Short Communication

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The Production of Artificial Caries-Like Lesions in Shark Enameloid in vitro

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Abstract.

It has long been shown that fluoride exerts a protective role against dental decay. It is thought that the fluoride incorporated into the enamel crystallites changes the resulting enamel so as to make it less susceptible to the carious process. This may be due to either a decreased rate of solubility of the enamel or by increasing the rate of remineralization [*Brown* et al., 1977].

Of all teeth studied to date, those of sharks have been shown to be amongst those with the highest fluoride content [*Glas,* 1962]. Although the external covering of the crowns of these teeth may not be true enamel, it does share many features with human enamel. It is hard, translucent and is composed of large, regularly deposited, apatite crystals in a fairly sparse organic matrix.

To investigate the role of high fluoride levels of around 33,000 ppm [*Büttner,* 1966] we studied the behaviour of shark teeth in a well-tried system that is commonly used to produce artificial carious lesions in human teeth in vitro [*Silverstone,* 1967].

Erupted functional teeth were sawn from the air-dried jaws of a Blue Shark *(Prionace glauca).* These were coated in nail varnish except for a small 'window' about 2 × 1 mm and the whole tooth then suspended in a 10% gelatin solution acidified with lactic acid to pH 3.5. After 3 weeks the teeth were removed and sections cut through the 'windows' perpendicular to the surface with a water-cooled rotating diamond-impregnated disc. The sections were then lapped down to about 50 μm. They were subsequently radiographed using a point projection X-ray microscope (XM-30) [*Cosslett and Nixon,* 1960], and also examined microscopically.

Figures 1a and b show the polarized light appearance of a section imbibed with quinoline and a microradiograph of the same section. They clearly show that a lesion has been produced by the action of the acidified gelatin. This lesion extends about halfway through the full thickness of the enameloid and the accompanying radiograph verifies

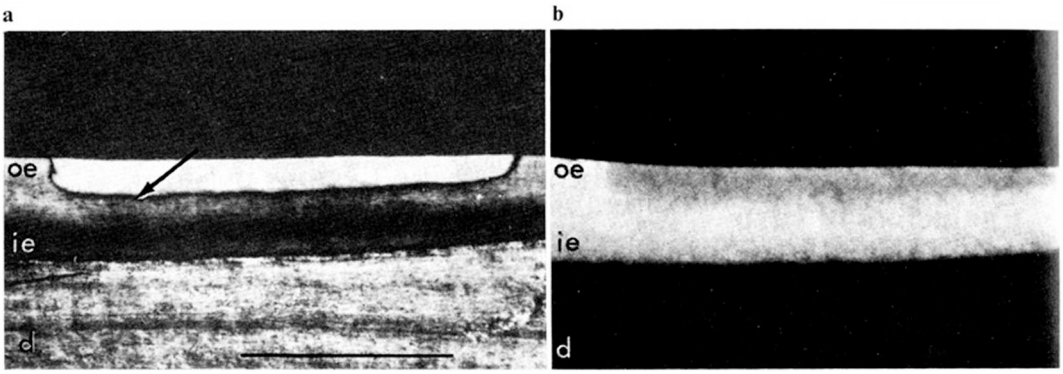

Fig. 1. Ground section through a lesion produced in a Blue Shark's tooth. **a** Section imbibed with quinoline viewed between crossed polars. The arrow indicates a region analogous to the dark zone of natural caries. oe = Outer enameloid; ie = inner enameloid; d = dentine. The bar represents 500 μm. **b** Microradiograph of the same section.

that this is indeed an area of decalcification. The similarity between these lesions and those produced by natural caries is apparent. From its appearance in polarized light the lesion can be subdivided into zones analogous to some of those found in natural caries in man. There is a marked isotropic region corresponding to the dark zone surrounding almost the whole of the demineralized area which itself corresponds to the body of the lesion. There were no translucent or surface zones found in any of the sections when examined by polarized light microscopy. However, some evidence of a surface zone with a higher radio-opacity than the subsurface region was revealed by microradiography.

Although shark enameloid differs in ways other than its very high fluoride content from human enamel, these experiments show that a lesion, other than mere surface etching, can be produced in teeth having a fluoride level close to that of fluorapatite.

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