A STUDY ON GROUP DENTAL EXAMINATION
— ESPECIALLY ON THE EFFECTS OF ENVIRONMENT ON DIAGNOSIS OF INCIPIENT DENTAL CARIES —

BY

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It may safely be said that the activities in oral hygiene begin and end with the group dental examination. The actual state of dental hygiene and effects of hygienic activities in a group should first be clarified, and only then should the next steps to be taken be considered. If the results of a dental examination should be different from the actual conditions through some cause or other, evaluation of the results and subsequent plans will turn out to be far in disaccord with the actual situation, which fact renders activities in oral hygiene absolutely ineffective. We doubted whether dental examinations done by an accredited dentist could be so far removed from the actual state and so unreliable as to make future plans worthless. The fact, however, appears to be that the reverse is true.

As an actual illustration, in schools A and B in the same district, the results of dental examinations of the pupils by a dentist in one school were so different from those attained by another dentist in the other school that the comparison of incidences of dental caries and gingival diseases between the two was a very difficult matter. The incidences of dental caries in the schools A and B were 15% and 65% respectively. It is quite unthinkable that such a wide difference should exist in the same district where their living conditions and environments would be about the same. What is the possible cause of such a big difference amounting to the extent of 50%? Are the pupils in the school B living in environments particularly detrimental to the health of their teeth?

Generally speaking, this is nonsense. If not then, what factors are responsible? If there is no wide difference regarding their environments in the same district, there should not be much difference in the incidence of dental caries. The only possible cause that can be surmised is the conditions under which the group dental examinations were carried out in these schools and the school dentists themselves. It is difficult to believe that they could be the cause of such a difference in diagnosis up to 50%. But if so, it gives rise to a serious problem. If the cause of such inconsistency in results is on the side of the dental examiners, what are the reasons for it? Let us consider one by one the various factors which may be responsible for this inconsistency.

1. The difference in diagnostic standards and clinical experiences on the part of the dentists concerned.

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2. The mental attitude of the dentist and his state of physical health.
3. Fatigue
4. Examining time per individual.
5. The proper number of examining dentists.
6. The factors of environments regarding the examining places.
8. Aptitude of assistants.

The fact that differences in environmental conditions and diagnostic standards of dentists during group dental examinations could cause a 50% difference in results is still debatable. We would, however, like to present some data from our investigation which affirm this fact. Since the school dentist system was established in Japan and education and administration of dental health took a formal shape, various projects regarding the education and administration of dental health have been put into effect. Group dental examinations are carried out at the beginning of each new school year during the 6 years of a primary school and 3 years of a junior high school. The diagnostic records of each pupil are kept on file during these school years and reported to the Ministry of Education.

In our study, the records of examinations of the current year and preceding years of pupils in the 2nd and 3rd years of junior high school were examined in an attempt to discover any discrepancy in diagnosis regarding the same tooth; in examinations of this year and last year in the 2nd year pupils and of this year and the two preceding years in the case of the 3rd year pupils. In connection with our study, the following results, as shown on the table, were obtained. Of a total of 2113 pupils consisting of boys and girls in the second and third year classes, inconsistent diagnoses were found in 1718 pupils, of whom 528 and 1190 were in the 2nd and 3rd year classes respectively. This shows an error of 0.8 tooth per pupils. This discrepancy in diagnosis was discovered by inquiry into the diagnostic records and does not truly indicate the actual misdiagnosis in the pupils as the errors in recording were no doubt made in addition to the wrong diagnosis. Classified in terms of teeth, the error in diagnosis shows the same frequency as the percentage of dental caries. We see from this that an error of over 60% in diagnosis between the decayed and healthy teeth can occur. It seems that these errors are chiefly made in the diagnosis of dental caries in the early stage. Is the diagnosis of incipient dental caries during the group dental examination so difficult? It is almost impossible during the group dental examination to diagnose a dental caries in the light of the pathological classification. The dentist generally bases his diagnosis on his own criteria or convictions but the fact that ten out of ten reputable dentists would differ in their diagnosis of the same tooth is beyond our comprehension.

We therefore conducted a small experiment in order to see whether this could happen or not. Fifteen extracted molars and premolars which appeared to the naked eye almost intact were put into test tubes, one to each tube, and kept in a moist state to preserve their natural conditions as much as possible. Then, the teeth were taken out of the test tubes and examined by the naked eye and an explorer by the dentists selected at random. The examining time and place were entirely left to the choice of examiners.
One hundred and three dentists with clinical experiences from less than one year to thirty-eight years participated in the experiment. After the completion of these tests, the result of X-ray examination and histo-pathological findings of each tooth were compared with those attained by the tests to observe whether the number of years in clinical experiences or difference in individual viewpoints influenced their diagnosis.

1) Difference in diagnosis is attributable to the number of years in clinical experiences.

In order to study whether the clinical experience of the dentists participating in this experiment made any difference in the diagnosis, they were divided into groups 0-4, 5-9, 10-19 and over 20 years according to their number of years in clinical experiences. Moreover, the diagnoses were classified into four categories according to whether they were (A) too light, (B) correct, (C) too grave, or (D) correct in regard to the healthy or diseased state of the tooth. In Table 2, the thick numerals show the number of correct diagnosis (B) in each group, and the number on the right and left of the thick numerals show the results respectively of (C) and (A). In the fourth category (D), a diagnosis of C₁, when the pathological finding was C₂, or vice versa, was regarded as correct as the diseased state of the tooth was accurately diagnosed. To ascertain whether the number of years in clinical experiences influenced the results in the four categories mentioned above, the results were subjected to an analytic study. This study showed that (a) between the teeth the difference was significant at the 1% level, which suggests that difference in diagnosis of each tooth comes into question, and (b) the deviation in diagnosis did not follow any definite tendency in regard to the number of years of clinical experiences.

2) Individual variances in diagnosis.

From the above observation, it was inferred that the diagnostic results were influenced by the divergence in individual viewpoints and not by the number of years of clinical practice. The factor, therefore, was subjected to a further consideration. As the teeth with early stage caries were used in this experiment, it was conceded that the giving of a clinical diagnosis which would coincide with the pathological finding was difficult, and so only the independent variables in the (D) category, that is the results in regard to whether the teeth were healthy or not, were analysed with the $\chi^2$-test. Although the frequency distribution of the diagnosis submits to the binominal distribution, approximation to the normal distribution was attempted with inverse sine transformation for the statistical purpose, utilizing the fact that the value of the sum of the squares of the inverse sine transformation multiplied by 4 times 15 (teeth) approximates to the $\chi^2$-distribution with 102 degrees of freedom. Calculation of $\chi^2$ gave the value of 325.2 and this, when compared with the value given in the $\chi^2$-distribution table, $\chi^2_{100}^{(0.1)}$ equals to 135.807, showed a high significance for actually calculated values; that is, the difference in the results of individual examiners was quite remarkable. From this observation, we are able to consider the divergence of individual viewpoints as one of the important causal factors which give rise to discrepancies in diagnosis.
In the diagnosis of incipient dental caries, we thus found that the diagnosis of each tooth comes into question and that the difference in diagnosis is chiefly attributable, not to the number of years in clinical experience which is of no great consequence, but to variance in subjective views on the part of individual dentists. It is conceivable that one method of reducing errors in diagnosis will be to obtain uniformity in the divergent subjective viewpoints of individuals. The value of this method has been demonstrated by Dr. Sakakibara and others of the Tokyo Medical and Dental University. They established various standards on which to base the diagnosis, and in experiments with different dentists who examined the identical groups according to these standards it has been found that the results of the examinations coincided very closely.

We keenly feel the necessity for such diagnostic standards as we found in our study that the diagnosis of incipient dental caries was influenced by the subjective views of individuals. But once these standards are established, can we be sure of obtaining satisfactory results all the time? In dental group examinations, there is always the question of limitation of time and examining places, which are in most cases practically disregarded. Is there no significance in the time allotted for an examination and the illumination of the examining room (whether light or dark in the mouth)? These factors have been considered and investigated as follows:

1) **Examining time**

We are in all circumstances and at all times under the restriction of time. Consequently it is first necessary to determine the minimum time in which the results cannot be influenced because of it, that is, the time necessary for the performance of an adequate examination. Now, let us suppose that one minute or less is taken up in examining one person. If each person has 32 teeth, 50 persons can be examined in one hour, that is, 1400 teeth will have to be examined.

Seven hundred teeth were put in seven boxes, 100 in each box, and the time limit for examination was set at 60, 30 and 21 minutes respectively. These tests were conducted during the day-time. The only instrument used was an explorer and the diagnosis was based on every examiner’s own standard of criterion. Examinations within the respective time limits were repeated for three times for each group. The \( \chi^2 \)-test was applied to obtain the point where the diagnoses were based faithfully on the examiner’s standard of criterion. It was shown that an examination of 700 teeth per hour has given the most dependable results.

2) **Illumination.**

It is clear from the foregoing experiment that the time factor can be neglected when the examining time is within the limit of 700 teeth per hour. Under these circumstances, the following experiment was carried out. In this experiment, extracted teeth, 350 in number, were placed in seven boxes, fifty teeth to each, and tests were conducted with an assistant giving signals at regular intervals. Under the illuminations of 20, 50, 100, 500 and 1000 Lx respectively, each experiment was repeated for three times. Each dentist was provided with a lamp which held a 90 watt bulb of daylight color and the experiments were conducted at
night under direct local illuminations. As results of these, we found that a range of 500 to 100 Lx was most appropriate for obtaining the reliable results based on the diagnostic criteria of the examining dentists.

(3) **Noises.**

In this experiment regarding possible influence of noises on the part of dentists, the same procedures used in the foregoing experiments were followed. The noise produced by 3 sets of radio dialed to the different broadcasts were first recorded on a taperecorder and this was used as a source of noises together with another set of radio. The experiment was done during the daytime and the noises were adjusted to 60 db, 70 db, and approximately 20 db. In this experiment, we observed that the effect of noises on the diagnosis had individual variations, some being affected while others were quite indifferent. The fact that noises may be a factor in influencing the diagnoses was demonstrated but there have been obtained no conclusive results.

In group dental examinations, which are generally apt to be carried out automatically, the results will be quite positively influenced by subjective individual factors and they differ greatly among the dentists concerned, even to the extent of a 50% difference in the same group, unless a standard basis of diagnosis is faithfully observed. Standardization of the time limit as to the number of persons to be examined, the illumination in the mouth and existence of noises etc., seems to be highly called for. The various data obtained in our experiments described above and other factors which weigh in the result of the group dental examination should be given a due consideration when a plan is laid for the establishment of these standards.