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Review Article

Dental Fluorosis – A Review

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Abstract

Dental fluorosis is a dental enamel development disturbance caused by repeated exposure to high fluoride concentrations during tooth development, resulting in enamel with a lower mineral content and more porosity. Dental fluorosis shows white opaque appearance of hypomineralized enamel subsurface, with pitting and subsequent loss of enamel surface leads to brown color. The lesions take place in these forms : hypoplasia of dental enamel, pitting, decalcified areas, mottling. Fluorides are always considered as double-edged sword. Fluorides are necessary for the healthy growth and development of the body, however excessive fluoride intake can be harmful and causes severe deformities by understanding the sources of fluoride, knowing to avoid over exposure, fluorosis can be prevented. They are also treated with bleaching, micro abrasion, resin infiltration, resin infiltration with bleaching, and microabrasion with bleaching.

Keywords : Fluorosis, hypomineralisation, mottling, nalgonda technique

INTRODUCTION

Fluoride is 0.08% of the earth and is the 13th plentiful element. The recommended daily intake of fluoride is between 0.05 and 0.07 mg F/kg. Researchers have found 4 sources that causes increased risk of dental fluorosis are: fluoridated drinking water, topical fluoride, fluoride supplements, (especially fluoride toothpastes), and formula prescribed for children (1)(2)(3)(4).Fluorides are mainly excreted by renal tubules. Extra fluorides are accumulated in the skeletal tissues. Dental fluorosis is a development disturbance caused by repeated exposure to high fluoride concentrations during tooth development, resulting in enamel with a lower mineral content and more porosity (5, 6). Dental fluorosis severity is influenced by the time and duration of fluoride exposure, the individual's response, weight, level of physical activity, nutritional factors, and bone growth. The recommended level of daily fluoride intake is 0.05 - 0.07 mg F/kg/day, helps in re-mineralization and prevents dental caries. In India, around 50% districts of Karnataka, Rajasthan, Gujarat and Andhra Pradesh are affected. India reported prevalence rates of 66.7, 71.3, and 69.3% (4, 5).

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On the other side, Kerala and Tamil Nadu have significantly low prevalence rates, 32.6 and 15.8%, respectively. These variations in dental fluorosis prevalence are due to the presence of fluoride in the local water supply. According to studies, in China and Brazil, high fluoride prevalence was found, with rates ranging from 50 to 80.4% (5).

Fluorosis is most commonly caused by increase in spikes. Whereas the normal plateau level of plasma fluoride is around 1.5 ml/l in a healthy adult. The individual's susceptibility to dental fluorosis may also increases by malnutrition and renal insufficiency. Clinically speaking, dental fluorosis affects the permanent mandibular incisors and first permanent molars the least and premolars the most. Additionally, the thickness of the enamel affects how severe the fluorosis is in the teeth. Therefore, dental fluorosis, which is indicated by the appearance of snow-capped cusp tips and incisal edges is the most severe, children would not be at risk around the age of 8 because fluoride overexposure period is between 1 and 4 years old. Dental fluorosis is more concerned for its cosmetic alterations in the permanent dentition, which are more likely to occur in children who have been over exposed to fluoride between 20 and 30 months of age. The children would not be at risk around the age of 8 because the essential period for fluoride overexposure is between 1 and 4 years old. Fluorotic teeth might show white streaks, brown discoloration, dark brown discoloration, or even black staining. Fluorosis has long been seen as a serious public health issue in India. In India, more than 60 million individuals drink water that contains more fluoride than is necessary (4, 5).

Fluoride - The Double-Edged Sword:

Fluoride is a prime example of a double-edged sword. Fluoride has positive effects in small doses but is hazardous in large doses, just like many other minerals and chemicals. Fluoride above a certain level has been shown to be harmful, so, daily supplementation with optimum levels has been shown to be a significant in preventing dental caries. Fluorides are also mitogenic stimulant, it stimulates osteoblasts and promotes mineral deposition in bone. Fluorides also have negative effects on body tissues, including teeth, bones and soft tissues, when consumed excessively over an extended period of time in various forms (7). The lesions in fluorosis have taken the following forms

Hypoplasia of dental enamel:

A) The enamel was smooth yet incredibly thin, leaving a few tiny, circular dentine patches that range 1 to ¼ mm in size.

B) Pitting: Pitting is nothing but numerous little pits with sloping edges on the outer surfaces of anterior teeth. They are mostly viewed as one or two horizontal rows, which is significant of acute infections and rickets in first years of life.

Decalcified areas:

The decalcified areas are uneven white enamel patches and are opaque in nature. There are pitting and mottling with clearly defined spots. These patches are diffuse and covers the entire tooth's surface. In these decalcified areas, the translucency of regular enamel will be contrasted with their dull white appearance.

Mottling:

Due to the enamel's uneven thickness, ridges frequently occur horizontally, mottling is not a typical fluorosis but a condition interfering the enamel organ development (8).

MEASURES

For the classification of fluorotic teeth, Dean's fluorosis index is used, it categorizes fluorosis based on clinical appearance (9).

Dean's index in 1942

Questionable: sporadic enamel spotting and white flecking.

Mild: most of the tooth's surface covered in opaque white patches.

Moderate and severe: pitting and a brownish stain on the tooth's surface with corroded appearance (10).

The Thylstrup and Fejerskov fluorosis index (TFI)

The Thylstrup and Fejerskov fluorosis index (TFI), has a wider range for more severe types of dental fluorosis, and is also a popular measure of fluorosis. It has a 10-point score and was developed to classify dental fluorosis that affects the buccal/lingual and occlusal surfaces. The Thylstrup and Fejerskov fluorosis index (TFI) correlates visual evaluation with polarized and light microscopic investigation. The TFI score for the Dean's index are: mild (TFI = 1-3), moderate (TFI = 4-5), and severe (TFI = 6-9)(9).

INTERVENTIONS AND MITIGATION OF FLUOROSIS:

Since dental fluorosis is permanent, it must be treated with time-consuming, expensive, difficult procedures that are not readily available to rural residents. The best strategy to mitigate fluorosis is said to be prevented and controlled through providing safe water and safe food as there are no effective treatment options for any form of fluorosis (10).

The other interventions are safe drinking water provision, identifying other sources of clean water, bringing water from a reliable source, dual sources of water, rainwater collection, removing fluoride from water using appropriate methods and implementing strict policies to reduce industrial fluoride contamination, which will help to prevent industrial fluorosis.

DEFLUORIDATION OF WATER:

The conventional way of providing safe water to the populations affected by fluorosis is Defluoridation. It is nothing but lowering fluoride levels in drinking water to optimum level.

Treating water centrally (at the source), treating water locally (at the household level). Most wealthy nations have chosen treatment at the source as defluoridation will be done on a big scale under trained personnel (10).

Defluoridation techniques are broadly classified into:

Adsorption technique: The adsorption technique involves defluoridation using activated alumina, bone char, calcined clay, mud pots and natural adsorbents

Ion exchange technique: The ion exchange technique includescation exchange resins, bone char, bone and anion

Precipitation technique: Aluminium salts (alum) (lime), brushite, poly aluminium hydroxy sulphate and poly aluminium chloride are the commonly used materials in precipitation technique. It includes nalgonda technique, contact precipitation, iisc method (11).

Nalgonda technique:

The first community defluoridation plant was built in the town of Kathri in the Andhra Pradesh district of Nalgonda to remove fluoride from drinking water. Alum salts, lime, and bleaching powder are added using the Nalgonda Technique, which is then quickly mixed, flocculated, sedimented, filtered, and disinfected. Aluminum sulphate (alum), aluminium chloride, or a combination of these two forms of the salt can be added. It is in charge of eliminating fluoride from water (12).

Contact precipitation:

A method for removing fluoride from water known as contact precipitation involves mixing calcium and phosphate compounds with water to cause fluoride to precipitate.

IISc method:

This defluoridation method was created by the Indian Institute of Science (IISC), Bangalore. Magnesium oxide, calcium hydroxide, and sodium bisulfate are used in this procedure. By precipitating fluoride as insoluble magnesium fluoride, magnesium oxide eliminates the dissolved fluoride ions from water samples (13).

Others: Electro chemical defluoridation and reverse osmosis (14).

TREATMENT OF DENTAL FLUOROSIS:

There aren't many options for treating fluorosis in teeth. Bleaching is suggested for mild cases of fluorosis (TFI 1, 2). Micro abrasion involves removing outer layer of damaged enamel from the tooth surface in an acidic environment, and is one of the treatments for moderate dental fluorosis. For patients with TFI of 5 or less, composite restorations combined with microabrasion or the placement of cosmetic veneers may be done, whereas prosthetic crowns may be required in situations with TFI of 8 to 9 (15).

PREVENTION OF DENTAL FLUOROSIS:

By adhering to the US Environmental Protection Agency's (USEPA) "recommended limit for fluoride exposure," dental fluorosis can be reduced or avoided. The USEPA recommends 0.06 mg fluoride/kg/day as the reference dose, and is the estimated daily exposure without any noticeable risk of adverse consequences (1).

CONCLUSION:

Fluoride is a public health tool for preventing dental decay when administered appropriately. Fluorosis in the teeth and bones can result from consuming too much fluoride, it also has negative consequences. Fluorosis is still an endemic problem, constantly expanding its geographic reach across the nation.

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CONFLICTS OF INTEREST:

The authors declare no conflicts of interest.

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