

FLOURIDES AS DOUBLE EDGED SWORD-A REVIEW

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Abstract

Dental caries is a public health problem as it hampers the quality of life of an individual. It is basically an imbalance between the etiological factors that leads to dissolution and preventive factors that results in remineralization of tooth structure. It is necessary to maintain the optimal level of fluorides in water since its low as well as high concentration both effects the structure of the teeth. Concentration of fluorides lower than the optimal level results in dental caries whereas higher concentration at developing stages of teeth results in fluorosis. That's why it is very important to identify the proper concentration of fluorides depending upon the age, frequency of taking water and pathway of absorption.

Key words: Dental Caries, Demineralization, Remineralization

Introduction

Fluoride is widely available in the nature and is derived from an element known as Fluorine. Fluoride is available in almost drinking water sources especially underground water. Fluoride is one of the most electronegative elements found on the earth and attracts positive ions. In human body nearly 96% of fluoride is present in bones and teeth in the form of crystals. Tooth enamel is composed of 96% minerals like Hydroxyapatite, free(1%) as well as bound (2.6) water and organic compounds (0.4-0.6%) together with proteins and lipids[1,2].

Fluoride is necessary for both humans and animals. The daily intake of fluoride is equivalent to 1.0-3.0 mg. Mostly fluoride is ingested into the body through drinking water. Fluoride is routinely absent in soft water where as hard water might hold above 10.0 ppm of fluoride. Since, fluoride is present in bones and teeth in small amount and prevents tooth decay gives a justification for its inclusion as a necessary constituent in nutrition. Various studies conducted in 19th century showed that fluorides possesses an attraction for calcified tissues (

bones and teeth). Many studies showed that the inclusion of fluorides in diet results in the reduction of dental caries and strong teeth. Fluorides reduces the decomposition of mineral by improving its resistance towards acid dissolution [3,4]. Keeping all these things in mind various agents like tooth-powders, tooth-pastes, mouth washes were launched to increase the consumption of fluoride. With time lot of incidents grabbed attentiveness towards the dangerous side effects of fluorides. The first case was seen in Naples, Italy where people had scarification of teeth due to an element in the water. After some time same conditions appeared in other countries also. Recurrent efforts were made to connect these imperfections with constituents of drinking water. Since various studies had shown that fluorides were responsible for mottling of enamel renowned analyst Black and Mckay noticed that these teeth were less susceptible to decay. In this paper we will discuss the benefits as well as side effects of fluoride.

FLUORIDES IN PREVENTION OF DENTAL CARIES

Tooth decay destroys the tooth structure locally and progressively. Bacteria present in oral cavity like *Streptococcus mutans* and

lactobacilli releases acids which acts on carbohydrates and demineralizes the tooth structure [5]. Tooth decay is a universal problem characterized by carious lesions responsible for ache, discomfort and poor quality of life. However, at initial stages the lesions can be treated through agents rich in fluoride, calcium and phosphate [6]. Hypersensitivity is designated by sharp shooting pain caused on exposure to external stimuli (hot, cold or chemical) due to exposed dentinal tubules. Varnishes, liners, dentifrices, mouth rinses and restorations can reduce hypersensitivity [7]. Around 60-90% of the school going children and adults are suffering from dental caries in developed nations[8]. Topical application of fluorides makes alterations in saliva and buffer pH of saliva which results in remineralization of lesion [9]. Since topical application of fluoride is a non-invasive therapy and can play a major part in control of the disease [10]. Presence of fluorides in community drinking water, incorporation of dental hygiene aids contingent on fluorides improves the awareness of people towards oral health [11]. World Health Organization directed the systemic as well as topical application of fluorides in order to prevent tooth decay. The main causes of carious lesions in children is substandard quality and amount of saliva, malaligned teeth, immunocompromised and diet. Thus, fluorides application decreases the dissolution of enamel at lower pH [12]. Prevention is primarily based upon remineralizing technologies. Amorphous Calcium Phosphate present on the outermost surface of teeth (enamel) acts as a pool of calcium and phosphate and helps in remineralization [13].

Table1. Concentration of fluorides in prevention of dental decay [14,15]

Method/vehicle	Fluoride concentration (ppm F)
Water supplies	0.7-1.2
Fluoridated salt	200-250
Mouth rinse, daily	230
Dentifrices, children	250-500
Mouth rinse, weekly	920
Dentifrices, adult	1,000-1,500
Self-applied gels or rinses, prescription	5,000
Professionally applied solutions (NaF)	9,200
Professionally applied solutions, gels, foams (APF)	12,300
Professionally applied solutions (SnF ₂)	19,500
Professionally applied varnishes	22,600

FOETAL EFFECTS OF FLUORIDE

In 20th century proposal was made to give fluoride to expecting mothers. Clinical records showed that fluorides works best when administered during calcification and other developmental phases of foetus. Although others studies showed that utmost profit can be obtained by administering fluorides during ending stage of calcification or during enamel maturation before eruption. Researches showed that pits and fissures and smooth surfaces can be prevented from carious lesions by exposing them to fluorides at initial phases of calcification and 2-3 years prior tooth eruption respectively. However, study conducted by Carlos(1972) showed that there is no correlation between foetal exposure of fluorides and dental caries. Thus, managing fluoride intake in expecting mothers cannot prevent dental caries.

METHODS OF FLUORIDES ADMINISTRATION

1. **Toothpaste/ Mouthwash:** Dentifrices is the most frequent method of fluoride administration. It is one of the most popular methods because it has easy application, convenient and does not require professional assistance.

2. **Fluoridation of water:** Community water fluoridation for the first time was carried out at Grand Rapids in USA (1945).Fluoride consumption at optimal level reduces the chances of dental decay. The consumption of water depends upon the climate of a particular

region due to this the concentration of fluorides varies in different areas. People living in hot region consumes more water as compared to those living in cold regions. Studies suggested that a drop of 0.3 mg/l below standard fluoride concentration can lower the useful effects of fluoride by as much as two thirds. On the other hand, range of fluorides above 1.5 mg/l shows toxic effects.

3. Salt fluoridation: After community water fluoridation the best method to incorporated fluorides is salt fluoridation. In salt fluoridation sodium and potassium fluoride are added during manufacturing of salt. By this methods we can prevent dental caries in large population.

4. Fluoridation of milk: Initiated by Zeigler. It is an alternative method of fluoride delivery. In this methods fluoride is added in calculated amount in milk consumed by children.

PROFESSIONAL APPLICATION OF FLUORIDE

Fluorides are applied by dentist in a dental clinic at higher concentrations for therapeutic use.

- 1. Foam/ Gel:** These are composed of different constituents. Acidulated phosphate fluoride (APF) can be prepared by using sodium fluoride at neutral pH or acidulating and buffering it with phosphate. For application, material is carried out in a tray then inserted into oral cavity covering the teeth. Time for the procedure is usually 4 minutes and then patient expectorate the leftover material.
- 2. Varnishes:** It is non-aqueous in nature. It is applied directly on the tooth surface with the help of a brush. Adhesion to the tooth surface is carried out in the presence of saliva.
- 3. Fluoride Solution:** Since long time silver fluoride or silver diamine fluoride is used to prevent dental caries in deciduous teeth.

FLUOROSIS

Ground water contains fluorides at optimal concentration whereas surface water contains only traces of fluorides. Sometimes well water

contains four to five times more concentration of fluorides than the optimal level. A condition called as fluorosis appears on exposure to excessive concentration of fluorides especially in case of children. Fluorosis in milder form is often seen as small, opaque white regions on the surface of teeth also known as mottling. In this condition the colour of the tooth surface changes from chalky white, yellow brown to black. Due to fluorosis tooth loses its enamel forever. Research showed that fluorosis was seen more in those children who were consuming water containing water more than two times of optimal concentration of fluoride at age below eight years.

Skeletal fluorosis influence the bone, ligament and tendons. It is an endemic disease. People affected with skeletal fluorosis complaints of painful and stiff neck, backbone, joints, restriction in the movement of knee and shoulder joint. Moreover, it is not easy to diagnose skeletal fluorosis at initial stage. The cases of chronic fluoride poisoning is seen in many states of India, Argentina, China etc. when the concentration of fluoride in water is above 10.0 ppm. Also seen among workers of cryolite industries. On clinical examination people suffering from chronic fluoride poisoning shows sclerosis of bones.

Cases of acute fluoride poisoning are seen in US, due to improper design or functioning of equipments containing fluoride. Sometimes concentration of fluoride above optimum level makes people sick.

HOW TO PREVENT FLUOROSIS:

1. Concentration of fluorides in community drinking water should be less than 1.0 ppm.
2. Use of dentifrices, mouth rinses, drops etc. under the guidance of experts.
3. Consumption of food rich in fluorides(sea-fish, tea).
4. Immediate consultation with a doctor in case of pain and stiffness in neck and joints.

5. Follow proper measures while working in industries dealing with fluoride content.
6. Adequate consumption of calcium and vitamin – C.
7. Consumption of defluoridated water in case of expecting mothers.

CONCLUSION

Fluorides plays an important role in the prevention and conservative treatment of dental caries. Oral health is very important for the overall well-being and quality of life. Topically applied fluoride varnishes, gels showed good success rate in the prevention of carious lesions. In India the main source of fluorides is community water only so it is important to keep an eye on the optimal concentration of fluorides in water. In case if the concentration of fluorides is above optimal level, defluoridation of water should be carried out in order to prevent any kinds of toxic effects.

Conflicts of interest: Nil

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