Occurrence and Prevalence of Fluorosis in India

After reporting the first incidence of Fluorosis in India during 1957, the disease remained backstage for sixty-four years. The disease has no treatment or cure. Patients of Fluorosis are not entertained in hospitals for fear of blocking the bed; unless admitted for investigations with research interests. This article is appearing with a simple, positive message that Fluorosis can be diagnosed early and is an easily preventable disease through practice of appropriate interventions. How did India achieve this? The information conveyed through this article is the testimony.

The crippling, painful malady has become one of the most serious public health problems in the Union Territory of India. The Government of India, during the last fifty years, has spent over Rupees thirty-four thousand crores for providing safe water for drinking to the rural Indian population. Year after year the occurrence of the disease is brought to light in new habitations, villages, blocks and districts. Presently 196 districts in 19 states out of the 35 states and Union Territories in the Indian Republic are confronted with the problem of Fluorosis, arising through drinking water fluoride contamination. The community living in rural/semi urban areas are most severely affected as they are dependent on ground water drawn by hand pumps, tube wells, open well water for consumption. Water quality is seldom tested in rural areas because of the strong conviction that water drawn from the deepest crust of the earth has to be safe/pure.

The list of states, Union territories and the number of districts confirmed for endemicity for Fluorosis is listed below. Those clinicians practising in endemic districts should be aware that some of the patients knocking at their door, may be a case of Fluorosis. They should also know that diagnostic procedures are now available for early detection and management of the patient is simple through practice of interventions. There is no justification for the patient to go through a treatment on a trial and error basis. The endemic districts, state-wise, are listed below.

India's contribution to the understanding of Fluorosis

The clinical description of Fluorosis published from India during the 1930s, 40s, 50s and 60s is still valid. But there has been value addition to the information during the 70s, 80s and 90s. That has led to understand the disease on precise scientific measures, and diagnostic tests for hospital laboratories were developed. However, the challenge was to diagnose the disease in rural areas where infrastructure is not available for carrying out tests. Developing a procedure/protocol for diagnosing Fluorosis in such areas was accomplished by the early 1990s. The protocol was field tested by different organizations in various parts of the country. Fluorosis can now be easily detected during early stages of its onset and patient management through interventions is accomplished. It is for these reasons that India leads the world. Patients suspected of Fluorosis from the developed world consult the Foundation through internet and this has become a very common occurrence.

Value addition through basic research

Value additions are based on observations gleaned from basic research on body tissues obtained from patients of Fluorosis. It became possible to make differential diagnosis of Fluorosis from other diseases with overlapping manifestations. The most valuable contributions are those based on fluoride action on various soft tissues, cells and organ systems which enable us to arrive at meaningful as well as practical conclusions.

Skeletal Muscle involvement in Fluorosis

During the 1970s, it was established that fluoride toxicity destroys skeletal muscle. The muscle proteins - actin and myosin - are not laid down as fluoride inhibits the enzymes leading to derangement in protein biosynthesis. Therefore generalized atrophy of skeletal muscle is observed. The muscle mitochondria is destroyed. The muscle membranes become highly permeable. These events lead to generalized muscle weakness. In fact the emergence of such fundamental observations became increasingly meaningful as one begins to deal with fluorotic patients. A good number of them may experience inability to walk even short distances.

When they are not able to carry out routine activities, their work output is not satisfactory; they become conscious of it and seek hospital intervention. Very
often, such health complaints are considered as non-specific and are dismissed. A word of caution is therefore added here: the different expressions of muscle weakness, tiredness, fatigue, etc., are important and significant messages to take note of.

**Red Blood Cell (Erythrocyte) involvement in Fluorosis**

As red blood cell membrane is an entity which lodges the chemical factor(s) responsible for blood group substances, considerable inquiry into the membrane structure and function has been carried out. These studies have led to certain vital information on fluoride action on red blood cell membrane and the cell as a whole.

It is now known that when fluoride is ingested it will also accumulate on the erythrocyte membrane, besides other cells, tissues and organs. The erythrocyte membrane in turn loses its calcium content. The membrane which is deficient in calcium content, is pliable and is thrown into folds. The RBCs attain the shape of an amoeba with pseudopodia-like folds. Such RBCs are termed as echinocytes.

The echinocytes are found in large numbers depending upon the extent of fluoride poisoning and duration of exposure to fluoride. Although the normal RBCs in humans have a life span of 120-130 days, the echinocytes undergo phagocytosis (eaten up by macrophages) and are eliminated from circulation. This means that RBCs in individuals exposed to fluoride poisoning would not live the entire life span, but are likely to be eliminated as echinocytes. This results in low hemoglobin levels in patients who are chronically ill due to fluoride toxicity. Anemia and depression sets in.

It has also been observed among workers exposed to fluoride pollution in aluminium smelters, that the number of echinocytes increases depending upon the duration of exposure to the fluoride polluted environment. Echinocytes have also been observed in newborn infants having physiological jaundice as bile salts are also known to induce echinocyte formation.

**Gastro-Intestinal Mucosa in Fluorosis**

It is now well established that fluoride in drinking water can cause 'non-uterine dyspeptic' complaints in human subjects. The main complaints are - Nausea, Loss of appetite, Pain in the stomach, Gas formation and bloated feeling, Constipation followed by intermittent diarrhea and Headache.

The investigations to assess whether fluoride has a role in inducing non-uterine dyspepsia were conducted using carefully drawn-up protocol by Departments of Gastroenterology and Anatomy in the All India Institute of Medical Sciences during the early 1990s. The aim was also to eliminate other non-fluoride causes of these non-uterine dyspeptic complaints. The investigative procedures involved besides other investigations were upper GI endoscopy and scanning electron microscopy of biopsy material obtained from gastric and duodenal regions. The observations revealed 'cracked clay appearance of the mucosa', loss of microvilli from the mucosal surface and even disappearance of mucus. Moreover, the same changes were found in patients with Skeletal Fluorosis, whose drinking water contained more fluoride, as well as with patients undergoing fluoride therapy for Osteoporosis for 3 to 12 months. It is noteworthy that the non-uterine dyspeptic complaints of those, drinking fluoride contaminated water disappeared in 10-15 days when patients were diverted to safe drinking water containing the least amount of fluoride (below 1.0 mg/ltr).

Non-uterine dyspeptic complaints can also be caused by fluoride entering the body through sources other than drinking water viz. food, dental products (fluoridated toothpaste and mouth rinses), which are rich sources of fluoride. In fact testing of drinking water, and of blood (serum) and urine fluoride levels, have become the most important tests to assess whether the source of fluoride is drinking water or food items or is it due to the use of fluoridated drugs/ cosmetics.

It is a fact that for non-uterine dyspeptic complaints, drugs are not required for treating, if the causative factor is fluoride. Safe drinking water with fluoride as low as possible is good enough to reverse the adverse health complaints within a fortnight.

**Calcification of Ligaments in Fluorosis**

Ligaments are soft connective tissue providing a protective sheath to bones. Under normal circumstances one is unlikely to appreciate the sheath as it appears as a fine 'muslin' cloth covering the bone. However, in Fluorosis, the ligaments tend to calcify and shall be visible in radiographs. Why ligaments calcify in fluoride toxicity and what renders the ligaments to remain unmineralized under normal circumstances was one of the most challenging exercises that have been addressed successfully. It is important to keep in view that the corollary is also true, that calcified tissues like the cancellous bone and teeth get demineralized and/or develop cariogenic lesions in fluoride toxicity. The studies on macromolecules of glycosaminoglycans have provided evidence to suggest that the ligaments normally have high dermbran sulphate content, a sulphated isomer of glycosaminoglycans and that renders the tissue to remain soft/unmineralized. In fluoride toxicity the dermbran sulphate gets depleted, and that appears to be the impetus for commencement for calcification. In calcified tissues such as the bone and tooth, under normal circumstances, dermbran sulphate is not known to occur (except in early developmental stages) and therefore the tissues are calcified. However, in fluoride toxicity, the tissue produces high concentrations of dermbran sulphate, which become the impetus for the mineralized tissue to develop cariogenic lesions. The dermbran sulphate and its role in calcification of ligaments and carious lesion formation in bone and tooth have been explored in both human and experimental animal model. The biochemical derangements with focus on dermbran sulphate would also perhaps hold good for ectopic calcification that may take place in the body under various pathological conditions.

Detection of calcified ligaments through radiograph of the forearm is very useful for diagnosing Skeletal Fluorosis during early stages. Rigidity of joints and pain would be felt much later, in an advanced stage of the disease. Calcified ligaments have greater value for distinguishing or making a differential diagnosis of Fluorosis with Osteomalacia from Osteomalacia by itself. This is because in the former, there will be calcification of interossaous membrane, which is very easily visible from a forearm X-ray film. In patients of Fluorosis with Osteomalacia, the classical changes by way of increase in bone mass and bone density may not occur and radiographs may not reveal the same; under such circumstances, calcification of ligament is the only dependent diagnostic criteria, besides fluoride levels in blood and urine.

**Sperm Abnormality in Fluorosis**

It is also a fact that male infertility with abnormality in sperm morphology, oligosperma (deficiency of spermatozoa in the semen) azoosperma (absence of spermatozoa in the semen) and low testosterone levels are common in those residing in endemic areas for Fluorosis and consuming fluoride contaminated water. However, it is not necessary that all male members would be infertile.

**Polyurea and Polydipsia in Fluorosis**

Fluoride ingestion in excess can also lead to polyurea (tendency to urinate more frequently than urine volume may be less) and polydipsia (excessive thirst) which are associated with fluoride toxicity. Very often such patients are investigated for Diabetes and not for Fluorosis. It has also been observed that when the patient's blood sugar is within normal limits, and he/she is not suffering from Diabetes, drugs such as steroids are also prescribed. That fluoride toxicity can also cause polyurea and polydipsia is a revelation to the medical fraternity. The patient needs no treatment, but should be advised to consume
water tested for fluoride within safe limits and to include adequate calcium, vitamins C, E and antioxidants ideally through dietary sources; the blood and urine fluoride levels should be monitored from a fortnight to 3 months, when it would drop to normal limits. While such changes are taking place he/she would be relieved of health complaints as well.

Still Birth and Repeated Abortion in Fluorosis
Fluoride is known to cause ectopic calcification. Among all the soft tissues, the aorta (the main blood vessel leaving the heart as right and left branches) is known to accumulate fluoride in very high concentrations. Calcification of blood vessels (arteries) in association with Skeletal Fluorosis is well established. Repeated abortion/still birth have been reported from endemic areas of Fluorosis, as fetal blood vessels calcify and been reported from endemic areas of Fluorosis.

An Obstetrician and Gynaecologist would never consider drinking water containing fluoride as a causative factor for repeated abortions. Therefore, efforts should be made to alert as many professionals as possible on the dangers of fluoride, so that the patients with a wide range of complaints, caused by consuming ground water with fluoride, receive proper medical attention.

In view of the confirmation that non-ulcer dyspeptic complaints are the earliest manifestations due to fluoride poisoning and the patients would certainly speak about their uneasiness due to GI track involvement, non-ulcer dyspeptic complaints are now considered as the early warning signs of fluoride toxicity/poisoning. In view of these it is possible to diagnose fluoride poisoning at early stages and prevention of Fluorosis has become possible if safe water consumption does not lead to recovery from non-ulcer dyspepsia within 10-15 days, then one may suspect reasons besides fluoride.

Module developed for early detection of Fluorosis

I. Hospital based diagnostic procedure
The following complaints from patients ought to alert the Physician to consider fluoride toxicity as one of the possible reasons for the health complaints:

- Aches and pain in the joints, viz. neck, back, hip, shoulder and knee without visible signs of synovial fluid accumulation: may be due to fluoride toxicity.
- Non-ulcer dyspepsia viz. nausea, vomiting, pain in the stomach, bloated feeling/gas formation in the stomach, constipation followed by diarrhoea, may be due to fluoride toxicity.
- Polyurea (tendency to urinate more frequently) and polydipsia (excessive thirst) if detected may be due to fluoride toxicity.
- Muscle weakness, fatigue, anaemia with very low hemoglobin level may be due to fluoride toxicity.
- Complaints of repeated abortions/still birth in the case of patients hailing from an endemic area may be due to fluoride toxicity.
- Complaints of male infertility with abnormality in sperm morphology, oligospermia (deficiency of spermatozoa in the semen), azospermia (absence of spermatozoa in the semen) and low testosterone levels in the case of patients hailing from an endemic area may be due to fluoride toxicity.
- Any loss of shine, or discoloration of the enamel surface in the front row of teeth of the patient (central or lateral incisors of the lower and upper jaw), seem to be away from the gums and appearing as horizontal streaks or spots, may invariably be due to Dental Fluorosis. This is an important clue for follow-up of the members of the family as they may be drinking fluoride contaminated water.

In view of the information provided, the tests that need to be carried out to confirm the diagnosis of Skeletal Fluorosis are:

1. Fluoride levels in Blood (serum) • Urine
2. Drinking water
   Although 24 hrs urine is ideal, it is impractical to collect such samples from the rural population/farmers and therefore spot sample of urine is collected for testing. Samples of blood, urine and drinking water are collected in plastic and not glass bottles. Glass bottles are unsuitable as fluoride would bind with the silica of the glass and lead to erroneous results.
3. Radiographs of the region/joint where there are complaints viz. pain, rigidity/stiffness the forearm to reveal interosseous membrane calcification.

The latter x-ray is a must, if Fluorosis is to be diagnosed at early stages as well as for differential diagnosis of Fluorosis from Osteomalacia. This is an important message as forearm x-ray is seldom taken unless specially asked for diagnosing Fluorosis.

II. Field based diagnostic procedure for early detection of Fluorosis
In rural areas, a field-based approach needs to be introduced. One can either get drinking water fluoride tested, or use fluoride data already existing with water supply department as every district water testing laboratory has been provided by the Government with an ion meter for testing fluoride in water.

If the drinking water has high fluoride, then one should proceed with the following:
- To look for discoloration of the teeth due to Dental Fluorosis in the children of the family.
- To carry out physical tests to assess whether there are aches and pain in the joints (viz. (1) bending and touching the toes without bending the knees, (2) touching the chest with the chin, (3) stretching the arms side ways and folding the arms to touch the back of the head).
- To retrieve history from the members of the family as to whether they have non-ulcer dyspeptic complaints, polyurea, polydipsia and/or fatigue.
- To confirm whether the health complaints in the family are due to fluoride, divert the family to a safer source of water existing in the village for cooking and drinking purposes; and follow-up non-ulcer dyspeptic complaints, if the complaints are due to fluoride, they would disappear within 10-15 days following the commencement of safe water consumption.

This is the approach to follow in a rural/village setting, if the disease is confirmed as Fluorosis, the patient should be monitored for the improvement of his/her health through interventions.

Fluorosis Management: Interventions to Practise
There is no treatment for Fluorosis and therefore prevention and control through interventions is the only approach to mitigate Fluorosis. Having diagnosed the disease, the next step that needs to be followed is management of the patient, so that he/she recovers from the health complaints in the shortest possible time.

Interventions to Practise
There are 2 interventions to practise for the management of the disease. Fluorosis can be totally prevented and the individual can lead a normal, healthy life. The interventions to practise are:
- Safe drinking water intervention
- Nutritional intervention

Safe Drinking Water Intervention
The drinking water source requires to be tested for fluoride, using an 'Ion Selective Electrode Technology. If the drinking water source is contaminated with fluoride more than 1.0 mg/litre of water, the patient needs to be advised to collect water with the least amount of fluoride i.e. less than 0.1 mg/litre for cooking and drinking purposes.

How do the patients get safe water? The different approaches for getting safe water are as follows:

There is a possibility of getting safe water from hand pumps/tube wells/open wells, which are existing in the same village/locality. The patients need to get more water samples collected which are existing in the same locality and get them tested for fluoride. If the patient has access to collect 2 buckets of safe water daily for cooking and drinking purposes from the safe source, it ought to be encouraged. It is estimated that one requires 10 litres of water for cooking and drinking purposes/day. This approach is preferred in villages where the patient incurs no hardships or expenditure for getting water treated for obtaining safe water for consumption.

Community installations (filtering tanks) for water treatment, using either the Nalgonda Technology or Activated Alumina Technology is the other alternative. In this effort there has to be involvement of a water supply organization and the community or the patient may not be able to get it organized immediately. This approach should therefore be given the least priority.

The third approach is treating the water at home in buckets or in earthenware pots, using the Nalgonda Technology, where alum and lime in certain proportions are mixed (depending upon the fluoride content and alkalinity of the raw water). In this approach also the patient needs assistance from a scientific organization which is familiar with testing the water and fixing the dose of alum and lime. Occasionally, the treated water needs to be tested for fluoride to ensure that all is well with the water.

There is a community installation commercially available for removal of fluoride, based on the principles of reverse osmosis (Kent-RO water purifying system) which is a viable proposition. However, its cost may or may not suit the patient.

The Kent-RO water purifying system cost approximately Rs.15,000 - 19,500/-. The 4 candles in the system require replacement once in a year incurring a cost of Rs.400/candle i.e. Rs.1600/- annually. Besides, the membrane used for reverse osmosis also needs to be changed once in 2-3 years.
and the cost of this is Rs.2,000/- Therefore, the Kent-RO system for water purification, specially for Fluoride, may be expensive for a family. But it is useful for commercial organizations, schools or for joint operations by a group of families. In the rural area, the most viable proposition, if water treatment is inevitable, is the use of a domestic filter, using Activated Alumina Technology. The system has been standardized by IIT, Kanpur with assistance from UNICEF. Nearly 10 thousand families are using the filter in Rajasthan and Andhra Pradesh. The cost of the system is Rs.1,500/unit. It requires to be cleaned and washed once in 2-3 months, depending upon the Fluoride concentration of the raw water and water usage. The family can be trained for the purpose. The best contact persons are (1) Dr. Leela Tyagi, IIT, Kanpur or (2) Swach, Udaipur. They have a number of people, who can demonstrate how to back wash the filter using acid and alkali for re-use of the filter. The system can be ordered also through Swach, Udaipur, Rajasthan.

During the past 2 decades, when we have been dealing with hospital based patients, till date, we have been able to divert the patient to a safe drinking water source existing in the same village/locality. This is the best solution rather than water treatment options.

**Nutritional Intervention**

The management of Fluorosis patients and the complete recovery from the adverse health effects of fluoride can be achieved in a shorter span of time, if nutritional intervention focussing on adequate intake of calcium, vitamins C & E and antioxidants, is also practised simultaneously along with consuming safe drinking water. It may be necessary to point out that drugs/tablets containing the above nutrients may be avoided as the patient basically requires a nutritious diet and due to the deficient and inadequate dietary requirements, he/she has become a victim of the disease. Nutrient supplementation through dietary regime has been found to be the best approach and is sustainable.

Diet and food are substances which one consumes/ingests at least 2-3 times a day and they have a lot to do with habits and customs of the individual based on religion and other social norms. While counselling for nutritional supplementation, it may be necessary to emphasize on items which are totally banned for a patient of Fluorosis. They are listed below:

**Food and Other Substances Rich in Fluoride to be Avoided**
- Black rock salt (Kala namak)
- Any preparation which has used black rock salt for flavour eg. daal moth, other salty snacks, chaat masala, etc.
- Red rock salt (RRS) and the preparations made by using RRS.
- Black Tea (Tea with milk can be consumed but not black tea i.e. without milk)
- Chewing of Tobacco by itself
- Chewing of Supari (Areca nut) by itself
- Use of Fluoride containing toothpaste, mouth rinse, varnish and other items commercially available.
- Fluoride containing drinking water.
- Use of Hajmola - which has high black rock salt.
- Use of Calcauria (Homeopathy drug)
- Use of Prozic or other Fluoride containing antidepressant or other drugs on long term treatment.

**Essential Nutrients**

It is our observation that diet counseling is extremely important and the messages conveyed shall be practised by the patient whether he/she is educated/less educated/uneducated. Even minor details need to be explained, so that the patient understands the items to consider consuming for adequate intake of calcium, vitamins C & E and antioxidants.

**Focus on Nutritional Counseling**

The focus on nutritional counseling should be to ensure that the patient has an idea as to which food substances or products available in the market are preferred, to ensure that the daily diet has all the 4 essential nutrients. It is also necessary to inform the patient about the different recipes that one can use for consuming the same item during the course of the week, so that adequate intake of the nutrients is guaranteed. The affordability and sustainability are the two major concerns on which the counseling should be based. The nutrients and the sources often recommended are listed below:

**Calcium**
- Milk: Yoghurt (Dahi) - Jaggery (Gur)
- Green leafy vegetables - Sesame (Jil) seeds - Cheese/Paneer - Kamal kadi (vegetable)
- Amla (vegetable) - Chaalai ka sag (vegetable) - Cumin seed (jeera) - Drumstick and the leaves (vegetable)

**Vitamin C**
- Amla (Gooseberry) - Guava fruit (Anarrat)
- Lemon - Oranges - Tomato - Dhania leaf - Carrot - Papaya - Pumpkin - Sweet Potato and any other source known for its richness of antioxidants.

**Vitamin E**
- Vegetable oil - Nuts - Whole gram cereals - Green vegetables - Dried beans and any other.

**Antioxidants**
- Garlic - Ginger - White Onion - Carrot - Papaya - Pumpkin - Sweet Potato and any other source.

**The different methods of preparing the food (recipes)**

Suggesting items containing high calcium, vitamins and antioxidants and emphasizing that they should consume more of such food items, has paid less in water as it provides very tasty drinking water rich in vitamin C and antioxidants.

- can be supplemented with any other fruits while making fruit juice for consumption.

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**Fluoride Level in Patients of Fluorosis Before and During Interventions**

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Fluoride in Drinking Water (ppb)</th>
<th>Fluoride in Serum (mg/l)</th>
<th>Fluoride in Urine (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>During</td>
<td>Before</td>
</tr>
<tr>
<td>1</td>
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<td>0.27</td>
<td>0.03</td>
</tr>
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<td>0.15</td>
</tr>
<tr>
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<td>0.04</td>
</tr>
<tr>
<td>5</td>
<td>29.00</td>
<td>0.80</td>
<td>0.04</td>
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<td>0.10</td>
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<tr>
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</tr>
<tr>
<td>8</td>
<td>0.00</td>
<td>0.14</td>
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</tr>
<tr>
<td>9</td>
<td>0.00</td>
<td>0.52</td>
<td>0.04</td>
</tr>
</tbody>
</table>

**Permissible limit of fluoride in drinking water: 1.0 mg/l**

**Normal upper limit of fluoride in serum:** 0.02 mg/L

**Normal upper limit of fluoride in urine:** 0.10 mg/L

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**Calcium - Gur (Jaggery)**

A very high source of calcium can be consumed in a number of ways, for example: Gur can be consumed:

- by itself with chapatties.
- by preparing sweet pickle/charney viz. mango, lime and any other
- can be added to milk or tea instead of sugar.
- can be added to sweet preparations viz. halwa, ladoo, kheer etc. halwa can be prepared using bottle guard / louchi (dudhi), carrot and even wheat flour.

**Antioxidants - Ginger**

- Ginger can be consumed very easily and effectively by preparing
  - Ginger tea
  - Ginger pickle
  - Any vegetable preparation can have ginger added to it.

Explaining the manner in which the supplements can be consumed has resulted in excellent results, which ensures speedy recovery.

**Impact Assessment**

The patient has been advised to consume safe water and nutritional supplements, and this needs to become a way of life. It is essential to check on the recovery and the first impact assessment should be carried out after 15 days and/or latest by 3 weeks after practising the two interventions. This is a part of a confidence building exercise.

The history of the patient focusing on the health complaints needs to be assessed. The relief is bound to be evident from the disappearance of:

- Non-ulcer dyspeptic complaints - Polyurea - Polydipsia - Muscle weakness - Fatigue - Much less itching and pain

(Items are listed in the order of relief that the patient is bound to experience).

- One ought to record the serum and urine fluoride levels (first recording after interventions have been introduced) and is bound to show decline in the levels of the poison. If the patient is co-operative, one can monitor the levels to normal within 4-6 months.

The patient may be provided a few additional tips for consuming essential nutrients by way of having

1. Salads
2. Green leafy vegetable soups
3. Dal/lentil cooked with milk during the first visit after introducing interventions. He/she should report again after 6-8 weeks for second impact assessment and so on.

The patient may have to be monitored until he/she is absolutely fine, and the patients would themselves feel that there is no need to go for further checkup as they feel well.

It may also be noted that presently very seldom is a case of Fluorosis diagnosed as Fluorosis in the early stages. As most physicians are unaware of the soft tissue manifestations in fluoride toxicity, they diagnose and treat them for ailments other than Fluorosis and it is only during late stages of the disease when the radiographs may reveal very characteristic changes suggestive of Fluorosis the correct diagnosis emerges. But it may be too late to manage through interventions. Such mishaps could be avoided, if the early diagnostic procedures are practised.

**This report in 'In-TOUCH' is contributed keeping in view that if the medical fraternity is able to diagnose and handle patient management through safe water and nutritional interventions the efforts to bring out this compilation would be rewarded.**

The number in parenthesis is the total number of districts confirmed for fluoride endemicity

- Dental Fluorosis and Dental Caries have not been dealt with in this article as these subjects merits special documentation.
- It is important to specify the method used for testing fluoride. Methods other than Ion Specific Electrode Technology are likely to result in 20-30% error and will not be in the best interest of the patient.

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