

EROSION OF TEETH DUE TO TARTARIC ACID DUST

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Clinical descriptions of occupational dental erosion have been written by Berenzon (1931), Schour and Sarnat (1942), and by Lynch and Bell (1947). But dental erosion due to a dust does not appear to have been described.

The present investigation originated in the observation of erosion of the upper incisor teeth of two dental patients, who thought that the destruction of their teeth was caused by their work. They mixed powders which, they understood, contained tartaric acid, and said that other girls were similarly affected. Observation in the factory showed that the atmosphere of the room in which these girls worked was indeed very dusty, and the problem was, therefore, to determine the composition of the dust and whether it affected the rest of the girls in the workshop.

Methods and Results

The Dental Survey.—The teeth of the 15 girls employed in the dusty process were examined, together with the teeth of 16 girls, who were comparable in age and in financial status, from those in the tin-making shop not handling the dusty product. It was assumed that there would be no gross nutritional differences among girls with a similar family financial status. There had been no interchange of staff between the two parts of the factory.

The erosion was observed in all stages from the early lesion with a rough, etched surface, which, on further exposure, becomes flattened and faceted, thereafter gradually extending until the enamel disappears and the dentine is exposed. More

advanced cases show the destruction of the incisal edge and a loss of the normal outline of the tooth (Fig. 1). Discoloration appears when the dentine is exposed.

The results of the dental examination showed that all but one of the girls in the mixing room were affected, but none of the control series showed the type of erosion described.

The table shows the relation between the length of exposure and the extent of the dental pathology. The earliest stages are obvious to the naked eye after six months' exposure, but even after three months there are complaints of roughening of the teeth. After three years the teeth, in some cases, had been so disfigured or destroyed that they had been replaced partially or completely by dentures.

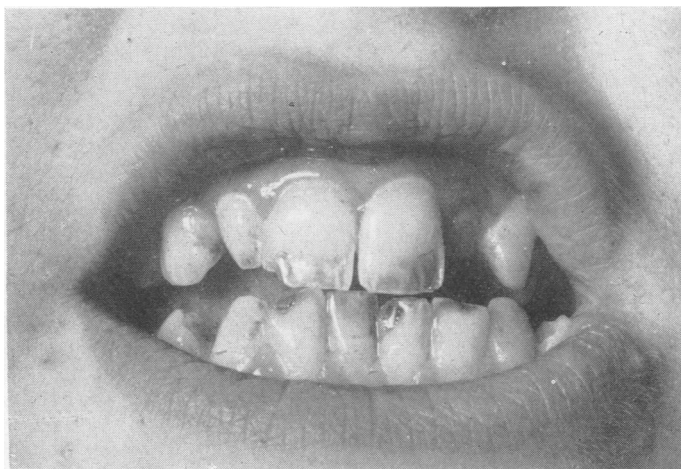


FIG. 1.—Photograph showing erosion of tooth enamel, exposure of dentine, and loss of normal tooth outline.

TABLE
THE EXTENT OF THE DENTAL EROSION AMONG AFFECTED
GIRLS RELATED TO LENGTH OF EXPOSURE

Appearance of Teeth	No. of Girls	Individual Lengths of Exposure (in years)	Average Exposure (in years)
Normal teeth ..	1	5/12	5/12
Eroded contour but normal outline ..	3	1, 6/12, 1	10/12
Contour and outline eroded	6	3, 5, 1, 2, 5, 2	3
With dentures (complete or partial) ..	5	5, 3, 5, 11, 6	6

The comparison of the teeth of the two groups of girls showed that five of those affected had dentures, (three with complete sets), compared with two controls with partial dentures and one with a complete set.

The four girls who were available were re-examined after 22 months. Examination disclosed that one girl had had her maxillary incisors extracted because of their unsightly appearance, and the lower incisors had become more affected. In another the enamel condition had progressed from etching to almost complete destruction. In the third patient the contour of the tooth had become involved, and the open bite deformity was more extensive. In the fourth, there was no etching when the girl was first examined, but it was present on the second examination.

Concentration and Analysis of the Dust.—The girls in the workshop concerned scooped powders out of drums by hand and weighed them, and both these jobs produced obvious dust. A mechanical mixer was used which was fed by a conveyor, and periodically in the process the powders were emptied by hand down chutes or into hoppers, and all these operations added their quota of dust to the general atmosphere.

Since the relationship of the clinical disease was measured by the month, interest was focused upon the long term average concentration and composition of the dust, rather than on the short term fluctuations. From a time study carried out for three whole working days it appeared that each girl spent 29 to 30 hours a week in the dust. The concentration of airborne dust, determined gravimetrically by passing air samples through tubes fitted with sintered glass plates, averaged 15 mg. per cu.m., and the mean percentage composition of the dust was as follows :—

Free tartaric acid	7.7
Combined tartaric acid	22.5
Sodium bicarbonate	16.5
Magnesium sulphate (dried to 27% water)	37.2
Sucrose (by difference)	14.3
Insoluble residue	9.5

Hence, about 1.1 mg. per cu.m. seems to be the concentration of free tartaric acid to which the teeth were subjected, and which under the conditions of the present experiment may have caused erosion in about six months, assuming that tartaric acid is alone responsible for the erosion.

Discussion

The type of dental erosion described by Lynch and Bell (1947) due to mixed nitric and sulphuric acid fumes is very similar to that described here due to the relatively weak tartaric acid, which, however, is in the form of a dust. It may be that this settles on the teeth normally exposed by the lips, forms a highly concentrated solution in the saliva locally, and converts the insoluble calcium salts of the enamel and dentine into soluble calcium tartrate.

In theory, to prevent the condition it is necessary totally to enclose the process, and weighing and handling should be automatic, but in this instance, since a new factory is being designed, it will hardly be financially justifiable to install new plant in the old factory. However, as a temporary measure, exhaust extraction at the main points of dust production has been installed. Masks are supplied, but are not worn, and, unfortunately, the dust cannot be wetted as it would prevent mixing and spoil the product.

Summary

Erosion of the teeth of girls working in an atmosphere containing dust composed of a mixture of tartaric acid, sucrose, magnesium sulphate, and sodium bicarbonate, is described.

Gravimetric analysis of the dust showed an average concentration in the shop of 15 mg. per cu.m. Spending 30 hours per week in this concentration, which, it is estimated, contained an average of 1.1 mg. per cu.m. of free tartaric acid, produces clinical erosion of the teeth which may be detectable after an exposure of six months.

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