

Dental Fluorosis and its Extended Effects

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Introduction

Fluorosis disease is a serious public health problem, affecting almost 60 million people in 19 states of the 35 states and Union territories in India, in which 6 million or more are children in the age group of 6–14 y [1]. Earlier reports on Fluorosis have been focusing on fluoride (F^-) entry to the body through drinking F^- contaminated water, drawn through hand pumps, tube wells and open wells. However, in recent years, information is emerging on F^- entry to the body through sources other than water viz. (i) food and food products, spiced with black rock salt with 157 ppm F^- ; (ii) use of fluoridated dental products and (iii) industrial emission of F^- dust and fumes. Discolouration of teeth known as Dental Fluorosis (DF) is the overtly visible sign of excess F^- ingestion by children. The genesis of DF may commence from intrauterine life when the mother was consuming F^- in higher quantities during the period of tooth germ eruption *i.e.*, 5–6 mo of gestation. The DF discolouration would be visible in the permanent teeth. There are however, a few reports, on DF in milk teeth.

This communication is focusing on the publication appearing in the Indian Journal of Pediatrics on 'Prevalence of Dental Fluorosis among primary school children in rural areas in Karera block, Madhya Pradesh' [2].

The problem of DF with an objective to classify DF in primary school children (age 5–12 y) in a few villages in Madhya Pradesh, indicating the percentage of boys and girls afflicted, is reported. Though F^- levels in water is published elsewhere, for sake of understanding, the lowest and highest F^- levels in untreated ground water checked by a reliable standard procedure of using Ion Meter is reported. It is also stated that DF examination is done by Dentists. It would have been informative for the target audience if details of DF is provided and described. As such information is missing, a

brief description is provided below to provide clarity in the understanding of DF [3].

Dental Fluorosis Characteristics

- (i) The discoloration in DF, irrespective of the grade would appear on the enamel surface away from the gums. The discoloration along the gums is due to dirty teeth and can be removed and cleaned by a Dentist. The discoloration in DF cannot be removed or cleaned.
- (ii) Secondly the discoloration is seen as lines or spots horizontally aligned; never vertical. With the use of a magnifying lens, tiny pits and perforations due to demineralization of the tooth matrix can be observed. This is to point out that F^- when ingested does not make the tooth stronger, contrary to the myth that prevails, F^- demineralizes the tooth matrix; pits and fissures appear and renders it weak. The tooth may also chip off.
- (iii) Thirdly the discoloured teeth in DF shall be seen bilaterally symmetrical from the midline. In other words, the central incisors if afflicted due to DF, one on either side of the midline, would be discoloured. Similarly the other teeth, if affected, would appear in pairs. No one tooth would get discolored in DF. The details for correct diagnosis of DF is missing in the communication and therefore information added for the benefit of those who may venture such studies in future.

The Differences Between DF and Dental Caries

- (i) The discoloration in Dental Caries unlike DF, there is no pattern.
- (ii) In Dental Caries, blue black discoloration may arise between two teeth or hidden crevices of a tooth *i.e.*, near the gums, where food debris collects, bacteria

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breeds; acids produced by the bacteria etches away the enamel and cavities are formed .

- (iii) In Dental Caries unlike DF, the whole tooth may become hollow due to acid dissolution, leaving the affected teeth to mere stubs.

Although, the article published is on DF, it is of importance to provide information to understand the details of Dental Caries, so that it is not mistaken as DF. DF is seen in permanent teeth of children only; though a few reports on DF in milk teeth have appeared in literature; it is rather rare. DF survey should be carried out preferably in children of 8 y and beyond when the discoloration is overtly visible and shall not be mistaken and the percentage error can be minimized.

The discoloration in DF depending upon its location on the enamel surface, whether it is at the tip of the tooth, middle level or upper 2/3rd of the tooth surface, it is possible to do “dating” of exposure to F^- . In other words, when the children are exposed from intrauterine life of 5–6 mo, when tooth germ erupts and exposed to F^- through placental transfer of F^- from mother to fetus and if so, DF discoloration will be seen in the tip of the tooth. If the exposure of F^- is during later years, the level of discoloration on the enamel surface would be at a higher level and not at the tip of the teeth.

Yet another important information that is missing in the communication is that the study has been conducted in high and low F^- villages where the ground water F^- level maximum is 3.91 mg/L and the minimum is 1.6 mg/L respectively. It is desirable to report whether 100 % sources have been tested? if so, the number of safe sources ($F^- < 1.0$ mg/L) and unsafe sources ($F^- > 1.0$ mg/L) existing should be marked and brought to the attention of the community living in that area. The community should be informed of the poison in water, so that they collect safe water for cooking and drinking from the safe existing sources. This is the approach preferred so that the community does not fall victims of major ailments. To develop and install a water treatment unit(s) by the Water Supply Agency may take 1–3 y. The community can ill-afford to wait such a long time for safe water. Scientific community investigating and reporting results of a study has an obligation to reach out to the community to educate them on such issues and shift “them to safer sources, sooner the better”.

It is in this context “DF and its extended effects of F^- ” is addressed. It is of importance to investigate urine F^- levels in the victims. The F^- burden of the body is seldom assessed from drinking water F^- levels alone. F^- can enter the body through food, food products, beverages, fruit-juices, cut fruits and many other items laced with black rock salt also adds to the F^- burden of the individual. Black rock salt (CaF_2) known as Sandhanamak, Vrat-kanamak, Lahorinamak, and Pakistani namak contains 157 ppm F^- [4], is widely used in cooking and

packaged ready to use spice. It is invariably inscribed on the package. In certain instances for example drinking water F^- level may be in safe limits with $F^- < 1.0$ mg/L; but urine F^- level can be extremely high ranging from 13.0 to 27.0 mg/L. The normal urine fluoride range is 0.1–1.0 mg/L. While addressing Fluorosis, besides testing ground water F^- levels, urine F^- should be tested, so that it is possible to ascertain the source(s) of F^- entry to the body.

If children have DF, they ought to be investigated for thyroid hormone levels *i.e.*, FT_4 , FT_3 and TSH. They are likely to suffer from (i) Sub-clinical hypothyroidism; (ii) Primary hypothyroidism; (iii) T_3 toxicosis and/or (iv) Low T_3 syndrome [5, 6]. It is also a known fact that F^- toxicity affects the intelligence or IQ of children. The literature is voluminous. One of the most recent reports is cited [7].

It is important to mention that clinical manifestations of children in F^- poisoning can have similarity with Iodine Deficiency Disorders (IDD). The children may suffer from short stature (cretinism), bow-leg, knock knee and mentally retarded. Therefore in diagnosing Fluorosis in children, iodine deficiency disorder should be ruled out by testing urinary iodine [8]. Endemic goitre in the absence of iodine deficiency and due to F^- poisoning exists in children [9]. Prevention and control of Fluorosis and IDD therefore requires an integrated approach for diagnosis and patient management contrary to the prevailing practices. The primary cause of IDD may not always be iodine deficiency but induced by F^- poisoning. Children with DF living in endemic areas of Fluorosis may have thyroid derangements that require special care and attention [10].

Children with DF may also suffer from Rickets (bow-leg, knock knee and other bone deformities) for which a treatment when introduced may or may not yield beneficial results if high urine F^- is detected. It is necessary therefore, to check the urine F^- levels of such children and diet editing introduced to withdraw F^- . The derangements of gastric mucosa and loss of microvilli in F^- poisoning can be rectified by withdrawal of F^- [11]. It is only then the children would respond to orally administered drugs.

Children when they are F^- poisoned, whether there is DF prevalence or not, there is every possibility that they shall be anemic with $Hb < 12.0$ g/dL due to non-absorption of nutrients from diet. Providing iron tablets/fortified food shall not be helpful unless F^- consumption is withdrawn followed by promotion of nutritive diet (ICMR project Report 2013) [12].

In conclusion, an effort has been made in this communication on DF and its extended effects to highlight how important it is to check drinking water quality with focus on F^- , when ground water is used for consumption. It is also important to state that this study has focussed on the prevalence of DF in boys and girls. This information ought to be understood as a warning for the extended effects of F^- poisoning in children. The various

forms of health problems that are likely to occur in children due to F⁻ poisoning, other than DF has been highlighted.

Conflict of Interest None.

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