



Dental Fluorosis and its Varied Treatment Options ‘A Case Series’

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ABSTRACT

Dental fluorosis is a known adverse effect of fluoride overuse. Enamel or dental fluorosis is a condition caused by 'excessive' intake of fluoride over an extended period of time. The most common symptom of dental fluorosis is a chalk-like discoloration of teeth with white spots or lines on tooth enamel. In more severe cases the affected areas have a yellow or brown discoloration. In extreme forms, fluorosis may result in a pitted tooth surface. Fluorosis has been reported way back in 1901. The treatment options for fluorosis are varied depending upon individual cases. The purpose of this article is to report various treatment options available for dental fluorosis, it also dwells on the need for the dentists to be aware of their local indigenous pathologies to treat it in a better manner.

Keywords: Dental fluorosis, Endemic fluorosis areas, Fluorosis, Treatment options for fluorosis.

I. INTRODUCTION

Dental fluorosis is a health condition caused by a child receiving too much fluoride during tooth development. The critical period of exposure is between 1 and 4 years old, children over age 8 are not at risk.[1] In its mild form, which is the most common, fluorosis appears as tiny white streaks or specks that are often unnoticeable. In its severest form, which is also called mottling of dental enamel, it is characterized by black and brown stains, as well as cracking and pitting of the teeth.[2] It is well documented that fluoride can have both beneficial and detrimental effects on the dentition ever since Mc Kay and G.V. Black in 1916 published the effect of fluoride on dentition.[1] The beneficial effects of fluoride on dental caries are due primarily to the topical effect of fluoride after the teeth have erupted in the oral cavity. In contrast, detrimental effects are due to systemic absorption during tooth development

resulting in dental fluorosis.[2] Dean, 1934, who developed a classification for fluorosis, which is still widely used, based on his interpretation of clinical appearance.[3] Dean and McKay suggested that optimum level of water fluoride should be below 0.9 - 1.0 PPM.[4] The severity of dental fluorosis depends on the amount of fluoride exposure, the age of the child, individual response, as well as other factors including nutrition.[1] Although water fluoridation can cause fluorosis, most of this is mild and not usually of aesthetic concern.[3] Severe cases can be caused by exposure to water that is naturally fluoridated to levels well above the recommended levels, or by exposure to other fluoride sources such as brick tea or pollution from high fluoride coal.[4] The earliest manifestation of dental fluorosis is an increase in enamel porosity along the striae of Retzius.[9] Clinically, the porosity in the subsurface of enamel reflects as opacity of the enamel. With an increased exposure to fluoride during tooth formation, the enamel exhibits an increased porosity in the tooth surface along the entire tooth surface. Very severely hypo mineralized enamel will be very fragile and hence as soon as they erupt into oral cavity they undergo surface damage as a result of mastication, attrition and abrasion. The definite evidence that fluoride can induce dental fluorosis by affecting the enamel maturation was given by Richards et al. [10] Thylstrup and Fejerskov proposed a way of recording dental fluorosis (TF index) based on the histopathological features.[11] Human and animal studies have shown that the enamel hypomineralization in fluorotic teeth are due to aberrant effects of fluoride on the rates at which enamel matrix protein breakdown or rates at which the byproducts of enamel matrix degradation are withdrawn, resulting in retardation of crystal growth in enamel maturation stage.[12]



Criteria for Dean’s system of classification for fluorosis . [3]

Score	Criteria
0 (Normal)	Enamel surface- smooth, shiny, and generally pale, creamy white colour Enamel Structure-Translucent semi vitri form type
0.5 (Questionable)	Enamel-Slight aberrations, few white flecks to occasional white spots.
1 (Very Mild)	Twenty-five percent area of the tooth has irregularly scattered small, opaque, paperwhite areas. Teeth show white opacity of approximately 1-2mm at the tip of their summit of cusps of the bicuspid or second molar
2 (Mild)	White opacities are more extensive but present in less than fifty percent of too
3 (Moderate)	Brown stains are frequently observed. All enamel surfaces show wear and are affected
4 (Severe)	The general form of the tooth is affected and hypoplasia is observed. Discrete and confluent pitting; widely spread brown stains and often corroded-like appearance



Classification of Thalstrup and Fejerskov index [11]

Score	Criteria
0	After prolonged drying, normal translucency of enamel is observed
1	Narrow white lines are observed, which are located corresponding to the perikymata.
2	Occasionally confluence of adjacent lines and more pronounced lines of opacity are observed on smooth surfaces. These lines of opacities follow the perikymata. The occlusal surface is marked with opacity <2mm in diameter scattered on surface areas and pronounces opacity of cuspal ridges.
3	Cloudy areas of opacities that merging and irregular are observed on the smooth surface. Accentuated drawing of perikymata is often seen in between opacities. Occlusal Surfaces are observed with confluent areas of marked opacity. However, worn areas appear normal but are generally circumscribed by a rim of the opaque enamel.
4	The entire smooth surface appears chalky white and also exhibits marked opacities. However, those parts of the surface that are exposed to attrition look less affected. The entire occlusal surface exhibits marked opacities. Attrition is often pronounced shortly after the eruption.
5	Marked opacities are observed over entire smooth and occlusal surfaces. These opacities are with pits < 2mm in diameter.
6	Smooth surfaces have pits that are regularly arranged in horizontal bands <2



	mm in vertical extensions. Occlusal surface Confluent areas <3mm in diameter exhibit loss of enamel. Marked attrition
7	Loss of outermost enamel in irregular areas involving <1/2 of the entire smooth surface Changes in the morphology caused by merging pits and marked attrition in occlusal surfaces
8	Loss of outer enamel involving >1/2 of the smooth and occlusal surface.
9	Loss of the main part of tooth enamel and change in the anatomic appearance of smooth and occlusal surfaces. The cervical rim of nearly unaffected enamel is generally observed.



TSIF classification and identification criteria [13]

Score	Descriptive Criteria
0	Normal tooth appearance and no evidence of fluorosis is observed
1	Definite fluorosis can be seen. Less than one-third of enamel is observed with parchment-white color. The fluorosis is confined only to incisal edges of anterior teeth and cusp tips of posterior teeth (“snow capping”) is considered under this category.
2	At least one-third of the visible surface is covered with Parchment-white fluorosis, but less than two-thirds.
3	At least two-thirds of the visible surface is covered with Parchment-white fluorosis.
4	Staining in addition to any of the earlier mentioned effects may be observed on enamel. Staining is defined as “an area of definite discoloration that may range from light to very dark brown.”
5	Discrete enamel pitting is present, but there is no evidence of staining of intact enamel. A pit can be defined as “a definite physical defect in the enamel surface with a rough floor surrounded by a wall of intact enamel. The pitted area is generally stained or of a different color from the surrounding enamel.”
6	Both discrete pitting and staining of the intact enamel are observed.
7	Enamel surface with confluent pitting is seen. The anatomy of the tooth may be changed because large enamel areas are missing. A dark brown stain is usually present.

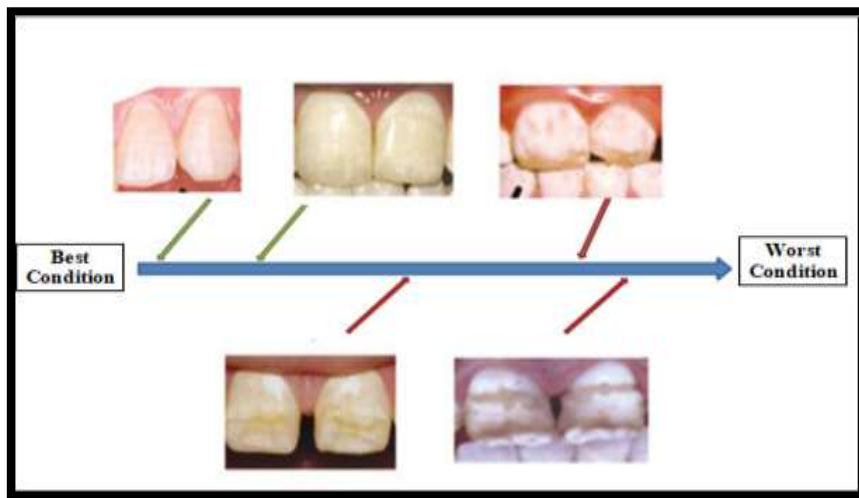


Indian Council of Medical Research (ICMR) Index [14]

ICMR Index for Dental Fluorosis

Grade	Description
0 (normal)	Enamel surface appears smooth, glossy, translucent, creamy white/pale in color.
1 (mild)	Enamel surface showing extensive chalky white opaque areas in two or more teeth.
2 (moderate)	Enamel surface showing extensive chalky white opaque areas in two or more teeth.
3 (severe)	Enamel surfaces showing brown color with the pitted, discrete or confluent, eroded or destroyed structure of two or more teeth.

VISUAL ANALOUGE SCALE FOR DENTAL FLUOROSIS ASSESSMENT



PREVENTING DENTAL FLUOROSIS

NATIONAL PROGRAMME FOR PREVENTION AND CONTROL OF FLUOROSIS (NPPCF)

NPPCF aims to prevent and control Fluorosis disease in the country.



AIMS AND OBJECTIVES

- To collect, assess the samples of drinking Water Supply and sanitation
- Comprehensive management of fluorosis in the selected areas
- Capacity building for prevention, diagnosis and management of fluorosis cases
- Health education
- Management including Surgery and Rehabilitation

Parents should take necessary measures for preventing dental fluorosis:

- To drink safe fluoride free water
- Diet supplementation with calcium
- Supply of micro-nutrients – fresh fruits and vit-c
- Powdered or liquid concentrate infant formula should be mixed with water that is fluoride-free or contains low levels of fluoride.



- Do not use fluoride toothpaste until the child is two years old, or unless advised to do so by a dentist.
- For children age two and older, place only a pea-sized amount of fluoride toothpaste.
- An adult should supervise the use of fluoride-containing dental products by children younger than six years old, and check that they do not swallow it.

The damage that dental fluorosis causes to the teeth enamel is permanent and not reversible. Dental fluorosis treatment is targeting in hiding the discoloration of the teeth. It can be cosmetically treated by a dentist. The cost and success can vary significantly depending on the treatment options for fluorosis varies with severity.

Depending upon severity, treatment option varies:[15]

- A. Micro/Macro abrasion
- B. Bleaching
- C. Composite restorations
- D. Veneers

E. Full crowns Generally speaking, bleaching and micro abrasion are used for superficial staining, whereas the conservative restorations are used for more unaesthetic situations.

Case Series

Case 1: A 18-year-old female patient reported to Government General Hospital, Tq -Sedam, Dist - Kalburagi , State - Karnataka, with a chief complaint of discoloured upper front teeth since her childhood. No other relevant medical history was reported by the patient. [Fig. 1] On examination, mild grade fluorosis according to Dean's Fluorosis index was present in his teeth (12 – 22). The teeth (12 – 22) were abraded using water cooled fine diamond finishing shaped points, with diamond abrasive particle size of 20 - 30µm with a high speed hand piece to remove surface enamel layer of 0.5mm thickness. Removal of surface enamel was done with intermittent pressure under water coolant. Final polishing of teeth was carried out with polishing discs . The patient was satisfied with final aesthetic outcome. [Fig.1: Case 1-A, Case 2-B]



FIG 1: CASE 1.A – Pre-operative and Post-operative images



FIG 1: CASE 2.B – Pre-operative and Post-operative images



Case 2: A 21-year-old female patient reported to Government General Hospital, Tq -Sedam, Dist - Kalburagi , State – Karnataka, with a chief complaint of discoloured upper front teeth since her childhood. No other relevant medical history was reported by the patient. [Fig - 2] On examination, mild grade fluorosis according to Dean's Fluorosis index was present in his teeth (12 – 22).During the

initial visit complete oral prophylaxis was carried out, followed by bleaching (etchant)using 37% phosphoric acid. Each bleaching session consisted of application of etchant for five minutes with one minute interval followed by polishing of teeth . The patient was satisfied with the final outcome after two sittings, which were done a week apart from each session. [Fig - 2]



FIG 2: CASE 1.A – Pre-operative and Post-operative



FIG 2: CASE 2.B – Pre-operative and Post-operative

Case 3: A 16-year-old female patient reported to Government General Hospital, Tq -Sedam, Dist - Kalburagi , State - Karnataka, with a chief complaint of discoloured upper front teeth since her childhood. No other relevant medical history was reported by the patient. [Fig - 3] On examination, mild grade fluorosis according to Dean's Fluorosis index was present in his teeth (12-22).During the initial visit complete oral prophylaxis was carried out, treatment plan involved direct composite

restorations from (12-22) and also presence of moderate grade of fluorosis, according to Dean's Fluorosis index. The treatment involved composite resin used was composite Ceram-X Duo (Dentsply, India) enamel shade E1 and dentin shade D2 bonding agent employed was Prime and Bond NT (Dentsply, India). Polishing of composite restoration was done. The patient was satisfied with treatment outcome. [Fig. 3]



FIG 3: CASE 3.A – Pre-operative and Post-operative images



FIG 3: CASE 3.B– Pre-operative and Post-operative images

II. DISCUSSION

In Case 1: Patient had mild grade of fluorosis and thus micro and macro abrasion were employed as the treatment of choice. Advantage of micro and macro abrasion being its much faster procedure in achieving the desired result compared to other treatment options. However, the main disadvantage is that these procedures employ high speed rotary instrument which can lead to excessive removal of tooth structure if operator does not have the desired skill level. Abrasion techniques can be successfully employed for discoloration presented either as single line discoloration or patchy type of discoloration, it cannot be successfully employed for discoloration which is more diffuse in nature.[Fig 1-A,1-B]

In Case 2: Patient had mild to moderate grade of fluorosis and therefore both the bleaching technique and abrasion procedures were employed. Most of the times, a combined treatment regimen is employed to produce the desired aesthetic result in patients with yellowish discoloration due to

fluorosis. In-office vital bleaching, with etchant was carried out with 37% Phosphoric acid, as it has been successfully used for treating mild fluorosis. Advantage of this procedure is that it is relatively non-invasive compared to other restorative procedures and also it could be done with minimum chair side time.[Fig 2-A, 2-B]

In Case 3: Patient had moderate type of fluorosis which necessitated to be treated by composite veneers. Composite veneers have been successfully employed for management moderate grade fluorosis, because of the time constraint given by patient, direct composite veneer treatment option was selected. Advantage of direct composite veneer is that it is done with minimal chair time when compared to indirect ceramic veneers, disadvantage being its long term wear resistance, colour stability.[Fig 3-A, 3-B]

One of the most important part of diagnosis of dental fluorosis is differentiating this entity from Amelogenesis Imperfecta and Molar-Incisor Hypo-mineralization (MIH) and most



important data for differentiating dental fluorosis from other pathologies will be familial history, place of residence, chronology of discoloration appearance. In spite of all these findings, dental fluorosis is difficult to distinguish clinically and histologically from other type of hypoplastic and hypomineralized enamel.

The purpose of this paper was to report various treatment options available for dental fluorosis from a conservative bleaching management to extensive composite build up. Also, it has been reported from findings that the predominant cariostatic effect of fluoride is not due to its uptake by the enamel during tooth development but during cyclic de- and remineralization processes, which take place at the tooth/oral fluid interface so it's possible to achieve caries reduction without concomitant risk of dental fluorosis. So it is in the interest of both patient and dentist that the dentist be aware of all the treatment modalities available to us.

III. CONCLUSION:

Fluorosis is a major health problem in India with over 65 million people at risk and 6 million children seriously affected. In all the cases described here, diagnosis of dental fluorosis was made from their familial history and place of residence and type of drinking water used. All the patients in this report were from localities in and around Tq-Sedam. Newer treatment options which combine these various treatment modalities are emerging. Other treatment options available are laser assisted bleaching, abrasion employing abrasive pastes. This paper does not advocate that one treatment option is superior to another but rather the severity of the lesion alone determines the treatment option.

Conflict of Interest: None

Source of Support: Nil

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