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Prevalence of Dental Fluorosis in Population of Hyderabad: A Cross Sectional Study

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ABSTRACT

Background: Dental fluorosis a developmental enamel defect which occurs due to the excessive intake of fluoride during enamel formation. Fluorosis is one of the major public health problems in India.

Aim

The aim of the study was to assess the prevalence of dental fluorosis among the population of Hyderabad.

Materials and methods

This study was conducted by OroGlee Solutions Private Limited, Hyderabad. A total of 6442 subjects (3952 males and 2490 females) of age 11 to 50 years were examined and grouped based on the presence or absence of fluorosis. Oral examination was done using intraoral camera.

Results

Prevalence of fluorosis between the age of 11-50 years is 2.8%. Among the total number of males examined, 136 (3.4%) were affected by dental fluorosis and among the total number of females examined, 44(1.8%) were affected by dental fluorosis.

Conclusion

Our study showed a low prevalence of fluorosis in the population of Hyderabad. On the basis of our study, we can conclude that there is optimum level of fluoride present in drinking water in the city of Hyderabad. Fluorosis not only causes damage to the teeth but also lowers a person's self-confidence by altering their appearance and smile.

Keywords

Prevalence, Dental fluorosis, Intraoral camera, Hyderabad.

INTRODUCTION

Dental Fluorosis is hypoplasia or hypomineralization of tooth enamel or dentine caused due to excess intake of fluoride during teeth development period.[1]

For the body to grow and develop normally, fluorine is one of the essential elements. When fluoride intake exceeds the recommended daily amount, it causes hazardous effects on teeth and bones such as dental fluorosis and skeletal fluorosis.[2]

Water is the primary source of fluoride. Although it varies from country to country, the ideal fluoride level in drinking water is 1 mg/l. Fluoride intake should be monitored to ensure that it does not exceed this amount. As frequency of consuming water is more in hot climates, the ideal fluoride concentration of drinking water is <1 mg/l in those nations when compared to >1 mg/l in countries with cold climates. [3]

In India, highest levels of fluoride in the water are in the states of Andhra Pradesh, Rajasthan, and Gujarat, where 50–100% of districts are affected.[1]

High fluoride consumption during tooth development is the major cause of dental fluorosis. Dental fluorosis can have a variety of clinical manifestations based on severity, from very imperceptible surface-level enamel changes like tiny white opaque specks that the patient may not even be aware of, to pitted enamel that turns a dark yellow-brown colour. The majority of patients will have aesthetic issues that causes teeth's discolouration.[1&4]

Narrow white lines and a snowflake-like look without a distinct boundary with unaffected enamel are the hallmarks of milder forms of enamel fluorosis in terms of clinical appearance. Histopathologically, the associated enamel lesion is represented as a subsurface hypomineralized lesion encased in an exterior enamel surface that has a good level of enamel mineralisation[5]

Fluoride in optimum level helps in prevention of decay. Fluoride is the most effective substance that affects the de- and remineralizing processes within a specific pH range because of its distinctive electrochemical activity.[5]

The finding of this study will be helpful in planning oral health education and awareness in general population, and incorporating preventive measures as well as effective treatment planning.

MATERIALS AND METHODS

A cross-sectional survey was conducted by OroGlee Solutions Private Limited among the people of corporate offices and school-going children in the city of Hyderabad. A total of 6442 people (3952 males and 2490 females) were examined at their respective places of work and schools.

A survey questionnaire was prepared to acquire personal details such as age, gender, relevant dental and medical history and habits. An oral examination was carried out by the dentist using an intraoral camera. Intraoral camera is very helpful to record the minute details in the oral cavity. Informed oral consent of corporate employees was obtained before the examination. Approval from respective school administration was taken for their students.

Inclusion Criteria

Participants from the age group of 11 to 50 years were included in the study.

Exclusion Criteria

Participants below the age of 11 and above the age of 50 years were excluded from the study.

RESULTS

In this study, 6442 people aged between 11-50 years were examined for the presence of fluorosis in their teeth. Among these, 3952 were males and 2490 were females. In the study population, 180 (2.8%) people were found to have varying degrees of fluorosis. And remaining 6262 (97.2%) people did not have any form

of fluorosis in their teeth. In the examined population, among the total number of males, 136 (3.4%) were affected by dental fluorosis and among the total number of females, 44 (1.8%) were affected by dental fluorosis.

Variables (gender)	Total subjects	Subjects with fluorosis (n)	Subjects with fluorosis %
Males	3952	136	3.4%
Females	2490	44	1.8%
Total	6442	180	2.8%

Table 1: Gender based prevalence of fluorosis in the study population

DISCUSSION

The ionic fluoride is important for health of general population. The distribution of fluoride in the enamel is not uniform. It varies from tooth to tooth and the pattern changes with age. Surface fluoride content was found to be highest in first created enamel along the incisal edge and declines sharply towards the more recently developed cervical region. This pattern is inverted in older teeth due to wear. [1]

The main source of fluoride consumed by humans is water but some fluoride is also derived from plants, fish(19ppm), tea leaves(97ppm), vegetables, fruits (0.2-0.3ppm).

Average intake from all sources per day;

Adults-2.2-3.2ppm

Children-1.1-2ppm [6]

Fluoride is mainly absorbed from stomach and intestinal tract. Fluoride levels in saliva are about 65% of the blood levels. It accumulates most heavily in the skeletal system, then in oral tissues. [7]

The development of porous hypomineralized enamel is caused by exposure to high plasma fluoride concentrations during amelogenesis. In extreme cases porosity may extend towards dentinoenamel junction. Patients who ingest excessive amount of fluoride during process of amelogenesis show more symptoms of dental fluorosis. This process of amelogenesis occurs between birth to eight years of age. [4]

The formation of calcium fluoride in plaque and on the enamel surface during and after fluoride rinsing or brushing is now thought to have the most effective anti-caries impact. [6]

Calcium fluoride acts as a fluoride reservoir. When the pH drops, fluoride and calcium are released into the plaque fluid. Fluoride diffuses into the enamel pores, where it interacts with the acid in the plaque to form fluoroapatite (FAP). As the critical pH of FAP (pH=4.5) is lower than that of hydroxyapatite (pH=5.5), it is more resistant to subsequent acid attack, hence integrated into the enamel surface. Fluoride reduces demineralization and increases remineralization of enamel between pH 4.5-5.5, resulting in a shorter demineralization period. It has

been reported that fluoride possesses antibacterial properties.[6]

Fluoride acquisition by the enamel surface appears to continue at a noticeable pace as long as the tissue is porous. Fluoride interferes with the maturation process, when enamel is porous and hence extending the period of fast fluoride uptake.[1]

Permanent teeth are more commonly affected than deciduous teeth. If the teeth are fully developed before the fluoride overexposure, the effects of dental fluorosis might not be visible. Therefore, just because an adult exhibits no symptoms of dental fluorosis does not suggest that their fluoride intake is within the safe range.[6]

Even though the structural arrangements of the crystals in cases of dental fluorosis look normal under a microscope, fluoride nonetheless, causes porosity by widening the spaces between enamel rods and the intercrystaline spaces in some rod segments during the process of enamel formation. The inner layer of enamel also becomes porous in severe cases, and the amount of fluoride in the tooth increases.[5]

The hypomineralized changes in fluorotic enamel are predominantly caused by in situ effects of the ingested fluoride on the local environment rather than general effects of fluoride on calcium metabolism or poisoning effects that slow down whole-body metabolism.[5]

After eruption, the affected areas become stained yellow to brown and in more severe forms causes the mechanical breakdown of the surface. Now a days it is accepted that pitting and larger surface of destruction of enamel are post eruptive features and not a true hypoplasia of the teeth.[5]

The affected dentition is resistant to caries in mild and moderate cases of dental fluorosis. This is hardly surprising given the well-established effect of fluoride in preventing cavities. Patients are more susceptible to dental caries, dentin hypersensitivity, dark discoloration, and tooth wear in severe cases of dental fluorosis where the structural integrity of the enamel and dentine is impaired. [4]

Chronic high-level fluoride exposure can cause skeletal fluorosis. Fluoride accumulates in the bone over time in skeletal fluorosis. The first symptoms of skeletal fluorosis are joint stiffness and discomfort. In severe situations, bone structure may change and ligaments may calcify, resulting in muscular weakness and pain. In advanced stage, osteoporosis may occur. [6]

Dean's fluorosis index-modified criteria (1942) [8]

Dean's Index	
Classification	**Characteristics of enamel**
Normal	Smooth, glossy, pale creamy-white translucent surface
Questionable	A few white flecks or white spots
Very Mild	Small opaque, paper white areas covering less than 25% of the tooth surface
Mild	Opaque white areas covering less than 50% of the tooth surface
Moderate	All tooth surfaces affected; marked wear on biting surfaces; brown stain may be present
Severe	All tooth surfaces affected; discrete or confluent pitting; brown stain present

Fig1: Teeth without fluorosis Fig 2: Teeth with fluorosis

Fluorosis not only damages the teeth but also undermines a person's self- confidence by impairing their appearance and smile. This issue is primarily caused by inadequate dental hygiene. To prevent fluorosis, efforts would be needed to educate the public about the proper oral hygiene such as brushing their teeth twice daily [9]

The most frequent reason individuals seek treatment for fluorosed teeth is because of the discoloration of teeth. Treatments can range from bleaching, microabrasion, veneering, crowning which restore the appearance of natural colour of enamel. [2]

The following methods can be used to prevent excessive fluoride intake in humans:

1) Using alternate water sources: Alternate water sources include surface water, rainwater and low-fluoride groundwater.[6]
2) Improving the nutritional status of population at risk: lower risk of dental fluorosis is directly linked to adequate calcium consumption. Daily intake of vitamin C also protects against the possibility of fluorosis. [6]
3) Defluoridation: In order to lessen the incidence and severity of dental fluorosis, defluoridation is the process of removing any excess naturally occurring fluoride from drinking water. One of the most commonly used method for

defluoridation of water is Nalgonda technique of defluoridation. [3]

4) Toothpaste: Children under the age of six should have their brushing and paste usage under close adult supervision. For the children under the age of 3 years, paediatric paste should contain the 500ppm of fluoride. [6]

Public health organizations should work to reduce the amount of fluoride in drinking water sources.[9]

In our study, Total of 6442 subjects were examined, among these, 3952 were males and 2490 were females. Prevalence of dental fluorosis was found in 180 (2.8%) subjects. Among these 136 (3.4%) were males and 44 (1.8%) were females.

According to a study conducted by Sunil Tejaswi K L et al titled "A Pioneering Study of Dental Fluorosis in the Libyan Population", the overall prevalence of fluorosis was 63.34% (3955 of 6244 patients). Men had a slightly higher prevalence of 64.27% compared to 62.28% among women. The 6-14 age group had the least prevalence, while patients in the 41–60-year age group had the highest rate of fluorosis [9]

According to study conducted by Amjad M. Al Warawreh et al on a "Prevalence of Dental Fluorosis among Southern Jordanian Population", the study sample was made up of 2,512 patients (46.1% male; 53.9% female) with a mean age of 21.5 ± 9.7 years. A total of 1,002 patients (39.9%) had some extent of fluorosis, and it was more commonly observed in females of 12- to 30-year-old group. Localized fluorosis was more common (44.7% of the total sample; 67.4% of patients with fluorosis)[10]

According to study conducted byOban Qadir Khan et al on a "Prevalence of Dental Fluorosis in School Going Children of Dammam, Saudi Arabia', Prevalence of dental fluorosis was found in 164 children among total screened boys and girls (n = 496). Hence, the prevalence of dental fluorosis was 33%; around 37% of boys and 28% of girls were having dental fluorosis. 25% of the 164 children were affected by moderate level of fluorosis. Mild fluorosis got highest proportion which was 44%. Percentage of boys, affected from fluorosis, was higher than girls.

According to study conducted by S. Saravanan on a "Prevalence of dental fluorosis among primary school children in rural areas of Chidambaram taluk, Cuddalore district", Tamil Nadu, India. Among 531 primary school children, 525 were included in the study as the remaining six children were chronic absentees. Gender distribution in the sample was 255 (48.6%) boys and 270 (51.4%) girls. Overall, 31.4% of the sample showed some grades of dental fluorosis. Dental fluorosis was more prevalent among boys than girls. However, gender difference was not statistically significant ($P > 0.05$, N.S.). The prevalence of dental fluorosis was found to increase with age ($P < 0.001$) [12]

Although dental fluorosis is an irreversible disorder of the tooth's enamel, it can be avoided if the sufficient level of fluoride is present in water. The communities living in places with high levels of fluoride would undoubtedly benefit from routine water testing, medical check-up camps, and ongoing health awareness programs. The study also aimed to alert policymakers to the severity of the problem and to put strategies in place, such as training on indigenous home-based defluoridation methods or establishing community defluoridation plants, to optimize and subsequently control the fluoride content of drinking water.[13]

CONCLUSION

Our study showed low level of prevalence of fluorosis in the population of Hyderabad. On the basis of our study, we may conclude that the fluoride level in drinking water in Hyderabad is optimal. And this may due to programme carried out by government named "Mission Bhagiratha" introduced in the state in 2015 aimed at providing piped safe potable drinking water to every household.The prevalence of fluorosis could be attributed to the influx of the migrant population in Hyderabad in the recent years. People having moderate to severe fluorosis have more chances of having a decay. The psychological effects of the disfiguring stains left by severe fluorosis are profound, and the adolescent age group is particularly sensitive because physical appearance is so important to a young person's sense of self-worth.

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