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# Fluorides in Tooth Pastes – A Review

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**Abstract**

Good oral hygiene is necessary for the healthy teeth, gum, and fresh breath. Common fluoride sources are fluoridated drinking water, toothpaste and some mouth rinses. Toothpastes containing fluoride help prevent cavities in both children and adults. Fluoride incorporated in toothpaste help to protect teeth by binding with enamel to make it stronger. Toothpaste is by far the most commonly used mode of delivery of fluoride and the decline in the prevalence of dental caries in developed countries are mainly attributed to its increased use. This review aims to discuss about the fluorides in toothpastes on all aspects.

**Key Words:** Fluoride tooth paste, caries risk prevention, oral hygiene.

## INTRODUCTION:

Toothpastes are recognized as the best source of fluoride, which most effectively protects both deciduous and permanent teeth from caries. The cleaning abilities of toothpaste provided by abrasives, the antibacterial qualities, which, in turn, are provided by a variety of substances with different abilities to inhibit the growth of germs in the oral cavity. The purpose of oral hygiene using toothpaste is to reduce oral bacterial flora.(1) Good oral hygiene is necessary for the healthy teeth, gum, and fresh breath. Fluoride incorporated in toothpaste help to protect teeth by binding with enamel to make it stronger. (2)

Toothpaste is by far the most commonly used mode of delivery of fluoride and the decline in the prevalence of dental caries in developed countries are mainly attributed to its increased use.(3,4) The advantages of fluoridated products are well documented in the literature. It is the most spoken and debated topic all over the world with researchers having diverse views about its use and safety. The intensive promotion of fluoridated toothpastes by the oral health-care industry is a major factor in their increased use. This review aims to discuss about the fluorides in toothpastes on all aspects.

## FLUORIDE TOOTH PASTES:

Fluoride helps prevent tooth decay by slowing the breakdown of enamel and increasing the rate of the remineralization process. The new enamel crystals that form are harder, larger and more resistant to acid. Tooth enamel is hard yet porous. Plaque on the surface of your teeth can produce acids that seep into the pores (rods) of the enamel and break down its internal structure. This process, called demineralization, can create a weak spot in the tooth that may become a cavity if left untreated. Learning what fluoride does for the health of your teeth will help you become more aware of how to identify plaque and prevent it from becoming a cavity. Common fluoride sources are fluoridated drinking water, toothpaste and some mouth rinses. Toothpastes containing fluoride help prevent cavities in both children and adults. Fluoride strengthens weak spots and exposed roots, and to help prevent the early stages of tooth decay, brush regularly with a fluoridated toothpaste.

## HISTORY:

The idea of using fluoride as a beneficial agent in caries prevention is not new. The pioneers in the field were Black and McKay. They started observing and describing the effects of fluoride in the late 19th and beginning of the 20th century (5). McKay was studying brown stains on enamel observed in the population from different parts of the USA. A condition which he termed mottled enamel. In 1931, Churchill's chemical analysis discovered the reason behind those changes – fluoride (6,7). After the discovery, Dean systematically conducted a series of epidemiological investigations (8). He listed enamel spots based on size and color and measured the degree of tooth impairment. He compared enamel changes to fluoride concentration in drinking water and made the connection between fluoride content and the quantity of enamel spots, which he termed dental fluorosis (9). He documented dental fluorosis prevalence in the USA until 1942 and then compared it to caries prevalence in children. He noticed a strong inverse relationship (10). After concluding his 21-city study (11,12), he found that drinking water with 1 PPM of fluoride can prevent dental caries, increase tooth strength and does not have a negative impact on enamel.

The first studies about positive effects were conducted in 1945 with systemic fluoridation of drinking water in four American cities (Grand Rapids, Evanston, Brantford and Newberg), where 1 mg of fluoride per liter was added to drinking water. The results were convincing. Caries incidence reduction was at least 50%. They came to the conclusion that fluoride in suitable concentrations significantly affects dental caries prevalence (13-16). These observations and discoveries triggered massive drinking water fluoridation, the use of fluoridated salt and milk and an increase in diet supplement production (pills, drops, chewing gum, lozenges). Consequently, caries prevalence was successfully decreased. In 1950, Bibby et al (17) conducted a study comparing the efficacy of fluoride-coated pills intended to be swallowed, with

fluoride lozenges intended to be dissolved slowly in the mouth. Research showed a lower number of new caries lesions in the research group which consumed lozenges. This research triggered different studies comparing pre- and post-eruptive effects, which consequently led to a rethinking of the theory of systemic use of fluoride and its incorporation into enamel during teeth development (odontogenesis). In the last 30 years, studies have shown that the maximum anti-caries benefits of fluoride are primarily through topical use and direct contact on the tooth surface. Daily use of topical supplements with suitable fluoride concentration is beneficial. (18)

Methods, which led to greater fluoride exposure and lowered caries prevalence, are considered to be one of the greatest accomplishments in the 20th century`s public dental health (19).

**FLUORIDE AND ENAMEL:**

The development of newer dentifrice formulations has paralleled the increased understanding of the caries process and how fluoride works. The original belief of a continual dissolution of tooth surface has been replaced by the acceptance of an understanding of subsurface demineralization and the maintenance of a relatively intact surface layer, probably by remineralization.(20) Demineralization occurs when there is an imbalance between processes of mineral gain and loss. Fluoride may interact with these processes in several ways. It is now widely accepted that fluoride has both systemic and topical modes of action.(21) The interaction of fluoride with the mineral component of teeth produces a fluorohydroxyapatite (FHAP or FAP) mineral, by substitution of OH- with F-. This results in increased hydrogen bonding, a denser crystal lattice, and an overall decrease in solubility. The incorporation of fluoride into the hydroxyapatite (HAP) lattice may occur while the tooth is forming or by ion exchange after it has erupted. A decrease in solubility increases with greater amounts of fluoride incorporation, but rarely do we exceed several thousand parts per million of fluoride in the outer enamel.(22).

**DISCUSSION:**

There are many studies in school-aged children in which investigators evaluated the effectiveness of fluoride toothpaste in preventing and controlling caries. There also is limited scientific evidence regarding the effectiveness and risk of fluorosis associated with using different amounts of fluoride toothpaste (smear versus pea-sized) in children.(23) This review included many studies for reference for a better understanding of fluoride toothpaste use in children for reducing dental caries in primary teeth.

Another critical factor related to fluoride toothpaste use in children younger than 6 years is its association with the potential risk of development of dental fluorosis.(24) The permanent incisors are of critical importance to dental esthetics and are undergoing crown formation from around birth to four years of age. Most cases of fluorosis associated with fluoride toothpaste use are mild.

According to our findings, higher concentrations of fluoride in toothpaste increase the odds of developing dental fluorosis. Low-fluoride toothpastes are not available in the North American market; however, reducing the dose of regular fluoride toothpaste when using a pea-sized amount or a smear may be equivalent to the use of low-fluoride toothpaste. Indeed, findings of a more recent evaluation suggested that children who start brushing by age 24 months but do not use more than a pea-sized amount of toothpaste do not have an increased risk of developing fluorosis.(25) .

The concentration of fluoride in the toothpaste, frequency of brushing and amount of toothpaste used are the primary determinants driving fluoride exposure related to fluoride toothpaste use.

The mere presence or absence of fluorosis at any level was the outcome of interest for most studies and their subsequent meta-analyses. In light of this, oral health care providers should discuss with caregivers the risk of developing fluorosis versus the benefit of reducing the risk for developing dental caries when providing oral health education.(26)

Although it is limited, there is scientific evidence that fluoride toothpaste is effective in caries control and that ingesting pea-sized amounts or more can lead to mild fluorosis. To minimize the risk of developing fluorosis in children while maximizing the caries-prevention benefit for all age groups, the appropriate amount of fluoride toothpaste should be used by all children, regardless of age. Parental brushing and close supervision along with close attention to the amount of toothpaste dispensed for each use are necessary to minimize toothpaste consumption in children younger than 6 years. It is especially critical that dentists provide counseling to caregivers involving the use of oral description, visual aids and actual demonstration to help ensure that the appropriate amount of toothpaste is used. Study findings indicate that caregivers apply up to twice the recommended amount of toothpaste, making it essential that they are well educated regarding how to use fluoride toothpaste appropriately.(27)

**CONCLUSION:**

On discussing fluoride tooth pastes in detail, we get to know that there are more advantages in caries prevention. This review concludes that more evidence based studies if established can make the use of fluoridated tooth pastes in caries risk prevention.

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