

## Prevention of 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

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individual response, as well as other factors including nutrition.<sup>[1]</sup> Although water fluoridation can cause fluorosis, most of this is mild and not usually of aesthetic concern.<sup>[3]</sup> 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.<sup>[4]</sup>

The earliest manifestation of dental fluorosis is an increase in enamel porosity along the striae of Retzius.<sup>[9]</sup> 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.*<sup>[10]</sup> Thylstrup and Fejerskov proposed a way of recording dental fluorosis (TF index) based on the histopathological features.<sup>[11]</sup> 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.<sup>[12]</sup>

**Dean's index:**<sup>[3]</sup>

1. Questionable - occasional white flecking's and spotting's of enamel
2. Mild - white opaque areas involving more of the tooth surface

### 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.<sup>[1]</sup> 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.<sup>[2]</sup>

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.<sup>[1]</sup> 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.<sup>[2]</sup> Dean, 1934, who developed a classification for fluorosis, which is still widely used, based on his interpretation of clinical appearance.<sup>[3]</sup> Dean and McKay suggested that optimum level of water fluoride should be below 0.9 - 1.0 PPM.<sup>[4]</sup> The severity of dental fluorosis depends on the amount of fluoride exposure, the age of the child,

3. Moderate and severe - pitting and brownish staining of tooth surface
4. Corroded appearance of tooth

**TF score:**<sup>[11]</sup>

1. Normal translucency of the glossy creamy white enamel remains after wiping and drying of the surface
2. Thin white lines are seen across the tooth surface
3. Opaque white lines are more pronounced and frequently merge to form small cloudy areas scattered over the whole surface of the tooth
4. Merging of white lines occurs, and cloudy areas of opacity occurs spread over many parts of the surface. In between the cloudy areas, white lines also can be seen
5. The entire surface exhibits a marked opacity or appears chalky white
6. The entire surface is opaque and there are round pits
7. The small pits frequently merge in the opaque enamel and forms bands
8. There is loss of outer surface of enamel in irregular areas and less than half the surface is involved
9. The loss of outer most enamel surface is more than half the enamel
10. The loss of major part of the outer enamel results in change of anatomical shape of the tooth

**Other indices available are:**

1. The tooth surface fluorosis index<sup>[13]</sup>
2. Fluorosis risk index<sup>[14]</sup>

**Preventing dental fluorosis**

Parents should take necessary measures for preventing dental fluorosis:

1. Powdered or liquid concentrate infant formula should be mixed with water that is fluoride-free or contains low levels of fluoride,
2. Do not use fluoride toothpaste until the child is two years old, or unless advised to do so by a dentist.
3. For children age two and older, place only a pea-sized amount of fluoride toothpaste.
4. 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:<sup>[15]</sup>

- 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 Reports**

**Case 1:** A 21-year-old male patient reported to Babu Banarasi Dass College of Dental Sciences, Lucknow with a chief complaint of discolored upper front teeth since his childhood. No other relevant medical history was reported by the patient. **[Plate 1, Fig. 1]**

On examination, mild grade fluorosis according to Dean's Fluorosis index was present in his teeth (12 – 22). Dental caries were present in 47 and 36, and oral hygiene was good. Caries were restored with amalgam restorations, and further treatment plan involved micro and macro abrasion followed by polishing.<sup>[17]</sup> The teeth 12 - 22 were abraded using water cooled fine diamond finishing flame 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 (Super Snap, Shofu Inc.). The patient was satisfied with final aesthetic outcome. **[Plate 1, Fig. 2]**

**Case 2:** A 19-year-old male patient reported to Babu Banarasi Dass College of Dental Sciences,, Lucknow with a chief complaint of discolored upper and lower front teeth since his childhood, his medical history was non-contributory and had poor oral hygiene. **[Plate 1, Fig. 1]**

During the initial visit complete oral prophylaxis was carried out, followed by in- office vital bleaching using McInnes solution, further aided by etching of the teeth by 37% phosphoric acid.<sup>[16-17]</sup> McInnes solution consists of one part anesthetic ether, five parts hydrochloric acid (36%), five parts hydrogen peroxide (30%), it was freshly mixed and applied to teeth using a cotton applicator. **[Plate 1, Fig. 2 & 3]** Each bleaching session consisted of application of bleaching solution for five minutes with one minute interval followed by polishing of teeth with prophylaxis paste<sup>[18]</sup> viz., Proxit (Ivoclar Vivadent). The patient was satisfied with the final outcome after three sittings, which were done a

week apart from each session. Finally microabrasion was done to aesthetically alien the teeth. [Plate 1, Fig. 4]

**Case 3:** An 18-year-old female patient reported with a complaint of discolored upper front teeth Patient gave history of discoloration present from her childhood. There was no relevant medical history reported by the patient.

On examination according to Dean's Fluorosis index she had mild to moderate fluorosis in 13 – 23 teeth. Her oral hygiene was poor. And no dental caries were found in any of her teeth. [Plate 1, Fig. 1]

Treatment plan involved direct composite restorations from 12-22, because of the time constraint given by the patient] and also presence of moderate grade of fluorosis, according to Dean's Fluorosis index. The treatment involved veneer preparation with window design, composite resin used was nano-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 accomplished with Super Snap (Shofu Inc, Japan). The patient was satisfied with treatment outcome. [Plate 1, Fig. 2]

**Case 4:** A 28-year-old female patient reported with a chief complaint of discolored teeth from her childhood. No relevant medical history was reported by patient. On examination she had moderate to severe fluorosis on her anterior teeth, oral hygiene was good. [Plate 1, Fig. 1]

Placement of porcelain veneers was the treatment of choice for this patient. Anterior crown preparations were done for veneers followed by temporary veneer placement. [Plate 1, Fig. 2]

Anterior temporary veneer acted as a deprogramming device which was fabricated with heat cure acrylic resin. Ceramic veneers' were luted followed by next appointment. [Plate 1, Fig. 3]

**Plate 1**

**Case 1**



**Fig. 1: Discolored upper front teeth**



**Fig. 2: Micro and macro abrasion followed by polishing**

**Case 2**



**Fig. 1: Discolored upper and lower front teeth**



**Fig. 2 & 3: Mc Innes solution applied after retracting the gums**



**Fig. 4: Micro abrasion done after completion of Bleaching**

**Case 3****Fig. 1: Discolored upper front teeth****Fig. 2: Direct composite restorations from 13 – 23****Case 4****Fig. 1: Discolored upper front teeth 13- 23****Fig. 2: Crown reduction done for porcelain veneers****Fig. 3: Porcelain veneers cemented****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.

**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 procedure was carried out with McInnes

solution, 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.

**In Case 3:** the patient had moderate type of fluorosis which necessitated that the patient was treated by veneer procedure. 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, color stability.

**In Case 4:** The treatment plan was fabrication of ceramic veneers as the advantage of this procedure is that desired aesthetic results and functional efficiency can be achieved.

In each of the treatment options described above, each one has its own advantages and disadvantages; a

good clinician should be aware of all the treatment options available assess its merits and demerits and select the best treatment option according to individual patient needs.

### 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 Uttar Pradesh. No other contributory findings were elicited for discoloration of tooth due to other reasons. One of the most important parts 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 article was to report various treatment options available for dental fluorosis from a conservative bleaching management to extensive ceramic veneering 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. Newer treatment options which combine these various treatment modalities are emerging. Other treatment options available are laser assisted bleaching, abrasion employing abrasive pastes. This article does not advocate that one treatment option is superior to another but rather the severity of the lesion alone determines the treatment option.

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