Original Article

Dental Fluorosis: its prevalence and sternness in Dindigul district

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ABSTRACT

Background: Dental Fluorosis is still a depreciated condition which lacks felicitous awareness among people. Fluorosis is an endemic problem affecting different parts of the country. This condition is generally perceived in places where there is excessive amount of fluoride in the drinking water. Clinical Dental fluorosis is a biomarker of exposure to fluoride. Hence, this study was conducted among 1505 school children of age 3-5 years to find the existence and severity of dental fluorosis in Dindigul district, one of the endemic areas of fluorosis. **Materials & Methods:** A cross sectional study was carried out in 1505 children of age group 3-15 years from two schools in Dindigul. The schools were selected by random sampling. All the students were screened for presence or absence of dental fluorosis and graded based on Dean's fluorosis index. The children were divided into 9 groups based on their residential areas. Water samples were collected from the 9 areas and fluoride levels were assessed. **Results:** An overall prevalence of 43.05% of dental fluorosis was observed among the study population. It was also observed that a high prevalence rate of 47.25% of fluorosis was prevalent in subjects using bore well water as drinking source. The levels of fluoride in drinking water ranged from 2.2ppm – 2.9 ppm. In our study Dental fluorosis was found to have a positive correlation with age, source of drinking water used and level of fluoride in drinking water. There is a gradual increase in severity of dental fluorosis with increase in levels of fluoride present in drinking water. **Conclusion**: We conducted this study to assess if, children living in endemic areas of fluorosis consuming water containing more than 1.5ppm of fluoride are at increased risk of developing dental fluorosis and the same has been reflected in our results. Skeletal and dental fluorosis should be managed by providing surface water from nearby dams if any. Rain water harvesting can be done and provided as source of drinking water. Water sources which are good as per WHO guidelines should be used for drinking and cooking purposes.

Key words: *Dental Fluorosis, Dindigul, Dean's index, dental fluorosis prevalence.*

Aesthetics becomes a part and parcel of today's world, amidst various caliber, tooth holds upper hand as a ritzy component, which upholds the looks of an individual. Any factor which can harm the appearance either directly or indirectly draws attention of an individual. Fluorosis is one such condition which would drastically alter the appearance of the tooth from an imperceptible level to a relentless destruction of tooth. Fluorine as such is the 13th most abundant element that is available in the crust of the earth and is the core element in the calcification of bones and teeth. But anything beyond normal can be harmful which includes fluorine. Excess intake of the element can cause dental and skeletal fluorosis. This exorbitant consumption is mainly due to intake of drinking water containing excess fluorine, which is beyond the safe limit of fluoride in drinking water. As

per the standards of WHO the safe limit of fluoride in drinking water for human consumption is only 1.5mg/l. But the fluoride intake differs in different climatic areas. In temperate climates, the optimal fluoride content is estimated to be 1 mg/l whereas in the tropical areas the optimal fluoride content may be 0.5 mg/l [1]. This is attributed to the increased intake of water in hot climatic conditions.

The endemic fluorosis is observed in many parts of the world where there is excessive amount of fluoride in the drinking water (3-5mg/l). Nearly 12 million of the 85 million tons of fluoride deposits on the earth's crust are found in India. This could be one of the main reasons for fluorosis to be an endemic disease in 15 states of India [1]. Clinical diagnosis of dental fluorosis is a biomarker of exposure to fluoride. Hence, we conducted this study among 1505 school children of age 3 -15 years with an aim to find the existence and severity of dental fluorosis in Dindigul district, Tamilnadu which was labeled as one of the endemic areas of fluorosis.

MATERIAL AND METHODS

The study was conducted among 1505 children in the age group of 3-15 years from two schools in Dindigul district, Tamilnadu. The selection of school was done randomly. Informed consent was obtained from the Head of the schools and parents of all students who were included in the study. School children aged 3-15 years who were residents of the particular region, using same source of drinking water from birth and children with primary and permanent dentition with no other physiological and pathological disturbances were included in the study. Children with nutritional deficiencies which can result in staining of teeth, children with traumatized or fractured teeth, children who presented with hypoplastic teeth due to conditions other than dental fluorosis and children who presented with extrinsic stains (e.g. tea stain, stains caused by beverage usage) were excluded from the study.

Prior to starting the study, an examiner received training to evaluate and score different grades of Dental Fluorosis (DF) with the help of archival records of dental photographs from the Department of Oral Pathology. This examiner had evaluated untreated caries, lesions and DF (for permanent anterior teeth and molars) using Dean's fluorosis index in all the children, thereby eliminating any chance of inter-examiner variability. Two types of questionnaires were used in this study, WHO oral health assessment form (1997) and an individual questionnaire specifically designed for collecting information on the prevalence and severity of dental fluorosis along with assessing the possible risk factors such as source of drinking water.

All the children were examined by a single examiner under adequate natural light in the school premises with the assistance of their parents. After collecting the necessary data and clinical examination the entire study group area was divided into 9 strata based on residing areas. Fluoride levels in drinking water were determined by collecting water samples from all the 9 areas. Water samples were collected in 500ml plastic bottles, which were doubly rinsed with distilled water. They were labelled, coded and sent to the water testing laboratory for fluoride estimation on the same day. The association of dental fluorosis with selected individual risk factors was studied using Chi-square test. All the analysis was performed with SPSS 16 version and a p value of <0.05 was taken to indicate statistical significance.

RESULTS

It has been found that among these children the prevalence of fluorosis was 43.05%. The 95% confidence interval of the proportion ranged from 40.54 - 45.55 (Figure. 1).

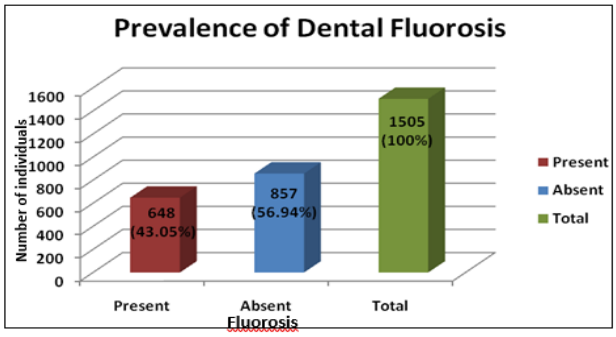

Figure 1: Prevalence of dental fluorosis among the study individuals.

By age group analysis with fluorosis it has been found that as age increases there is increase in prevalence of fluorosis. More number of children (451) were of age group of 9-12 years and the lowest number of children (324) were found in the age group of 12-15 years. The

prevalence of fluorosis among these individuals was 21.9% of very mild form of fluorosis in the age group of 9-12 years which was found to be higher among all the age groups. The least was found to be 0.8% with severe form of fluorosis among the age group of 3-6 years and by overall comparison it has been found that with increase in age there is a significant increase in type of fluorosis. P<0.000 (Table 1).

Table 1: Comparison of prevalence of fluososis among different age groups

Age (in years)	Fluorosis		Total
	Present	Absent	
3-6	57 (16.86%)	281 (83.13%)	338
6-9	165 (42.09%)	227 (57.9%)	392
9-12	283 (62.74%)	168 (37.2%)	451
12-15	143 (44.13%)	181 (55.86%)	324
Total	648 (43.05%)	857 (56.94%)	1505

The present study group had more number of male children 857(56.9%) and about 648 female children (43.05%). The prevalence of fluorosis was higher among male individuals 378 (44.10%) compared to female 270 (41.66%). By comparing the differentiation of both sex in relationship to degree of fluorosis gender was not found to be statistically significant.

Based on the amount of fluoride in drinking water all the 9 residing areas of the study group were divided into 3 groups. The first group included areas with less than or equal to 2.2 ppm fluoride in drinking water. The second group included areas with fluoride levels of about 2.2-2.4 ppm in drinking water. The third group included areas with fluoride levels of about 2.4-2.9ppm. It was observed that majority of individuals are having fluorosis in area of ppm 2.2-2.4 ppm and there is a gradual increase in level of fluorosis with increase in level of ppm in drinking water. The least amount of prevalence of fluorosis was present in areas where there is less ppm of 2.2. The difference of raise in level of ppm and presentation of fluorosis among drinking water users was found to be statistically significant.

With regard to the source of water 1310 individuals were using bore water and the remaining 195 individuals were using river water as a source of drinking water. Among them the prevalence of fluorosis is higher in people using bore well water. The difference in source of water usage with fluorosis was found to be statistically significant (p<0.000). There is 3.58 times increased risk of developing fluorosis of people drinking bore water as source compared to river water (Figure 2).

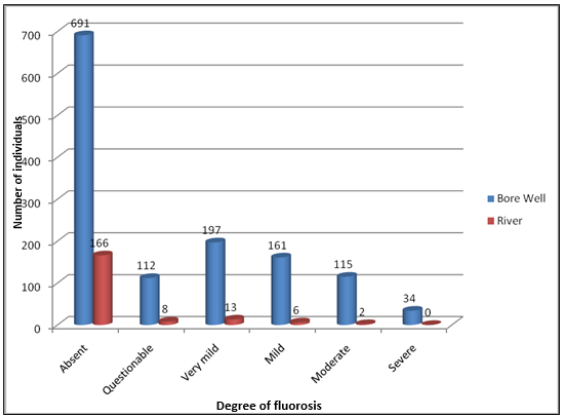

Figure 2: Various Degrees of fluorosis of study subjects with respect to source of drinking water used

It has been found from the study that the prevalence of fluorosis among caries patient was (25.37%). The difference of caries and fluorosis was found to be statistically significant (p<0.001). It suggests that people with fluorosis have 0.39 times risk of developing dental caries (Table 2).

Table 2: Comparison among fluorosis and caries in study group

Caries	Fluorosis		Total
	Present	Absent	
Present	67 (25.37%)	197 (74.62%)	264
Absent	581 (46.81%)	660 (53.18%)	1241
Total	648 (43.05%)	857 (56.94%)	1505

DISCUSSION

Fluorosis is considered endemic in 17 states of India [2]. In Tamil Nadu, fluorosis has been reported to be endemic in districts of Dharmapuri, Erode, Salem, Coimbatore, Trichy, Dindigul, Madhurai, Vellore and Virudhunagar. Children in the age group of 0-12 years are most prone to fluorosis as their body tissues are in

formative/ growth stage during this period. The risk of fluorosis is best related to the total cumulative exposure to the developing dentition. In our present study we observed that the prevalence of dental fluorosis among the 1505 children of age 3-15 years was found to be 43.05% [Figure 1]. Among them most of the individuals were found to be having very mild form of fluorosis. In a similar study by Saravanan et al (2008), the prevalence rate was reported to be 31.4% in Cuddalore district of Tamil Nadu [2]. A prevalence rate of 29.35% was recorded in rural school children in Lucknow district, Uttar Pradesh [3].

The study subjects were divided into 4 groups according to their age in years. Most individuals were of the age group 9-12 years. The highest prevalence rate of fluorosis among the children was in the group of 9-12 years [Table 1]. The statistical analysis of our study shows that with increase in age there was found to be a significant increase in the risk of fluorosis. This trend is consistent with the findings of Dental Council of India among children in rural Tamil Nadu [4]. One possible reason is that most of the teeth in the 5-6 years the group are deciduous (primary teeth), and much of the mineralization process occurs in the intra-uterine phase, where the placenta serves as a partial barrier to the transfer of fluoride to the developing primary teeth [5]. Other reasons for lower prevalence in the younger age groups may be that (i) the period of enamel formation for primary teeth is shorter and hence the exposure to fluoride is shorter; (ii) the enamel of primary teeth is thinner than that of permanent teeth and (iii) the rapidly growing skeleton of foetus may absorb fluoride at more rapid rate since fluoride is a hard tissue seeker and is thus less available for primary teeth [6]. On the other hand, the greater body size and weight, the increased physical activity and the kind of food consumed may lead to a higher water intake and thus a higher prevalence in older age groups [2].

In the present study, prevalence of fluorosis was found to be less in areas with less amount of fluoride in drinking water (about 2.2ppm and less). A stepwise increase of dental fluorosis was noted with corresponding increase in the water fluoride content in the various blocks. According to a study by Kola Reddy et al, Dental fluorosis in primary dentition was more in 6–7-year-old children and it was low in 11–12-year-old children. The probable reason could be that children who had continuously resided in an area with elevated water fluoride content for the 1st 5 years of their life showed more dental fluorosis when compared with those who resided in a similar area between 5 and 10 years of their life. This is in accordance with the fact that most permanent teeth including permanent incisors and first molars undergo crown formation within the 1st 5 years of life [7]. A highly positive significant correlation between fluoride ion concentration in water and fluorosis was observed, i.e., as the fluoride level in water increases, the prevalence rate and severity of fluorosis increases indicating the increase in the percentage of objectionable dental fluorosis. This is in accordance with the previous findings [8]. Thus, the upper permissible limit of fluoride in drinking water has to be calculated based on temperature so as to prevent the occurrence of objectionable dental fluorosis in the study area.

With respect to the source of water used for drinking most children were found to be consuming bore well water and the rest were drinking river water. It was found that fluorosis was more prevalent in individuals drinking bore well water. Children consuming bore well water had 3.58 times more risk in developing fluorosis compared to those drinking river water. Though very mild form of fluorosis was found to be more prevalent among the bore well water users. Out of all the children screened in the study most of them were found to be free of caries and only 264 children were found to be affected with caries. Prevalence of caries was found to be comparatively lesser in children with fluorosis (25.37%) than in children without fluorosis (74.62%). Odds Ratio was calculated and a negative association was observed between the prevalence of fluorosis and occurrence of caries. This finding is consistent with the previous findings which state that teeth with fluorosis are most resistant to caries [8, 9]. Most of the children 25 (3.8%) the least 1 (0.01%) were found to be having severe form of fluorosis with caries presented with very mild form of fluorosis.

This finding is contradictory with previous findings of Cortes et al, who stated that with increasing severity of fluorosis there is increase in risk of caries development [9]. According to Cunha-Cruz et al, there is no agreement if dental fluorosis increases, decreases or has no effect on caries risk. Their study suggests that there is increased risk of caries among children with fluorosis. It was observed though degree of fluorosis and caries prevalence had no linear relationship with higher degree of fluorosis there was higher prevalence of caries [10]. However, some additional factors which may play a role in the development of dental fluorosis such as the consumption

of tea, nutritional status of individuals, the environmental factors, average water intake require further investigation [11]. In a study done by Maya et al, Dental fluorosis seems to be found to be higher in children who consume black tea compared to children who did not consume black tea [12]. The fluoride content of enamel may be influenced by fluoride ingestion pre-eruptively. But post-eruptively the fluoride concentration in surface enamel may be increased through topical treatments with fluoride concentrations [12].

Our study was done only among school children as a representation of a large population of fluoride exposed individuals. We couldn't assess the dental status of their parents neither could evaluate presence of skeletal fluorosis if any among the study group which we see as a major limitation of our study. However in future we aim at including adults from the areas of study to rate the prevalence and severity among them.

CONCLUSION

Clinical dental fluorosis has been described as a biomarker of exposure to fluoride. From the results obtained we conclude that children living in endemic areas of fluorosis consuming water containing more than 1.5ppm of fluoride are at increased risk of developing dental fluorosis. To avoid these undesirable effects of fluorosis one has to differentiate fluorotic villages and towns into those with low and high endemicity. Cases in low endemic areas can be provided with calcium and vitamin supplements to prevent Genu valgum deformities, whereas in high endemicity areas defluoridation techniques can be carried out.

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