A DENTAL EPIDEMIOLOGICAL STUDY
IN A HIGH FLUORIDE AREA OF COUNTY FERMANAGH

C. McKay, Ph.D., M.D.S., F.F.D.R.C.S.I.
School of Dentistry, Royal Victoria Hospital, Belfast

INTRINSIC STAINING OF TEETH, apart from being caused by localised injury or infection, may be due to one of a number of factors. For example, the white patchy hypoplasia sometimes seen on the tips of the permanent incisors may have been due to a debilitating illness, such as broncho-pneumonia, in infancy. Pink staining of the teeth may occur in porphyria and in icterus gravis neonatorum the teeth, when they erupt, may be stained bluish green. Osteogenesis imperfecta may cause, in addition to blue sclerotics, a distinctive brownish colour of the teeth, which soon wear down due to poorly formed or absent enamel. Several of the tetracycline group of antibiotics are known to cause yellowish staining of the teeth in children (Stewart 1964, 1973) and the time of administration of the drug may be calculated approximately from the area of tooth so discoloured.

It has been known for many years that people living in certain districts have peculiar staining or mottling of the teeth. One such area in Mexico was mentioned by Kuhns in 1888. The inhabitants of a district of Italy, near Naples, were described by Eager (1901) as suffering from a dental peculiarity known as "denti di chiaie".

Black and McKay (1916) gave the classic description of mottled teeth which they found in inhabitants of parts of Colorado. This was followed by reports of similar conditions in China by Anderson & Stevenson (1930), in Japan by Masaki (1931), in North Africa by Velu (1932) and in Argentina by Chaneles (1932).

The association of this type of mottling with fluorides in drinking water was established by Churchill (1931). McKay (1929) had noted that children with mottled enamel were less susceptible to dental caries than those with normal teeth. Since then research in many parts of the world, e.g. Weaver (1944) has shown that, if fluorides are present in or added to drinking water at the amount of 1 part per million, caries is reduced by approximately 50 per cent.

In Northern Ireland, Stoy (1952) saw cases of enamel hypoplasia strongly suggestive of dental fluorosis and it was decided to carry out a survey of drinking waters in Northern Ireland. The results of this survey have been published (McKay 1973). Samples were obtained from over 1,300 drinking wells and tests were carried out to ascertain total hardness and hydrogen ion concentration in addition to fluorides and other trace elements. Several wells in County Fermanagh were found to have a high fluoride content. It was decided to carry out an epidemiological study of the dental condition of school children in the area concerned.

The district is sparsely populated. It lies between the south-western shore of Upper Lough Erne and Slieve Rushen which is in the Republic of Ireland. The country is low-lying and is made up of small farms. There are few shops in the district. Free milk is provided for school children and school meals are available.

Four schools were selected. Two of these, Anghakillymaude Primary School and the Earl of Erne Primary School, are situated close to the Lough shore and are
attended by all children of primary school age (i.e. 5-14 years) in the district. The other two schools selected, Clonmaulin and Cornagague Primary Schools, lie a little to the East in an area where one or two deep wells had been discovered to have high fluoride content. Although it was known that some wells had a high fluoride content no detailed knowledge of the fluoride content of the water supply used by these individual children was available at the time of examination.

Two hundred and twelve children, between the ages of five and fifteen, were examined. Full dental charting was carried out; decayed, missing and filled deciduous and permanent teeth were noted, using the methods described in the Report on the Incidence of Dental Caries in School Children (1960). Examination was carried out using mirror and probe. Only lesions penetrating into the dentine, i.e. Grades 4, 5 and 6 described in this Report, were noted. Oral hygiene, periodontal condition and any evidence of mottling were observed. Oral hygiene was, generally speaking, poor. Some mouths appeared to be neglected, but there was little evidence of periodontal disease. No marked mottling of the enamel was seen in any of the mouths examined.

After the inspection was carried out, samples were taken and tests carried out for fluoride content of the drinking water used by the children. Sampling was made difficult by the fact that none of the children used piped water, but families were generally quite large and in some cases two families used the same well. It was found that, of the 212 children involved, 150 used well water containing less than 1.00 p.p.m. fluoride, 6 used well water of 1.0 p.p.m., 10 of 1.4 p.p.m., 6 of 1.5 p.p.m., 12 of 1.6 p.p.m., 9 of 2.3 p.p.m., 4 of 3.9 p.p.m., 7 of 5.0 p.p.m., 2 of 5.5 p.p.m. and 6 of 6.0 p.p.m. All the children examined had been residing continuously in the area.

Detailed lists of the results of the survey were prepared and statistical analyses were carried out. Due to limitation of space these figures are not reproduced in this paper. They are, however, available for inspection in the School of Dentistry, Royal Victoria Hospital, Belfast, and will be sent to anyone expressing a special interest.

A summary of the results follows:

34 children between 5 and 10 years of age and 42 children between 8 and 15 years of age were found to use drinking water from wells with a high fluoride content. This was compared with 70 children between 5 and 10 years and 117 between 8 and 15 years who were using wells containing less than 1.0 p.p.m.

A marked difference in the caries rates of the various groups was found. For example, 70 children aged between 5 and 10 years using well waters containing less than 1 p.p.m. fluoride were found to have a total of 508 decayed, missing or filled (D.M.F.) deciduous teeth, an average of 7.36. This compared, unfavourably, with 34 children of a similar age group, using well waters containing more than 1 p.p.m. fluoride, who had a total of 71 D.M.F. teeth, an average rate of 2.06.

In the older age group, 117 children using well water with less than 1 p.p.m. fluoride had 419 decayed, missing or filled teeth, an average of 3.53, whereas 42 children, using water containing more than 1 p.p.m. fluoride had 57 D.M.F. teeth, an average of 1.36.
Further examination of the results showed that, in the 5-10 age group using water with less than 1 p.p.m. fluoride, 16 children of the 70 examined had each more than 10 deciduous teeth decayed, missing or filled and 3 children had each more than 18 D.M.F. teeth, whereas in the similar age group using water with more than 1 p.p.m. fluoride, only one child of the 34 examined had more than 6 D.M.F. teeth. Similarly, in the 8-15 year olds, of 117 children examined in the low fluoride group, 55 had 4 or more permanent teeth decayed, missing or filled, while only 4 children had 4 or more D.M.F. out of 42 examined in the high fluoride group.

Various statistical tests were carried out to test the significance of these findings. The results of these tests show the difference between the low and high fluoride groups to be significant in all the categories tested.

CONCLUSIONS

In a sparsely populated area of South Fermanagh, in the Aughakillymaude district, some wells used for drinking purposes contained amounts of fluorides varying from 1 part per million to 10 parts per million. A dental examination of school children in the area showed evidence in a few cases of mottling of enamel which was strongly suggestive of fluorosis. It also showed that children drinking water from wells with even a very high fluoride content had significantly less dental decay than children using wells containing less than 1 p.p.m. fluoride.

It is of interest to note that, according to the health authorities in the county, there is no evidence of any ill-health in the area which could in any way be attributed to the high fluoride content of the water supplies. Sickness and mortality rates are about the average for the county. (Moore 1973).

SUMMARY

In South Fermanagh, the only area in Northern Ireland where wells with a high fluoride content were found, an epidemiological survey was carried out on two hundred and twelve school children. A statistical study of the figures shows that there is a difference, which is of statistical significance, between the number of decayed, missing and filled teeth in the children examined using well water with a high fluoride content and those using well water with a low fluoride content. The D.M.F. rates found were 6.74 (boys) and 7.90 (girls) for deciduous teeth (low fluoride) compared with 1.70 (boys) and 2.64 (girls) for deciduous teeth (high fluoride) and 3.60 (boys) and 3.61 (girls) for permanent teeth (low fluoride) compared with 1.35 (boys) and 1.36 (girls) for permanent teeth (high fluoride).
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