Combined Effects of Xylitol and a Low Concentration of Fluoride on Promotion of Remineralization of Human Enamel, an Experimental Study.

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Abstract: The purpose of this study is to evaluate the combined effects of xylitol and low concentrations of fluoride on the promotion of remineralization of human enamel. Demineralized enamel blocks were immersed in remineralizing solutions containing 10% xylitol and various concentrations of fluoride (0-1.2ppm). The remineralizing solution containing xylitol and fluoride was found to promote remineralization between 14 and 15 degrees of saturation with respect to fluoroapatite. Although both fluoride and xylitol are thought to promote remineralization, from this study, it can be suggested that for effective remineralization, the degree of saturation with respect to fluoroapatite should also be considered.

Back ground

Fluoride as a material, which promotes remineralization of human enamel, has long been used for prevention of tooth decay. Although the concentration of fluoride used for this purpose varies, when used as an additive in foods or water, low fluoride concentrations are required. Xylitol as a substitute for sucrose is thought to also have a remineralizing effect and is added to sweets and toothpaste. Recently, fluoride and xylitol have been used together for the prevention of tooth decay. However, few papers have discussed their combind effect, more specifically using low concentrations of fluoride, with regard to remineralization. The purpose of this study is to evaluate the combined effects of xylitol and low concentrations of fluoride on the promotion of remineralization of human enamel.

Objectives

To evaluate the combined effects of xylitol and low concentrations of fluoride on promotion of remineralization of human enamel.

Materials and Methods

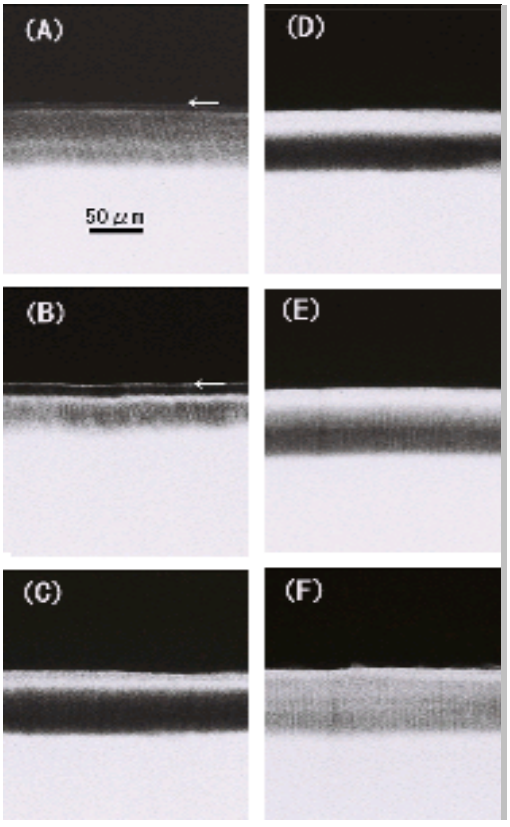
Extracted human wisdom teeth without lesions were placed in 50ml of 0.01M acetate buffer (pH4.0) at 50 C to demineralize for 48 hours. The teeth were then placed in 33ml of remineralizing solutions containing 10% xylitol and various low concentration of fluoride as shown below, and allowed to remineralize for 14 days at 37C. Polished sections 100micronÊm thick were made and contact microradiograms (CMRs) were taken. Microscopic images of the CMRs were downloaded onto a computer with a CCD camera. The brightness of the remineralized parts were placed on a gray scale of 256 grades. These results were then used to calculate the degree of remineralization of each specimen. The concentration of calcium ions was measuredusing a calcium ion electrode. The degree of saturation of the remineralizing solution was calculated with respect to fluoroapatite .

Remineralizing solution
Base composition
$CaCl_2$ 1mM
KH_2PO_4 0.6mM
NaCl 100mM
KOH (pH: adjusted to 7.3)

The following six xylitol mixtures are added to the above base to create six remineralizing test solutions.

(1) 10% Xylitol
(2) 10% Xylitol and 0.008ppm F (NaF)
(3) 10% Xylitol and 0.08ppm F (NaF)
(4) 10% Xylitol and 0.4ppm F (NaF)
(5) 10% Xylitol and 0.8ppm F (NaF)
(6) 10% Xylitol and 1.2ppm F (NaF)

The total volume of each solution is 100ml.



Results

The degree of remineralization of 10% xylitol with no less than 0.8ppm fluoride was greater than that of 10% xylitol with 0.4ppm fluoride. There was a significant difference ($P<0.001$) between 0.8ppm fluoride and 0ppm fluoride (control). That is to say, the degree of remineralization had increased between 14 and 15 degrees of saturation with respect to fluoroapataite.

Conclution

As a result of the study, the remineralizing solution containing both xylitol and fluoride was found to promote remineralization between 14 and 15 degrees of saturation with respect to fluoroapatite. Although both fluoride and xylitol are thought to promote remineralization, from this study, it can be suggested that for effective remineralization, the degree of saturation with respect to fluoroapatite should also be considered.

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