



Review Article

Managing dental fluorosis: A guide to improving appearance of the teeth

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ABSTRACT

Too much consumption of fluoride during tooth formation causes the disorder known as dental fluorosis, leading to changes in their appearance and structure. The severity of dental fluorosis is typically classified into different stages based on the visual appearance of the teeth. Mild cases of dental fluorosis may not require any treatment, and the condition may improve over time as the enamel continues to mineralize. In more severe cases, treatment options include teeth whitening, dental bonding, veneers, and crowns. While treatment can improve the appearance of the teeth, it cannot reverse the damage that has already occurred to the enamel surface. Therefore, it is important to take steps to prevent further damage by monitoring fluoride intake and practicing good oral hygiene. Regular dental checkups and cleanings can also help to identify and manage any issues related to dental fluorosis. Overall, dental fluorosis is a cosmetic issue which has got nothing to do with functional changes related to a tooth and appropriate treatment can help to improve the appearance of the affected teeth. In this article we will see various aspects of dealing with dental fluorosis right from its etiology to management.

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1. Introduction

This condition purposely impacts the way a tooth appear and it is due excessive exposure to a particular element known as fluorine and it occurs during stages of development of a tooth. If we talk about fluorine as an element it is found in nature and has shown evidence of preventing dental caries, when used in appropriate amounts. However, excessive exposure to fluoride during early tooth development can lead to dental fluorosis, which can cause white or brown spots, discoloration, and pitting on the tooth surface.

This condition is mostly prevalent because of intake of more than usual quantity of fluoride by any source be it by food or by drinking or of taking some supplements when a prson is in the early stages of life i.e. upto 8 years. This situation is more prevalent in those areas where the water

supply in itself has more than normal amounts of fluorides present in it, at a concentration far more than a normal average. This situation can also occur if a person is taking other supplements of fluoride.^{1,2}

While dental fluorosis does not typically cause pain or discomfort, it can have a significant impact on the appearance of the teeth, leading to self-consciousness and reduced confidence. Severe cases of dental fluorosis can also lead to the outermost layer being weakened and hence the tooth in itself becomes very much susceptible to caries and this further leads to other common oral health conditions being more prevalent.

Preventing dental fluorosis involves monitoring fluoride intake during tooth development, particularly in young children. This may involve using alternative water sources, limiting fluoride supplements, and ensuring that fluoride-containing dental products are used appropriately.

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Treatment options for dental fluorosis may include such type of procedures which will help in improvising appearance of the tooth particularly as this condition leads to altered appearance of the teeth.^{3,4}

In summary, this particular destruction is caused by overexposure to this element while tooth development is in progress, which can affect the appearance and strength of the teeth. Prevention involves monitoring fluoride intake during tooth development, while treatment options may involve cosmetic dental procedures.

2. Etiology

Due to this condition the main parameter that is altered is the appearance of morphological structure of the tooth particularly due to overingestion of fluoride while tooth is still developing. This element as we all know is found in nature and very commonly found in variable quantities. However, excessive exposure to fluoride during early tooth development can lead to dental fluorosis, which can cause white or brown spots, discoloration, and pitting on the tooth surface.^{5,6}

In summary, this condition due to overexposure to fluoride during tooth development, which can affect the appearance and strength of the teeth. Prevention involves monitoring fluoride intake during tooth development, while treatment options may involve cosmetic dental procedures.⁷



Figure 1: Different types of fluorosis

3. Epidemiology of Dental Fluorosis

If this condition will be prevalent or not in various parts of the world, it'll depend on a number of factors which includes the quantity of water intake and its chemical composition, the diet taken and the various components of a diet, and along with that how many supplements are used which have fluorine in them. If we go by the data of WHO then we can say that according to organization there are several parts of the world which involve excessive fluoride intake as a part of their daily routine. Particularly in the continents of Africa and Asia there are excessively high

amounts of fluoride present in their water content while if we talk about the continents of North America and Europe then we can say that there are comparatively lesser incidence of fluorosis as excessive amount of fluoride is not present in the water bodies.^{8,9}

Particularly since the last few years especially last 10 years the prevalence of fluorosis has increased multifold as there are a variety of products used particularly for oral cavity which have a higher quantity of fluoride present in them. There are several toothpastes present and several mouthwashes present which have an excess of fluoride amount in them and when someone uses them without supervision then that can lead to creating a problem for that person. In a variety of situations there are several children who intake a large quantity of fluoride and that results in fluorosis in them.^{10,11}

If we talk about the range for classifying fluorosis extent then it can be divided in several ranges. This range can be divided into mild, moderate, severe. If we see mild fluorosis it'll appear as very small and white spots or some streaks which are present on the surface of the tooth. If we will see severe dental fluorosis then we can see a huge amount of discoloration and a severe amount of pitting on the outermost layer of enamel.^{12,13}

So this condition which occurred due to excessive amount of fluoride intake can be caused due to a variety of several factors which ranges from the supplements being used or the amount of water present in the water uptake by the person. Further the extent can also be divided into mild, moderate and severe.¹⁴

4. Dental Fluorosis Pathophysiology

Studying about the pathophysiology of this prevalent disease we can say that this happens by the common interaction between the element of fluorine and the outermost layer of the tooth structure that is enamel. This element is found naturally in nature, in water, in soil, and in many foods as well. This element has previously shown that it has led to prevention of caries by making the outermost layer strong enough and also by making the outermost layer super resistant to the attacks in oral cavity by acids and several other attacks. A more than normal quantity of exposure can further lead to dental fluorosis.^{15,16}

While the stages of tooth development procedures are ongoing, formation of enamel occurs and this enamel contains crystals of hydroxyapatite which are deposited on the outermost layer. Fluoride as an element comes up while interfering with this procedure and lead to abruption in the crystal formation and further leads to abnormal structure formed of that enamel. The proper mechanism is much more complicated than the normal mechanism which is described here but it is said that the enzymes which hampers the formation of these crystals along with the mineralization are somewhere interrupted by this element.^{9,10}

The extent of how much fluorosis can occur in a tooth depends upon the amount of fluorine that has been taken, along with the duration of intake of fluoride and along with the duration since the intake of fluoride that has occurred. A very mild amount of dental fluorosis can be present and it will appear in the form of spots which are white and in the form of streaks on the surface of the tooth. Severe fluorosis in the other hand can lead to excessive discolouration and excessive pitting on the surface of enamel.

Categorization of dental fluorosis can be ranged in four categories based on their extent ranging from a questionable extent to a very mild to a mild and the last being moderate or severe extent. In the questionable extent we can hardly see some white flecks present on the surface of the tooth while in mild ones we can see some white fine lines or some spots which are present on the outermost layer of that tooth. Also some opaque areas can be seen on the tooth surface. While in cases of severe fluorosis we can see excess staining and pitting on the outermost surface of enamel.

In short this whole etiology of pathogenesis of fluorosis involves the action between fluoride and the outermost layer of tooth and the crystals which leads to alteration in the normal structure of the enamel. The severity of dental fluorosis should be noted and further action should be taken so as to reduce the incidence of fluorosis.^{8,17}

5. Assessment of Dental Fluorosis

The assessment of extent of fluorosis involves a thorough examination (clinically) of the whole oral cavity and further classifying the extent or severity of that condition. The diagnosis of this condition relies on the morphology of the extent of fluorosis in the tooth which can range from barely visible white flecks or spots to extensive discoloration, pitting, and loss of enamel.

The extent of how much severe dental fluorosis can be, is typically classified using a scoring system called the Thylstrup-Fejerskov index, which grades the condition from 0 (no fluorosis) to 9 (severe fluorosis). The index takes into account the location, size, and color of the affected areas on the teeth. In addition to a visual examination, the evaluation of dental fluorosis may also involve the use of dental imaging techniques, such as X-rays or dental radiographs, to assess the extent of the condition and to rule out other dental problems. It is quite noticeable to note the point that this condition doesn't lead to any kind of pain and the main manifestations are only morphological in kind. But if this dental fluorosis gets severe in nature with time then we need to involve those measures when we have to give proper restoration and other treatment to the patients.

In summary, the evaluation of dental fluorosis involves a clinical examination of the teeth and the classification of the severity of the condition using a scoring system. Dental imaging techniques may also be used to assess the extent

of the condition. While dental fluorosis does not typically cause any symptoms or pain, severe cases may require restorative dental treatment.¹⁸

6. Dental Fluorosis Treatment

The kind of treatment that we have to administer to the patient will depend upon the extent of how much severe the disease has been in that person along with what are the aesthetic demands of that person, this also has to be kept in mind. Those cases which are somehow mild to moderate in nature can be cured by giving those treatment procedures which fulfill cosmetic demands in particular while those cases which are more severe in nature will require treatment which is more extensive and varied in nature.¹⁹

Very minimal treatment for mild to moderate dental fluorosis can involve minor procedures of whitening tooth or by doing microabrasion. In tooth whitening we administer bleaching agents to lighten the teeth which is affected and in microabrasion we remove a very thin layer of teeth in which appearance of the teeth is directly enhanced. For more severe cases of dental fluorosis, restorative dental treatment may be necessary. This may involve the use of dental bonding, veneers, or crowns to restore the appearance and function of the affected teeth. In cases where the dental fluorosis has caused extensive damage to the tooth enamel, tooth extraction and replacement with a dental implant may be necessary.^{20,21}

It is worth noticing that while we are treating dental fluorosis we are treating the damage that has been done but we aren't doing anything the primary cause underlying the etiology which is excessive intake of fluoride from surrounding sources. Therefore the primary action along with treatment that should be taken is to prevent the excessive intake of fluoride which will further reduce incidence of fluorosis. In short if we conclude we can say that the extent of fluorosis depends upon the intake of fluoride and along with that whatsoever are the morphological concerns of the patient. We can give a variety of treatment ranging from whitening of teeth to microabrasion further by giving veneers or by dental bonding and all of it depends on the actual extent of the tooth's severity or the amount of affected tooth by fluorosis. Though the first step should always be preventing the fluoride to be more ingested by that person.²²

7. Dental Fluorosis Staging

This condition which arises due to more than normal intake of naturally found element fluorine particularly leads to morphological alterations in the structure of the teeth. As they appear visually, so is the morphological categorization of the staging of the teeth affected by dental fluorosis.

The following are the different stages of dental fluorosis (Figure 1)

1. *Questionable fluorosis*: This is the first stage and in this stage we can see very rare white streaks or white specks on the outermost layer of the teeth.
2. *Very mild fluorosis*: In this stage we can see some opaqueness in the form of white patches which are scattered all over the tooth surface but won't involve more than 1/4th of the tooth surface.
3. *Mild fluorosis*: In this we can see the opaqueness in the form of white patches scattered along more than half of the tooth surface.
4. *Moderate fluorosis*: In this stage of severity we can see that opaqueness in the form of white patches in more than half of the tooth surface hence this stage is a progressive stage. We can also see brown stains in this stage of progression.
5. *Severe fluorosis*: This stage can be staged as the terminal stage of dental fluorosis. Pitting is seen in this stage and such brown stains are present which are difficult to remove.

The most important point is to understand that though functional alteration is not present due to fluorosis but severe morphological alterations are present. If there is any such case in which initial symptoms are being witnessed then necessary protocols must be immediately taken like visiting a dentist so as to reduce the further progression/ destruction of the tooth.²³

8. Differential Diagnosis

Dental fluorosis is a condition that can be diagnosed based on the appearance of the teeth, especially their enamel surface. However, there are other conditions that can cause similar changes in the teeth, and a differential diagnosis may be necessary to rule out these conditions. Some of the conditions that can be considered in the differential diagnosis of dental fluorosis include:

1. *Amelogenesis imperfecta*: In this genetic abnormality we can witness structural alterations in the morphology of the tooth hence more or less it might appear similar to that to fluorosis alterations present morphologically.
2. *Enamel hypoplasia*: This is a condition where there is a deficiency of tooth enamel due to damage or interruption of the enamel-forming cells during tooth development.
3. *Hypocalcification*: This is a condition where there is a deficiency of calcium in the enamel, leading to a soft and porous enamel that may be more prone to decay.
4. *Tetracycline staining*: This is a condition where the use of the antibiotic tetracycline during tooth development can lead to a yellow or brown discoloration of the teeth.
5. *Trauma*: Injury to the teeth can lead to structural changes, including pitting or staining of the enamel surface.

It is quite noteworthy to understand that a proper diagnosis regarding a patient having fluorosis can only be done with the help of taking proper history and noting amount of exposure witnessed along with finding out other potential reasons of having the same. If any person is concerned about any unusual morphological change happening in the tooth then immediate appointment with a dentist should be done and necessary preventive and treatment modalities must be employed.

9. Dental Fluorosis Prognosis

The amount of prognosis in this condition is directly associated with how much severe this condition already is in the individual. This condition has got nothing to do with functional properties of a tooth. In some cases which are mild, there need not be any need to administer any kind of treatment and in those cases which are severe, in them we can alter the appearance as they have been severely affected.

Some of the treatment options for dental fluorosis include:

1. *Teeth whitening*: Through this kind of treatment we can reduce the amount of stains present on the outermost layer of the tooth.
2. *Dental bonding*: Through this procedure we can improve the appearance of the tooth by applying a material which is more or less of the same color as the surface of the tooth itself.
3. *Veneers*: With the help of porcelain shells or some other thin light coated material we can cover the tooth surface and further improve the appearance of the tooth surface.
4. *Crowns*: In severe cases, crowns may be necessary to cover the entire tooth to improve its appearance.

It is important to note that while treatment can improve the appearance of the teeth, it cannot reverse the damage that has already occurred to the enamel surface. Therefore, it is important to take steps to prevent further damage by monitoring fluoride intake and practicing good oral hygiene. Regular dental checkups and cleanings can also help to identify and manage any issues related to dental fluorosis.²⁴

10. Conclusion

In conclusion, dental fluorosis is a cosmetic condition that can result from excessive fluoride intake during tooth development. The amount of severity of fluorosis that is occurring is quite varied and it depends on the amount of exposure that individual experienced and it is typically classified into different stages based on the visual appearance of the teeth. Mild cases of dental fluorosis may not require treatment, while more severe cases may require cosmetic procedures to improve the appearance of the teeth. It is important to take steps to prevent further

damage to the enamel surface, such as monitoring fluoride intake and practicing good oral hygiene. Regular dental checkups and cleanings can also help to identify and manage any issues related to dental fluorosis. Overall, with proper management, dental fluorosis is a condition which can be managed by the dentist and which has got nothing to do with the functional alterations of the teeth.

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None.

12. Conflict of Interest

None.

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