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ORIGINAL COMMUNICATIONS

THE ORGANIC CONTENT OF " CHALKY " ENAMEL

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THIS study arose from the observation by Hardwick and Manley (1952) that " There must be an *increase* in the organic content of ' altered ' enamel to account for the great change in the staining reaction and the increased resistance to the action of mineral acids to which it was subjected experimentally." Malleson (1925) and Bodecker (1927) were perhaps the most outspoken of authors who were of the opinion that there was an increase in the organic content of enamel accompanying early caries. Hardwick and Manley have now demonstrated clinically recognisable " chalky " or " altered " enamel by histological methods. They had the advantage of the special decalcification technique devised by Brain (1949), who collaborated in the preparation of the specimens for their study.

It may be thought advisable to reserve the term " chalky enamel " for the soft, white, opaque areas which characterise recent rapid carious attack. Gottlieb (1947) regarded chalky enamel as a product of acid action, but would not admit that such regions were carious unless yellow pigmentation were also visible. Similar partially decalcified regions in which the contour is maintained but where pigmentation is present are here described as " altered " enamel. Biochemical study of chalky enamel appears to be confined to a paper by Coolidge (1951) on the nitrogen and phosphorus contents of the early smooth-surface caries of enamel. This author's conclusions were that no large general difference had been detected when comparing such chalky enamel with sound specimens. Nitrogen : phosphorus ratios were thought to be more significant than the separate analyses because of the possible loss of water from the enamel samples.

The chief object of the present study was therefore to apply a direct method of determining organic content to the problem of whether an increase in organic content occurs when sound enamel becomes chalky. Information on the extent and variation of this increase was also required, and it was also intended to compare this type of chalky enamel with that found on the inner surface of the enamel overhanging gross dentine caries. As a basis for these comparisons, a brief survey was made to determine the constancy of the organic content of enamel at various points on the smooth surfaces of teeth. A description of the method of preparation of chalky enamel will indicate further how this material has been defined for the purpose of the present investigation.

Teeth were collected immediately after extraction, dried at room temperature, and a selection made of those in which the smooth surfaces showed opaque white areas or bands distinguishable from hypocalcified spots by their lack of hardness. Surface contamination was removed with a grinding disc, and if no loss of surface contour was apparent at this stage, the friable material was easily separated from the surrounding hard enamel, using a slow-running blunt steel rose-head bur.

Another source of material, partially fulfilling this definition, was the inner surface of the enamel overhanging major cavities, particularly in molars. This enamel chipped readily from the grossly carious dentine when dry, exposing a soft chalky-white surface. Much greater amounts of material were obtainable from this source, but it was shown that the organic content of this " inner chalky enamel " was also much greater than that of the " outer chalky enamel," this was probably due to extensive invasion by bacteria, which can often be demonstrated histologically. Such material from the inner surface was used chiefly for the development of techniques required in further studies of the composition of the material thought to be absorbed in the initial lesions of the outer surface.