Dental Fluorosis and Extended Health Effects in children: Guidelines for rectification and improving the well-being of children.

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Fluorosis: The Indian Scenario

• A tentative estimate = 75 million people affected with Fluorosis
• 7 Million are children (age 6-14)
• Men and women of all age groups victims
• Rural and Urban population affected
F⁻ entry to the body

- The 3 decade old concept – Drinking water the source
- Concept changed: Besides DW
  - Food
  - Beverages
  - Dental Products
  - Drugs used for long term treatment
  - Industrial emission
Dental Fluorosis in Children

1. DF is the overtly visible sign of F⁻ poisoning

2. Genesis: Commence from Intra-uterine life (mother consumes F⁻ and placental transfer from mother to foetus)

3. In some countries, during 5-6 months pregnancy F⁻ tablets prescribed, when tooth germ erupts.

4. DF Discolouration – in permanent teeth
   [a few reports on DF in milk teeth]

5. DF is a warning to suspect other health problems in the children
Children with DF from Different Nations

**Turkey**
Source: Dr. Ümit Demirel, Istanbul Leprosy Hospital Turkey

**Kenya**

**India**
Source: FR&RDF, Data Bank

**Sri Lanka**
Source: 4th International Workshop on Fluorosis Prevention and Defluoridation of Water, Sri Lanka 2004

**Thailand**
Source: Eli dahi, Sunsanee Rajchagool, Nipaphan Osiriphon, Chiang Mai, Thailand 2000
This presentation aims to highlight

- The health problems – the extended effects of DF on Growth & Development of Children

- Rural & urban communities in India and many developing countries are confronted with the problem.
Dental Fluorosis: Identification

1. The discolouration on the enamel surface; chalky white teeth
2. Away from the gums
3. Bilaterally symmetrical
4. DF affects teeth in pairs (not a single tooth)
5. Discolouration has a pattern – horizontally aligned (never vertical) lines / spots
Differences between Dental Fluorosis and Dental Caries

1. Discolouration in DC unlike DF, no pattern
2. In DC, discolouration may arise between two teeth or in hidden crevices, beneath the gums
3. It is a bacterial disorder
4. In DC, the whole teeth may become hollow – as acid dissolves the matrix
5. It may affect milk teeth and/or permanent teeth
6. May affect young and old
Dating to F\textsuperscript{−} exposure in Dental Fluorosis possible

In DF discolouration may be at the

1. Tip of the teeth
2. Middle of the teeth
3. Upper part of the teeth

This enables to carry out “dating” of the exposure to F\textsuperscript{−}
Importance of assessing Urine F⁻ in children

- F⁻ burden is seldom assessed from Drinking water fluoride alone
- Fluoride entry through multiple sources - DW F⁻ may be safe; urine F⁻ may be high

Three sets of results with high and normal fluoride levels in drinking water

<table>
<thead>
<tr>
<th>Patient</th>
<th>Drinking Water F⁻ (mg/l)</th>
<th>Urine F⁻ (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>7 Years, Male * (U.P)</td>
<td>4.41</td>
</tr>
<tr>
<td>Patient 2</td>
<td>5 Years, Male * (Rajasthan)</td>
<td>0.89</td>
</tr>
<tr>
<td>Patient 3</td>
<td>7 Years, Male ** (Madhya Pradesh)</td>
<td>0.61</td>
</tr>
</tbody>
</table>

BIS Standard Drinking Water: 1.0 mg upper limit; less the better as F⁻ is injurious to health
Urine F⁻ Normal range = 0.1 – 1.0 mg/L

* Samples received through Dr. Suma Ganesh, Paediatric Ophthalmologist, Dr. Shroff’s Charity Eye Hospital, Darya Ganj.
** From Jhabua District through an NGO
Children with DF ought to be investigated for:

**Thyroid hormone levels: FT₄, FT₃ & TSH**

**Children likely to suffer from:**

1. Sub-clinical hypothyroidism
2. Primary hypothyroidism
3. T₃ toxicosis and/or
4. Low T₃ syndrome

Hormone deficiency detected, it can be treated with drugs
1. Endemic goitre exists in the absence of iodine deficiency; due to F⁻ poisoning in children

2. Primary cause of IDD may not necessarily be iodine deficiency; but F⁻ poisoning

3. DF with Bone deformities need special care and attention
Have a peep into the children living in Indian villages

- Short stature (cretinism)
- Deaf mutism
- Low IQ (mental retardation)
- Knock-knee
- Bow-legs

GENESIS:
Consuming high $F^- = 7.0 – 14. mg/l$
Children from Bihar
One of the Most important facts to be understood in $F^-$ poisoning

Showing Scanning Electronmicrographs of the Intestinal lining (Duodenal region) of a normal volunteer and those consuming fluoride contaminated ground water

Normal Mucosa

$F^- \ 1.2 \ mg/l$

$F^- \ 3.2 \ mg/l$

Regeneration

Occurs upon withdrawal of $F^-$

100% Absorption of nutrients

Hemoglobin enhanced
Children with Rickets
(Ca$^{++}$ and Vitamin D Resistant)
(bow-leg/knock knee + other bone deformities)

Protocol:

- Check Urine F$^-$; drinking water F$^-$
- To carry out Diet editing; Diet counselling
- Loss of microvilli/mucosal damage rectified
- It is only then mega dose of Ca$^{++}$ & Vit. D orally administered will be absorbed.
- Ca$^{++}$ & Vit. D Resistant rickets – rectified in 3-6 months in children upon following the above protocol.
Children with Anemia

- Children with Dental Fluorosis may be anemic with low hemoglobin < 12.0 g/dl
- Providing iron or fortified food with iron may not help, if urine F$^-$ is high
- Withdraw F$^-$, absorption of nutrients from Diet would commence, rectifying / controlling Anemia
Improved Hb in school children without Iron tablet (in Delhi State)

Baseline data vs after nutrition education to parents; monitored at intervals of 1, 3 and 6 months

Hb > 12.0 g/dl

<table>
<thead>
<tr>
<th>School</th>
<th>Baseline</th>
<th>After 1 month</th>
<th>After 3 month</th>
<th>After 6 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1 Sample</td>
<td>31%</td>
<td>20%</td>
<td>31%</td>
<td>20%</td>
</tr>
<tr>
<td>School 2 Sample</td>
<td>39%</td>
<td>41.40%</td>
<td>41.40%</td>
<td>41.40%</td>
</tr>
<tr>
<td>School 3 Sample</td>
<td>57.0%</td>
<td>52.6%</td>
<td>52.6%</td>
<td>52.6%</td>
</tr>
<tr>
<td>School 4 Sample</td>
<td>39%</td>
<td>39%</td>
<td>39%</td>
<td>39%</td>
</tr>
<tr>
<td>School 5 Control</td>
<td>9%</td>
<td>14%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>School 6 Control</td>
<td>17%</td>
<td>21.40%</td>
<td>17%</td>
<td>17%</td>
</tr>
</tbody>
</table>
Bar Diagram (RSKV School – Sample School 1)

% Increase in Hemoglobin vs decrease in Urine Fluoride levels

0 – 0 = Baseline

Hb (<12.0 g/dl)

UFL (<1.0 mg/l)
Concluding Remarks

- Dental Fluorosis is a warning sign, to assess children for other diseases viz.
  (1) *Thyroid hormone deficiency*
  (2) Low IQ
  (3) *Bone Deformities*
  (4) Anemia

- Drinking Water $F^-$ and Urine $F^-$ need to be tested

- Children need care and attention

- Providing $F^-$ tablets to pregnant women in the name of making tooth stronger is a dangerous proposition – should be avoided.
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Thank You