

The major safeguard for fluorosis using age-appropriate toothpaste.

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Abstract

Until now it is well established that fluoride is an important ingredient to combat dental caries, working both systemically and topically. As the action of fluoride is dose-related and it has a cumulative action, it's over dosage can cause serious toxic effect. Fluorosis is one of the chronic toxic effects of fluoride that appears as a developmental disorder of dental enamel. Fluorosis develops due to multiple and continuous exposures to high concentration of fluoride in low dosage. Therefore, the development of fluorosis is not only dependent on the dose but also greatly reliant on length and timing of fluoride exposure. This paper presented a case of dental fluorosis of a 9 years old girl who had a history of swallowing of toothpaste during tooth brushing when she was younger than 3 years. Clinically fluorosis appears as subsurface hypo mineralization or porosity (mottling enamel) of teeth where usually fine white to chalky opaque to brown discoloration of enamel occur which was typically seen in all of my patient's permanent teeth (all permanent incisors and all permanent first molars) present at that time in her mouth while all of her deciduous teeth (all deciduous canines and molars) present at that time in her mouth were absolutely sound. Micro-abrasion is one of the procedures to treat the fluorosis teeth. In this case micro-abrasion was performed successfully.

Keywords: Fluorosis, Toothpaste, Children of Toddler age, Micro-abrasion.

Accepted on April 20th, 2019

Introduction

In the world, amongst the most abundant elements, the position of fluorine is 13th that constitutes 0.08% of the earth crust [1]. To combat dental caries, fluoride is considered as the most useful key ingredient which is effective both systemically and topically [2]. To avail its benefit children may be exposed to fluoride from diverse sources. Since the available evidence suggests that fluoride is a cumulative toxin and the action of fluoride is dose-related, it has a potential to cause a pernicious human health problems at its overdose [3]. Therefore, it is vital to aware our children about getting too much or too low amounts of fluoride. Fluoride supplements are available in many forms like tablets, mouth rinses, pastes, or gels and so on [4,5]. In 1909 for the first time the impact of fluoride on human teeth was recognized by the two dental surgeons, Frederick Mckay and Grant Back, in Colorado, United State during initiation of an investigation to detect the causes of mottled enamel. In 1931, Mckay, Kempf, and Churchil confirmed the link between mottled enamel and water fluoride level by further studies on water samples in areas in Idaho and Arkansas [6].

The fluoride toxicity may occur because of ingestion of fluoride either in single high dose or multiple lower doses. It is proved that after ingestion of fluoride, 100% of fluoride is absorbed in the gastrointestinal (GI) tract and approximately 90% is absorbed in the stomach [4,5], consequently nearly 99% of the body's fluoride is strongly bound to the calcified tissues such

as bones and teeth [7]. Therefore, fluoride has a strong systemic effect on teeth even before their eruption. It happens once they ingested it during the period of tooth development and thus increase the mineralization content and decrease the solubility of enamel by incorporating into the matrix of developing teeth. Due to overdose of fluoride two types of toxic effects (acute or chronic) may take place. Acute fluoride toxicity usually occurs due to ingestion of high dosage of fluoride at a time. It may show symptoms ranging from excessive salivation, nausea, vomiting, abdominal pain, and diarrhea towards central nervous system irritability, paresthesia, tetany, convulsions, and respiratory and cardiac failure. Fluoride dosage 70 to 140 mg/kg is considered as a lethal dose. On the other hand, chronic fluoride over dosage causing fluorosis [5,8-10].

Fluorosis ensues when fluoride interacts with mineralizing tissues and initiating alternations in the mineralization process [11]. The incidence of dental fluorosis is a toxic effect of fluoride on teeth when fluoride is ingested continuously for a long time during enamel formation. It is thought that due to overdose of fluoride, the role of ameloblast is affected during their late secretory and early maturation stages [12].

Fluorosis can occur in three stages:

Stage 1: Early maturation stage of enamel formation while the late secretory phase exist

Stage 2: After completion of mineralization just prior to eruption of slight amount of tooth.

Stage 3: Immediate after eruption, when enamel is noticeably porous in nature.

Though the exact mechanisms of development of fluorosis are not well spotted yet, dental fluorosis may develop during late secretory phase that is, in the early maturation stage or during matrix formation stage. During this stage the function of ameloblast is disturbed due to presence of excess fluoride. At this stage of enamel formation seems to be sensitive to fluoride exposure [11] and the uptake of fluoride into developing mineralizing tissues competes with calcium. The threat of enamel fluorosis is lowermost when only during the secretory stage exposure takes place, but when exposure happens in both secretory and maturation stages it would be the highest [11].

Clinically fluorosis appears as mottling (hypo-mineralization) and sometimes hypoplasia where fine white to chalky opaque to brown discoloration of enamel is noticeable that may be exhibited by pitting or discoloration of enamel due to lower mineral contents of tooth causing increased porosity. Dental fluorosis may outspread toward the dentinal enamel junction as severity rises [11]. So dental fluorosis is considered as a developmental disorder of dental enamel due to multiple and continuous exposures to high concentration of fluoride throughout tooth development. The overall fluoride exposure of children is mostly contributed by the fluoride supplements and once the total fluoride exposure to the developing teeth is excessive the consequence will be fluorosis [11].

In the context of Bangladesh, my perception is that the reason for the increasing trend of the development of dental fluorosis might be due to swallowing of toothpaste during tooth brushing at the age of tooth development. Because our water is not centrally fluoridated and no fluoride supplemented foods or beverages are easily available here. Recently in Bangladesh the most people are able to afford using toothpaste and brush in comparison to earlier days. The aim of this paper is to aware the parents/caregiver about selecting as well as using toothpaste among the children whose age is in between 1-4 years or who are not able to spit out yet whatever the age during tooth-brushing.

Case Report

This paper mainly specifies a coherent evaluation on the enormousness of the positive impact of ingestion of fluoride content toothpaste on human health. Here is a case of Dental Fluorosis who had a history of swallowing of toothpaste during tooth brushing when she was younger than 3 years old.

Now she is a 9-years-old child. Her mother brought her to our department for seeking help about her aesthetic problem. Her chief complaint was chalky white permanent teeth with brown stain that made her socially embarrassed.

History

To evaluate chronic fluoride over dosage and dental

fluorosis, it is essential to take a detailed past and present history of fluoride intake. Her mother informed us that she was very careful and punctual to clean her teeth regularly using fluoride content toothpaste when she was less than three years old. Her mother also recalled that she used to swallow the toothpaste during tooth brushing. It seems likely that Shelly ingested fluoridated toothpaste that exceeded the optimal level (0.5 to 1.0 mg/L, milligrams per liter), at the time of tooth development (Figure 1).

Clinical Examination

Clinical examination revealed that both maxillary and mandibular permanent incisors and all permanent 1st molars were chalky white in color where dark chocolate stain was present. The attention-grabbing feature of this crisis was that all of her primary teeth present in her mouth were quite sound and not affected by fluorosis at all while all the permanent teeth exist at that time in her mouth were affected by fluorosis.

History said the patient ingested more fluoride than the required dose. In turn the girl developed dental fluorosis due to ingestion of excessive fluoride during tooth brushing that appeared as a chalky white to brown discoloration of her all permanent teeth present at that time in her mouth. In such a way many children often get more fluoride than their daily requirement. Tragedy is that most parents/caregivers cannot realize about such pernicious effects of fluoride and so may never be able to recognize 'how their children develop fluoride toxicity'.

Clinical Diagnostic Procedure

The proper diagnosis of fluorosis needs assessment of

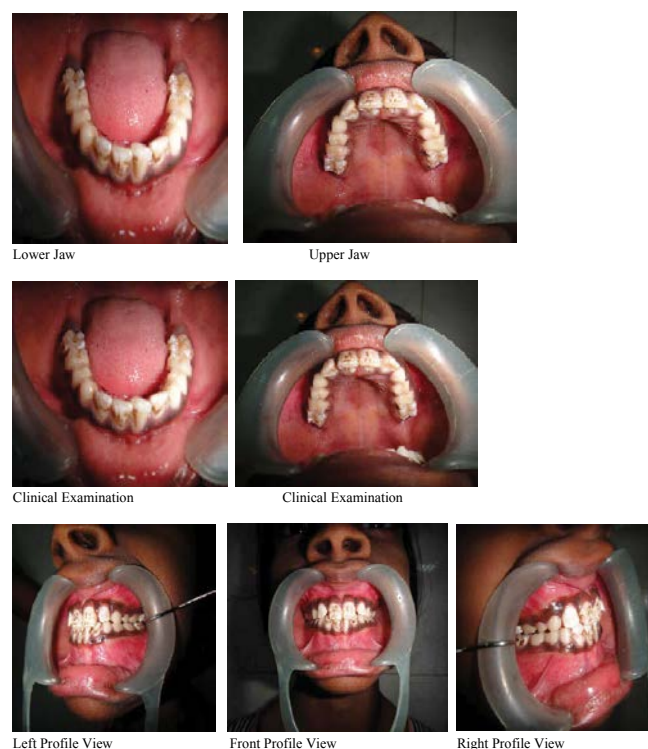


Figure 1. Clinical Examination View revealed the following features.

dry and clean dental surfaces, under a good light source. She developed mild type of dental fluorosis. The clinical appearance of mild dental fluorosis is considered by bilateral, diffuse (not sharply demarcated), opaque, and white striations, taking a horizontal course through the enamel.

White patches may form following coalesced of the opacities. Enamel may turn into discolored and/or pitted in more severe stages. The fluorosis enamel is not discolored, upon the eruption of the tooth into the mouth. Due to the dispersion of exogenous ions from food, such as iron, copper; and spices, into the abnormally porous enamel the stains develop over time.

Treatment Modalities Performed in this Case

As in cases of mild and moderate fluorosis bleaching and enamel micro-abrasion techniques provide highly satisfactory results without excessive wearing of sound dental tissue. We performed micro-abrasion for this girl patient. Firstly, micro-abrasion was carried out, and in the next appointment the bleaching was done. Before doing micro-abrasion for mouth preparation scaling and polishing was done (Figure 2).

Micro-abrasion

Enamel micro-abrasion is a minimally invasive conservative technique. This technique was first practically applied by Dr. Theodore Croll in Doylestown, PA and Richard Cavanaugh in 1986. It uses a combination of hydrochloric acid and pumice (an abrasive) which is scrubbed onto the surface of the affected tooth repeatedly up until the superficial layers of the enamel having the stains are abraded away [13].

Other treatment modalities

For mild cases: For treating discolored areas composite resin and resin-modified glass ionomer can also be used.

For moderate cases: Composite restorations can be accompanied by micro-abrasion or esthetic veneers.

For more severe cases: Prosthetic crowns might be required to use

Discussion

Esthetics changes in permanent dentition are the greatest concern in dental fluorosis, which are more prone to occur in children who are excessively exposed to fluoride between 20 and 30 months of age. Fluorosis on the front teeth, even in its



Figure 2. After Micro-abrasion.

“mild” forms, and obviously in its severe forms, can cause self-esteem problems for a child, particularly when they reach adolescence. Due to our ignorance/negligence the self-esteem of our future generation may be hampered. Self-esteem is so important for a child to develop their future carrier as well as to build up their personality that for our future generation it is our responsibility to help them especially in terms of mental health.

The critical time for development of fluorosis in late developing primary teeth is 4 months gestational age through 11 months of age. Though in primary tooth, fluorosis is less common and usually less severe than in permanent tooth. Permanent teeth will begin to grow around age 3 years underneath the gums and bony structures of the mouth. For permanent teeth especially in case of the early developing permanent teeth, such as incisors and the 1st permanent molars, the critical period to fluoride overexposure is between 1 and 4 years old, and the child would not be at risk around 8 years old in terms of dental fluorosis.

Therefore, 1- 4 years are the critical age for the children to take care about their dental health. At this age (one to four years old) usually the children may not be able to expectorate (spit out) fluoride-containing toothpaste during tooth brushing. Moreover, because of attractive color and flavor of pediatric paste it is possible for children to swallow the toothpaste. Consequently, these youngsters may ingest an excessive amount of fluoride during tooth brushing which is the greatest risk factor for the development of fluorosis.

Suggestion for the parents or caregivers

Help the children between the ages of 1-8 years old with supervised tooth brushing by showing the exact method of tooth brushing. In addition, most importantly they should learn how to spit out toothpaste during brushing and also teach them how long they should spend during brushing.

If the child is too young or unable to spit out tooth paste even after reaching 8 years, consider them to use fluoride free toothpaste or using no toothpaste or using only a smear amount of tooth paste during tooth cleaning.

Prevention of excess fluoride ingestion at the critical time of tooth development

Fluoride concentrations of both human milk (0.005-0.010 ppm) [8] and cows' milk (0.03-0.06 ppm) [14] are low, and consumption of either human milk or cows' milk could decrease fluorosis risk. Therefore, their fluoride concentrations are so low that disruption of enamel development is not possible in this situation because they (especially breast milk) provide exactly adequate fluoride for the children what they need at that age.

Avoid man-made drinks

Partial or full replacement of higher fluoride containing beverages (e.g., formula make again with fluoridated water) by human milk or cows' milk would increase the fluoride

intake. Supporting long-term lactation could be an important strategy to decrease fluorosis risk of primary teeth and early developing permanent teeth.

Poison Warning: FDA

In 1997, the FDA ordered toothpaste manufacturers to add a poison warning on every tube of fluoride toothpaste sold in the US

The warning reads

“Keep out of reach of children under 6 years of age. If you accidentally swallow more than used for brushing, seek professional help or contact a poison control center immediately” [15].

Conclusion

I think natural food especially human milk is an ideal food for children and that should not be replaced by any formula or other prepared food with high fluoride content.

In case of child’s toothpaste, the manufacturers use child-appealing flavors that make it particularly dangerous because young children have poorly developed swallowing reflexes, and invariably swallow large amounts of the paste. We know the concentration of fluoride is very high in toothpaste (800 to 1500 mg) whereas the optimal dose is only 0.5 to 1.0 mg/L (milligrams per liter). However, there is no study reporting such relationship.

Recommendation

Use fluoride-free toothpaste for children between the ages of 2-4 years old: My perception is to use fluoride-free toothpaste for those children between the ages of 2-4 years old or who cannot able to spit out toothpaste during tooth brushing.

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