

## Fluorine and decay inhibition

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### Abstract

**For long fluorine absorbed by internal way during the process of forming and calcification of enamel matrix was considered as a pronounced protection against decay. It is false. Fluorine quantities stored in enamel are too much feeble to act as a protective decay process. The supply of fluorine must be carried on even after the dental eruption. The deciding factor is fluorine, which, once the crown forming has ended, is laid down pre and post eruptively in the enamel surface. *First published in Dental Update 1998; 5(5): 15-16.***

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### Introduction

For long fluorine absorbed by internal way during the process of forming and calcification of enamel matrix was considered as a pronounced protection against decay. It is false. Fluorine quantities stored in enamel are too much feeble to act as a protective decay process. The supply of fluorine must be carried on even after the dental eruption. The deciding factor is fluorine, which, once the crown forming has ended, is laid down pre and post eruptive in the enamel surface. This fluorine supply confers protection. It must be able to pile up in the most external enamel layers up to a decided concentration as the decay occurs on the enamel surface. Up to the crucial rate of 1000 ppm, the fluorine supply should be carried on before the dental eruption (by fluorine water or tablets). Effectively, ingested fluorine reaches through flow of blood the interstitial liquid which irrigates externally teeth crown already formed or on their way to eruption. In this way, superficial layers store fluorine progressively.

After dental eruption, fluorine incorporating continues by direct contact between enamel surface and fluorine water or saliva. For a better understanding of the fluorine chemical incorporation in the enamel surface before and after the eruption, it is essential to distinguish between two enamel reactions.

- a- The one with fluoride solution irrigating enamel in feeble concentration, inferior to 100 ppm, for example: 0.1 to 0.2 ppm

fluorine post eruptive, either by direct contact with fluoride water, 1 ppm fluoride or by saliva mixed with fluoride toothpastes. On clean enamel surfaces, fluoride solutions, weakly concentrated, bring about a steady enrichment of the enamel external layers (steady fluoride storage).

- b- The one with fluoride solutions strongly concentrated as topical solutions filled with 1 or 2 % fluoride. These strong concentrated fluoride solutions first bring about the forming of an unsteady storage tank of fluoride, from which a stable enrichment can develop after a while.

### **The steady fluoride storage tank in the enamel**

In its crystalline shape, the enamel apatite is mainly composed of calcium phosphate. The enamel without fluoride is an apatite hydroxide. If the apatite hydroxide of the enamel, the bone or the dentine is in contact with strongly diluted fluoride ( $F < 100$  ppm) as it occurs physiologically with interstitial tissue fluid, or by absorption phenomena, there are then exchanges of apatite hydroxyl ions against fluoride ions causing fluoride apatite forming. By this substitution (physiological process) the fluoride ion settles in the apatite grid instead of the hydroxyl; steady fluoride storage has developed. This type of fluoride enrichment is extremely slow. The resulting fluoride apatite owns the best crystalline properties; it is less soluble. The steady storage development does not cause any morphological change on the enamel surface.

### **The unsteady fluoride storage tank in the enamel**

The clean enamel reacts differently to more concentrated fluoride solutions supply, i.e. fluoride  $> 100$  ppm, very often slightly acidified as recommended for topical applications on enamel. The immediate reaction of the enamel with concentrated fluoride solutions causes for a few seconds to a few minutes a hydroxyapatite chemical change, which turns into solution. The released calcium ions form a fluoride of calcium with fluoride ions of the treatment solution. Following the saturation this calcium fluoride quickly precipitates on the corroded enamel surface. In the same time, the phosphate ions turn into solution following the reaction. The immediate reaction causes a softening and a decay of the most external layer of the enamel. In the same way, by deposit, a calcium fluoride layer on the corroded enamel has developed. We could compare this reaction to the one of caustic forming a bedsore when in touch with a mucous membrane. A 4 minutes local fluorination protects the enamel against decay because fluoride content has reached the critical limit of 1000 ppm but the coating of calcium fluoride is unsteady. It is an unsteady fluoride storage tank. This unsteadiness can be more or less strong. The unsteady fluoride storage tank is eliminated by cleaning and is never desirable. However, if the calcium fluoride coatings stay long enough in contact with enamel, the underlying hydroxyapatite can capture fluoride and turn into fluoroapatite. The unsteady storage tank contributes in the developing of steady fluoride storage.

### **Conclusion**

The forming of a straightaway steady fluoride storage tank is a physiological process. Time is essential: months and years are

required to obtain steady fluorine enrichment. A steady fluorine storage tank can be developed secondarily by means of fluorine enrichment more or less unsteady (coating of calcium fluoride). First of all, it always turns out an unsteady storage tank from a topical application of fluoride solutions used at a strong concentration. As a rule, fluorine toothpastes contain 1000ppm fluorine. When for a few minutes and in vivo you put in contact well cleaned teeth with toothpastes diluted in water, an immediate reaction occurs. 2 fluorine grammes of toothpaste contain 2 mg fluoride which major part has been lost quite quickly during the teeth brushing. The remnant is mixed with much oral fluid and by this means is alkalized. Conditions of an immediate reaction are barely outlined. Fluorination by toothpaste would rather be comparable to a physiological fluorination producing directly a steady fluorine storage tank. To obtain optimal and steady fluorine enrichment, toothpastes must contain the following properties:

- The steady coating brought about by the immediate reaction should be as resisting as possible to mechanical and chemical external influence.
- It should own a good adhesion and be able to develop secondarily steady fluorine storage tank.
- Even in a high dilution it should possess a great affinity for the enamel surface in order to pile up in it and to maintain as long as possible the forming of fluorapatit primarily present.

Only the amin fluorides fulfill these three conditions.

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#### 摘引

长期以来, 在珐琅基质的形成和钙化过程中经由内部方式吸收的氟被认为是对抗牙腐的一种有效保护。这并不正确。存储于珐琅质中的氟的含量太少, 不足以抑制牙腐。氟物质的供给即使在长牙后亦需继续。决定性的因素是在牙冠形成后, 在珐琅质表面出牙前及出牙后沉积的氟物质含量。首次发表于 *Dental Update 1998; 5(5): 15-16.*

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#### Resumen

Por mucho tiempo el flúor absorbido por vía interna durante el proceso de formación y calcificación de la matriz del esmalte fue considerado como un reforzamiento de la protección contra caries. Esta aseveración es falsa. Las cantidades de flúor almacenadas en el esmalte son demasiado débiles como para actuar como un proceso protector. El suministro de flúor debe continuar aún luego de erupción dental. El factor decisivo es el flúor que, una vez finalizada la formación de la corona, es asentado pre y post eruptivamente en la superficie del esmalte. Publicado primero en *Dental Update 1998;5(5): 15-16.*

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