Comparisons of dental maturity between the rural community of Kuhmo in northeastern Finland and the city of Helsinki

Abstract - The aim of the study was to check whether dental maturity charts made in southern Finland can be used without modifications in other parts of the country. For this reason the dental maturity of 90 children living in the sparsely populated areas of Kuhmo in northeastern Finland was compared with that of a larger sample of Helsinki children. Most of the Kuhmo children were 7.0-8.5 and 10.5-12.5 yr of age. The method of DEMIRJIAN and associates was used to estimate dental maturity. The means of dental maturity scores were greater in Kuhmo in most half-year groups in both sexes. The median dental maturity scores of Kuhmo children were between the 50th and 84th percentile curves of Helsinki children. A referent of the same age and sex was chosen for each Kuhmo child from the Helsinki children. The paired t-test was based on the difference in dental age. The dental age of the Kuhmo children was higher (P<0.05). These findings suggest differences in dental maturity within a fairly homogeneous population, which should be considered when national charts are used.

Key words: dentition, mixed; epidemiology, oral; radiography, panoramic; tooth mineralization

Somatic maturity is the degree of adult form which different tissue systems of an individual have attained. Dentition is one of the tissue systems most commonly used for measuring physiological maturity.

Tooth formation is suitable for the estimation of dental maturity because it is a continuous, progressive process that can be followed radiographically from the crypt stage to the closure of the root apex. When information about the stages of formation of several teeth is combined, the dental age of an individual can be estimated. There are several methods of estimating dental age (1-4), but none of them has gained unreserved support.

DEMIRJIAN et al. published their method of rating the developmental stages of individual teeth and calculating the overall dental maturity in 1973 (5). The method was slightly revised by DEMIRJIAN & GOLDSTEIN in 1976 (6). This methodology has been widely used during recent years (7-10). Since the same method has been used in many countries, it is possible to compare the results.

Using this method, dental maturity has been estimated in two groups of healthy children in southern Finland (11, 12). The aim of the present study was to find out whether the means and medians of dental maturity of children living in southern Finland can be used as standards for the whole country. For this reason, comparisons of dental maturity were made between two groups of children, one from Kuhmo in northeastern Finland and the other from Helsinki on the southern coast.

Samples and methods

Kuhmo is a community with 13 500 inhabitants near the eastern border of Finland about 500 km northeast of Helsinki (Fig. 1). It is representative of the sparsely populated type of community which is common in northern Finland. The original Kuhmo sample of the present study consisted of 97 orthopantomograms collected from the files of the public dental care center of Kuhmo. The radiographs had been taken from 1979 to 1985 for reasons common in dental health care: caries, trauma, or assessment of the need for orthodontic treatment. One radio-
graph had been taken of each child. Two of the children were under school age; the others were pupils in 17 small schools all over the community. The total number of pupils in these schools was 340 in 1985. The first criteria for choosing the orthopantomograms for this study was that the formation of at least one mandibular tooth other than the third molar was not completed. Seven of these orthopantomograms were excluded for the following reasons: unclear radiograph, agenesia of mandibular teeth, cleft lip and palate. The final Kuhmo sample comprised 90 orthopantomograms, 50 from boys and 40 from girls (Table 1).

The Helsinki sample consisted of orthopantomograms taken of the participants in a longitudinal investigation of dental development (13). All 395 orthopantomograms which had been taken at the same ages as those of the Kuhmo children were included to calculate the means of the dental maturity scores (Table 1). All orthopantomograms which had been taken of these children by 1986 \( n = 800 \) were used to construct the median curves of dental maturity (Fig. 2).

Dental maturity was determined using the seven-teeth method of DEMIRJIAN & GOLDSTEIN (6). In this method the stages of mineralization of the seven left mandibular teeth are assessed using an eight-stage scale. The stage of development of each tooth is given a maturity score. The total dental maturity score is the sum of the scores of the individual teeth.

The first author rated all the radiographs. The majority of the radiographs of the Helsinki children had been rated about 2 yr earlier. To study the amount of intraobserver variation over this period of time, the assessments were repeated on 100 orthopantomograms of Helsinki children. The chosen radiographs were taken at the same age as those of the Kuhmo children with an accuracy of 0.1 yr of chronological age. The ratings were identical in 86% of the cases. The difference between the two assessments never exceeded one stage and no consistent tendency toward either an earlier or a later direction was observed.

### Results

The means of the dental maturity scores for Kuhmo children were higher than those for Helsinki children in 8 of 11 age groups in the boys and in 9 of 12 groups in the girls (Table 1). The same tendency was seen in the median dental maturity scores (Fig. 1). The median dental maturity scores of Kuhmo children were between the 50th and 84th percentile curves of the Helsinki children.

Since the Kuhmo sample was rather small and its distribution into age groups uneven, it was desirable to use some method of combining age groups before testing whether dental maturity really was greater in Kuhmo children than in Helsinki children. A kind of case-referent type analysis was applied. For each child from Kuhmo a referent of the same sex and age was chosen from the Helsinki children. When a referent radiograph was chosen, all the other radiographs of that individual were removed from the file in order to ensure that the referents were unique. Because the material from southern Finland was roughly in chronological order, the matching was carried out both starting from the beginning of the file (first match) and backwards from the end of the file (last match). In the nine cases where an exact match was not found, the nearest radiograph with an

<table>
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<th>Age</th>
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<th>Girls</th>
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Table 1. Dental maturity scores according to DEMIRJIAN & GOLDSTEIN (16) for Kuhmo children in half-year groups of chronological age. Corresponding values for Helsinki children in parentheses. Ages are midpoints of half-year groups.

Total

50 (181)
40 (214)

**Fig. 2.** Median dental maturity scores of Kuhmo children compared with the scores of Helsinki children. Smoothing of three points was used. Symbols: asterisk = median maturity score of Kuhmo children. Solid line = 50% (median) dental maturity score of Helsinki children. Dashed lines = 16% and 84% dental maturity scores of Helsinki children.
age difference of 0.1 yr was taken. The difference (Kuhmo—Helsinki) in dental age was used as test variable in the paired t-test. The other possibility would have been to use the Demirjian score, but its variance depends on age. The determination of the dental age of individual children was based on the median dental maturity curves presented by Demirjian et al. (6).

Student’s t-test was used to test whether dental maturity was different in children living in Kuhmo than in those living in Helsinki (Table 2). The results of the paired t-tests were slightly different but not contradictory. The t-values of the girls and the boys were very similar. The results of the tests indicate that the Kuhmo children were advanced in dental maturity at the P<0.05 significance level.

Discussion

The use of any method of estimation contains subjective sources of error. Demirjian et al. (6) tried to reduce the intra- and interexaminer variation to a minimum by giving exact verbal descriptions, model radiographs, and illustrations of the eight developmental stages used in their method. Accordingly, the intra- and interexaminer variation of this method has been reported not only between white and black populations (9), but also between white children from different countries (7–9, 12). In addition, Loeyv & Shore (10) noticed differences within a nation. They reported that a group of white children from a suburb of Chicago was more advanced in dental maturation than a group of white children from the city of Chicago.

The Finnish population is fairly homogeneous, but small signs of differences in dental development have been seen between different parts of the country. The clinical eruption of primary teeth in northern Finland (17, 18) might be slightly earlier than in children born in the southernmost part of the country (19). Similarly, in the present study a group of children from northeastern Finland was advanced in dental maturation compared with Helsinki children.

It is obvious that national standards of dental maturity are of great value in studies of normal and disturbed growth. The results of the present study suggest that differences in overall dental maturity exist not only between nations but also between groups of children in a nation with a relatively homogeneous population. This should be kept in mind when dental maturity charts are used.

Table 2. Paired t-test results of difference in dental age between children from Kuhmo and Helsinki

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<th>Sex</th>
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References

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