Knowledge, Attitude, and Esthetic Perceptions about Dental Fluorosis amongst the Rural Population in Meerut District, Uttar Pradesh

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Abstract

Introduction/Background: Fluorosis has attained an alarming dimension all over the world. It has been identified as an endemic disease among which Uttar Pradesh is facing serious health problems. Aim and Objectives: This study is aimed to determine the awareness about fluorosis among the rural population examined during oral health screening camps, to assess the opinions about the appearance of dental fluorosis and to correlate the perception of dental fluorosis with the psychological health of the rural population. Materials and Methods: A questionnaire was used for the assessment of knowledge, attitude, and esthetic perception toward dental fluorosis among the rural population of Meerut. A cross-sectional study was conducted in four blocks of Meerut where 677 patients were screened positive for dental fluorosis were selected. Results: The present study revealed that 80% of the study populations were aware of the dental fluorosis and 51.2% of the study population knew about the availability of the treatment for dental fluorosis. The study participants had a negative attitude toward the dental fluorosis as 70.9% of them never consulted the dentist and 31.5% responded that they do not find their teeth to be esthetic. Conclusion: Dental fluorosis is a not only a cosmetic problem that impairs social well-being but also affects the oral health-related quality of life.

Keywords: Dental fluorosis, esthetic perception, knowledge

INTRODUCTION

The data suggest that 15 states in India are fluoride endemic areas which contain increased levels of fluoride in drinking water about >1.5 ppm. Around 62 million people in India are suffering from dental fluorosis, skeletal fluorosis, and nonskeletal fluorosis. Of 62 million, 16 million children below the age of 14 years have been severely affected. Groundwater is considered as the major source of drinking water in most of the part of India. Fluorosis is a crippling and painful disease caused by excess intake of fluoride. Fluorosis may be classified into dental fluorosis and skeletal fluorosis. Dental fluorosis in teeth exhibits the first sign of fluoride toxicity in the form of “mottled enamel.”

Esthetics changes in permanent dentition are the greatest concern in dental fluorosis, which are more prone to occur in children who are excessively exposed to fluoride between 20 and 30 months of age. It is also important to remind that the critical period to fluoride overexposure is between 1 and 4 years old, and the child would not be at risk around 8 years old.[3]

Fluorosis has attained an alarming dimension all over the world. It has been identified as an endemic disease among which Uttar Pradesh is facing serious health problems. In Uttar Pradesh, children have suffered from a high prevalence of dental fluorosis (60%–78%) for decades, and many risk factors were found associated with severe dental fluorosis.[4,5] The fluoride concentration in groundwater wells was measured up to 4.4 ppm fluoride. Dental fluorosis is the first visible sign indicating that much fluoride has poisoned the whole body. Besides the health hazards, there are other adverse effects of dental fluorosis such as high costs of other medical and dental problems and the effect on the victims and their loss of time.

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Therefore, there is a need for improving levels of awareness among people about the harmful effects of excessive fluorides in the body.

Rare knowledge of the causes of dental fluorosis may be considered one of the associated risk factors which increase dental fluorosis problem because it will be reflected on people practice and attitude. Different studies have found the very low knowledge on risk factors of dental fluorosis and its disadvantages.[6,7] Regarding public perception, previous studies showed that more than half of the children who have dental fluorosis were avoiding smiling and not accepting their appearance.[8] In addition, parents felt worried and embarrassed when their children who had dental fluorosis,[9]

Dental fluorosis has negative effect on children appearance. In addition, it negatively affects the public perception which will be reflected in the public manner with people who suffer from this problem generally and children especially. There are no information to assess the awareness about the risk of having excessive fluoride, the methods that minimize and prevent this problem and the public perception of dental fluorosis among the population of Meerut, Uttar Pradesh.

Study objectives
1. To examine the knowledge of dental fluorosis among the rural population of Meerut
2. To study the attitude of dental fluorosis among the rural population of Meerut
3. To study the esthetic perception of dental fluorosis among the rural population of Meerut.

Materials and Methods
Study population and procedure
A cross-sectional survey was carried out to assess the knowledge, attitude, and esthetic perceptions of dental fluorosis among the population of Meerut district. Meerut is divided into four directions-east, west, north and south and the then these regions are further divided into 12 blocks, of which four blocks were taken for the study.

Meerut district is divided into 12 blocks, namely, Meerut, Rajpura, Kharkhaua, Jani, Rohata, Mawana, Parikshitgarh, Machhara, Hastinapur, Sardhana, Daulara, and Saroorpur.

Eligible participants were randomly selected through multistage cluster sampling. Of the 12 blocks, four blocks were selected for the study that is one from each region, namely, Sardhana, Machhara, Rohota, and Parikshitgarh. All the individuals were broadly screened for dental fluorosis, and questionnaire forms were distributed to assess the perception of dental fluorosis. The close-ended questionnaire consisted of 19 questions in both English and Hindi language and was designed to obtain information about knowledge, attitude, and esthetic perceptions of dental fluorosis. The study was approved by the Institutional Ethical Committee, and written consent was obtained from all the participants before they were given the questionnaire. The validity of the questionnaire was checked by doing a pilot study on a small group of 30 participants from rural areas. Confidentiality of the participants was maintained.

In the first stage, the block was geographically divided into four regions-northeast, northwest, southeast, and southwest. In the second stage, from each geographical region, one village was randomly selected. Through the general screening procedure, a total of 962 patients were examined and 677 have fulfilled the complete questionnaire from all the four villages. Near an equal number of participants were selected from each village fulfilling the inclusion criteria and surveyed to obtain a sample size of 962.

Statistical analyses
Data were analyzed using the Statistical Package for Social Sciences (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Bivariate analyses were performed using cross tabulation, \( \chi^2 \) statistics, independent sample test, one-way ANOVA, paired sample \( t \)-test, and their corresponding nonparametric alternatives.

Multivariate logistic regression analyses, with measures of self-rated oral health as dependent variables, were performed using the logit model. Ninety-five percent confidence interval was given for the odds ratio.

Results
The questionnaire was distributed to 962 patients, of which 677 patients filled the questionnaire completely and are included in this study. Questionnaire performa was divided into three parts as follows: knowledge, attitude, and practices.

In Table 1, out of 677 patients patients, only 80 (11.9%) respondents are aware of fluorosis and 347 (51.2%) respondents know about the treatment available for fluorosis. When patients were asked about the cause of the appearance of fluorosis, 246 (36.3%) responded about poor oral hygiene and 173 (25.5%) about water quality. Out of 677 patients, 608 (89.8%) received information about ill effects of excessive fluoride in water and 503 (74.3 of excessive fluoride in water and 503 (74.3) received information about ill effects from the dental surgeon. Only 66 (9.7%) and 75 (11.1) responded that they have received information about ill effects from the government and school teachers, respectively.

In Table 2, out of 677 patients, 480 (70.9%) responded that they have never consulted dentist regarding the appearance of their teeth and 611 (90.3%) shows the willingness for treatment of their appearance of teeth. Five hundred and four (74.5%) respondents wants the Government should take any step for the prevention of dental fluorosis. Out of 677 patients, 381 (56.2%) responded that they want government should step up defluoridation plant for the prevention of dental fluorosis and 463 (68.4%) wants government should provide rebate in Reverse Osmosis purifiers. Five hundred and sixteen (76.2%) respondents wants government should make policy for the prevention of dental fluorosis and almost 655 (96.7%)
amount of fluoride in drinking water. It has resulted in the occurrence of dental fluorosis in younger and older age group. It has also affected the various sociological aspects of daily life, namely, esthetic appearance. Therefore, the present study was carried out to assess the knowledge, attitude, and esthetic perception about dental fluorosis in different blocks of Meerut.

**The major findings**
A total of 962 patients were screened for dental fluorosis, and 677 patients with fluorosis were included in the study.

The main findings of this study were:

a. There was a lack of knowledge about the term dental fluorosis as a major oral health problem among the population of Meerut
b. There was a lack of knowledge among the population on what is the cause of dental fluorosis
c. There is a positive attitude among the population toward taking active part in any intervention initiation in the future by the Government, which attempts in the prevention of dental fluorosis.

**Knowledge around dental fluorosis**
In the present study, there is a lack in knowledge of the patients about the term dental fluorosis. Only 11.9% of the respondents want that government should launch mass public health campaign for the prevention of dental fluorosis.

In Table 3, out of 677 patients, 213 (31.5%) responded that they do not find their teeth to be esthetic and 248 (36.6%) were embarrassed by the appearance of their teeth and because of that 386 (57%) patients avoided attending social gatherings.

**Discussion**
Fluoride (F) is probably an essential element (<1 ppm F/l) for both animals and humans. Fluoride and Iodine are often called as a double-edged sword. Because prolonged ingestion of fluorides through drinking water in excess of the daily requirement is associated with dental (1–2 ppm F/l) and skeletal fluorosis (2–6 ppm F/l) and inadequate intake with dental caries. More than 90% of the rural Indian population uses groundwater for domestic purposes.10

Uttar Pradesh is considered as the endemic area of fluorosis in India.11 The Meerut district of Uttar Pradesh contains a higher amount of fluoride in drinking water. It has resulted in the occurrence of dental fluorosis in younger and older age group. It has also affected the various sociological aspects of daily life, namely, esthetic appearance. Therefore, the present study was carried out to assess the knowledge, attitude, and esthetic perception about dental fluorosis in different blocks of Meerut.

| Table 1: Knowledge | Number of respondents (%) |
|--------------------|---------------------------|
| Questions          |                           |
| 1. Are you aware of the term fluorosis? | 80 (11.9) |
| Yes                | 597 (88.1) |
| No                 | 347 (51.2) |
| 2. Do you know that treatment is available for such teeth? | 330 (48.8) |
| Yes                | 173 (25.5) |
| No                 | 71 (10.5) |
| 3. What can be the cause of such appearance? | 69 (10.2) |
| Food               | 118 (17.5) |
| Poor oral hygiene  | 246 (36.3) |
| Water quality      | 173 (25.5) |
| Tea/coffee         | 5 (0.7) |
| Any other          | 69 (10.2) |
| Total              | 677 |
| 4. Have you received information about ill-effects about excessive fluoride in water? | 608 (89.8) |
| Yes                | 69 (11.1) |
| No                 | 503 (74.3) |
| 5. Have you received information about ill-effects about excessive fluoride in water from dental surgeon? | 174 (24.4) |
| Yes                | 66 (9.7) |
| No                 | 611 (90.3) |
| 6. Have you received information about ill-effects about excessive fluoride in water from government? | 22 (3.3) |
| Yes                | 75 (11.1) |
| No                 | 602 (88.9) |

| Table 2: Attitude | Number of respondents (%) |
|-------------------|---------------------------|
| Questions          |                           |
| 1. Have you ever consulted any dentist regarding the appearance of your teeth? | 197 (29.1) |
| Yes                | 480 (70.9) |
| No                 | 611 (90.3) |
| 2. Are you willing to get the treatment done for the appearance of your teeth? | 66 (9.7) |
| Yes                | 6 (9.7) |
| No                 | 173 (25.5) |
| 3. Do you want that government should take any step for the prevention of dental fluorosis? | 296 (43.8) |
| Yes                | 381 (56.2) |
| No                 | 463 (68.4) |
| 4. Government should step up defluoridation plant for the prevention of dental fluorosis? | 214 (31.6) |
| Yes                | 516 (76.2) |
| No                 | 161 (23.8) |
| 5. Government should provide rebate in RO’s for the prevention of dental fluorosis? | 22 (3.3) |
| Yes                | 655 (96.7) |
| No                 | 22 (3.3) |
Public perception towards dental fluorosis

This study illustrated a negative public perception for dental fluorosis in Meerut district as 70.9% of the people have not consulted any dental surgeon regarding the appearance of their teeth but in spite of the negative perception, 90.3% of the respondents wanted the treatment to be done for their discolored teeth.

Majority of the respondents believed that the government should play a pivotal role. Nearly 74.5% of the people wanted the government to actively take steps for the prevention of the dental fluorosis either by setting up defluoridation plant or by providing a rebate in reverse osmosis water purifiers or finally by launching mass public health campaigns for the prevention of dental fluorosis.

Even though many studies have been conducted to investigate the perception of dental fluorosis around the world,[13-16] and the results of most of them were in consistency with the study done in Meerut district, but not much evidence is reported in studies to explore the public perception toward the role of government in the prevention of dental fluorosis.

Aesthetic perception toward dental fluorosis

This study found that most respondents 36.6% are embarrassed or worrisome about the appearance of their teeth, Yadav et al.[12] also found the fluorotic teeth to be less esthetic and similar results were also reported by McKnight et al.[17] Feelings of distress, embarrassment, worry hindered respondents from smiling due to dental fluorosis and prevented them from attending social gatherings even though not a significant difference was reported. This may be attributed to the fact that the high prevalence of dental fluorosis makes people less embarrassed about having discolored teeth. The findings of the present study are similar to the findings of studies conducted by Riordan,[18] Clark et al.,[19] and Bhagayjothi and Pushpanjali.[20]

Despite the severe impact of dental fluorosis on participants, awareness about the availability of the treatment procedures, only a small percentage consulted the dentist regarding the appearance of their teeth. This shows the negative attitude of participants toward their oral health. More studies should be undertaken to look at the children’s and general population’s esthetic perceptions regarding dental fluorosis so that national and regional defluoridation programs can be formed.

Recommendations

Multisectoral approach should be adopted including dental health professionals, governing bodies, social workers, and health workers.

- To establish a national plan to solve dental fluorosis problem by encouraging media and all providers of health service to illustrate the magnitude of dental fluorosis problem in India and building health education program aiming to improve the knowledge about dental fluorosis and about the methods of prevention of fluorosis
- The study participants have a positive attitude of taking

Table 3: Esthetic perception

| Questions                                                                 | Number of respondents (%) |
|--------------------------------------------------------------------------|---------------------------|
| 1. Is the appearance of your teeth appealing?                            |                           |
| Yes                                                                      | 257 (38.0)                |
| No                                                                       | 213 (31.5)                |
| Do not know                                                              | 207 (30.5)                |
| 2. Are you embarrassed by the appearance of your teeth?                  |                           |
| Yes                                                                      | 372 (55.0)                |
| No                                                                       | 248 (36.6)                |
| Do not know                                                              | 57 (8.4)                  |
| 3. How much has the appearance of your teeth worried you?                |                           |
| Lot of time                                                              | 221 (32.7)                |
| Sometimes                                                                | 195 (28.8)                |
| Little of time                                                           | 141 (20.8)                |
| Not at all                                                               | 120 (17.7)                |
| 4. How much has the appearance of your teeth hindered you from smiling freely? |                           |
| Lot of time                                                              | 89 (13.1)                 |
| Sometimes                                                                | 150 (22.1)                |
| Little of time                                                           | 127 (18.8)                |
| Not at all                                                               | 311 (46.0)                |
| 5. Does the appearance of your teeth prevent you from attending social gatherings? |                           |
| Lot of time                                                              | 78 (11.5)                 |
| Sometimes                                                                | 150 (22.2)                |
| Little of time                                                           | 158 (23.3)                |
| Not at all                                                               | 291 (43.0)                |

are aware of fluorosis, and this ignorance could be the reason for the increase in the risk of exposure to dental fluorosis among the population of Meerut district. Similar kind of a study done by Levalois et al. found that knowledge of advantages and disadvantages of fluoride was rare in communities with fluoridated or nonfluoridated water supply in Quebec City region, and he warned of its reflect on people’s practice and attitude.[7]

The study results of 131 (36.3%) participants reporting poor oral hygiene to be the major cause of such appearance are in accordance with the study done by Yadav et al.,[12] where 57.8% reported the same reason followed by the staining with water or food. This can be because of the poor knowledge of dental fluorosis amongst the population of Meerut district, but on the contrary, 185 (51.2%) respondents know that treatment is available for the dental fluorosis.

Among all, dentists as well as public health dentists are at the center of this problem and can help in the spreading awareness about ill effects of the excessive amount of fluorosis in water. Therefore, significantly contributing to society and preventing them from the harmful effects of dental and skeletal fluorosis. The results were similar to the study conducted by Vallée and Kandelman[6] and Nanjundan and Ramalingam[10] emphasizing on the role of dentists in improving people knowledge by educating and motivating these people to adapt to practices regarding safe drinking water.
an active part in future efforts in providing the community with safe water. Therefore, stakeholders and concerned governmental bodies should support and mobilize resources in the provision of safe and fluoride free water and mitigation programs should be promoted

- To identify the population affected by the varying levels of fluorosis and help to provide prompt treatment for improving the patient’s quality of life
- Social workers and village health guides can be trained to teach water purification methods to villagers.

**Conclusion**

Dental fluorosis is a not only a cosmetic problem that impairs social well-being but also affects the oral health-related quality of life. The maintenance of oral health requires an informed public as well as self-awareness of the disease to motivate the sufferer into play a role in the prevention and control of the disease through self-care and professional assistance. The government also has a key role to play in control of fluorosis. Dentists, as well as public health dentists, are at the center of this problem. Dentists, who come across fluorosis patients in their routine clinical practices, can educate and motivate these people to adapt to practices regarding safe drinking water. Due to the high cost of the treatment, most of the people in developing country cannot afford the treatment cost, thus are reluctant to seek the treatment.

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**Conflicts of interest**

There are no conflicts of interest.

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