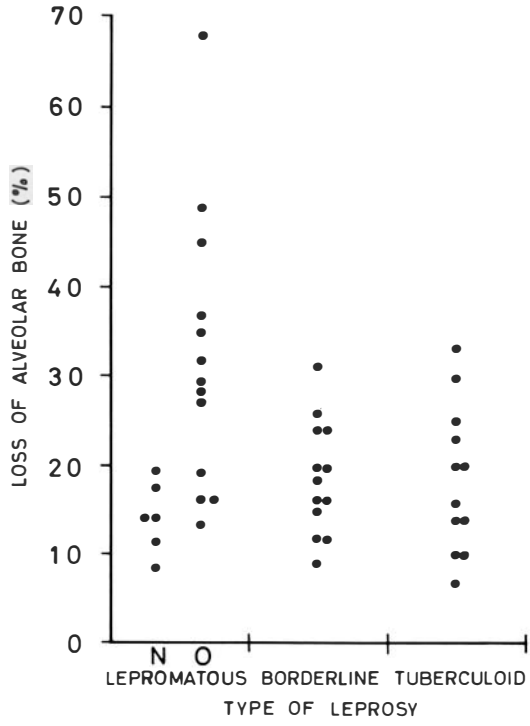

Fig. 6. Graph of alveolar bone loss around maxillary central incisors in patients with leprosy by disease type. In the lepromatous group, patients known to have the disease 5 years or less are shown above N (new); those known to have the disease longer than 5 years above O (old). Only 2 patients each in the borderline and tuberculoid groups were in the former group. We have not indicated these 4 patients separately because their alveolar bone loss was near the mean for their groups (see text).

probing underestimate alveolar bone loss, often by as much as 1–2 mm (Glavind and Löe, 1967; Soumi *et al.,* 1968), combined use of these methods is recommended (Lang and Hill, 1977). With simple standardized techniques, periapical radiographs may furnish quantitative estimates, albeit underestimates, of alveolar bone loss (Schei *et al.,* 1959).

Our data indicate that in patients with leprosy, alveolar bone loss is greater around maxillary anterior teeth than in other areas and that maxillary alveolar bone loss is significantly greater in those patients with the lepromatous form of the disease than in those with either tuberculoid or borderline leprosy. Furthermore, mean alveolar bone loss among our patients with advanced lepromatous leprosy, mean age of 40 years, was equal to that observed in patients from the general population without leprosy in their 5th and 6th decades. Alveolar bone loss in patients with borderline and tuberculoid leprosy, on the other hand, was comparable to that found in the general populace during the 4th decade.

Schei *et al.* (1959) measured alveolar bone resorption in 737 Norwegian males and found maximal bone loss in the maxillary anterior region in all age groups. Bone loss between maxillary central incisors was less than 15% during the 3rd decade, 12–18% in the 4th and 18–33% in the 5th. The range indicated mean measurements from patients with good and poor oral hygiene respectively (Schei *et al.,* 1959). We found the same predilection for maximal bone loss in maxillary anteriors in our patients with leprosy. However, our measurements of bone loss between maxillary centrals in 56 patients without leprosy were at, or exceeded, the upper limit observed in the Norwegians.

Because radiographic evaluation of the oral cavity is not routinely done for all patients here, we had to take our measurements of alveolar bone from patients without leprosy who presented with potentially pathological conditions of the maxillary dentition that justified radiography. Thus, these patients probably do not represent the general population, in which mean maxillary bone loss might be less.

We were unable to detect any increase in alveolar bone loss over a 6 month period in leprosy patients with or without periodic scaling and polishing. Thus, alveolar bone loss even in this group is a slow process. The low incidence of periodontal disease in our patients suggests that maxillary alveolar bone loss in leprosy is not dependent upon underlying periodontal disease. We conclude that it is a characteristic manifestation of the disease, particularly of the lepromatous type, as previously suggested (Møller-Christensen, 1953; Michman and Sagher, 1957).

In this study we were not able to determine if alveolar bone loss was related to duration of treatment or if early treatment could prevent this bone loss, because we could not accurately estimate the interval between onset of disease and the initiation of effective treatment. These questions are certainly worth investigating.

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