Systemic fluoride therapy for caries prevention

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Although recent data suggest that the incidence rate of dental caries has begun to decline dramatically in developed nations, Canadians still have a moderate to high rate of the disease. Fluoridation of communal water supplies is the most cost-effective measure to prevent dental caries; it reduces dental decay by 30% to 60% yet costs only about 15¢ per person per year. Unfortunately, only about one third of the Canadian population benefits from this measure. This places a major responsibility for caries prevention on the physician who in a US survey was found to be more likely than the dentist to prescribe dietary fluoride supplements. However, only 37% considered fluoride supplements for children to be very effective, whereas 66% considered fluoridation of the community water supply very effective.

Fluoride supplements can be as effective as fluoridation of the community water supply in preventing dental decay, but they must be prescribed and taken properly. Physicians' lack of confidence in dietary fluoride supplements may be attributed to concerns about patient compliance and proper dosage.

Dental caries is characterized by demineralization of tooth enamel or cementum, with eventual destruction of the underlying dentin and possible damage to the pulp. Before the teeth erupt they can incorporate systemic fluoride during enamel formation and in the phase of rapid mineralization to form fluoroapatite, a mineral that is more stable and more resistant to demineralization than hydroxyapatite, the usual constituent of enamel. After the teeth erupt, fluoride from such sources as water, toothpaste, mouthwashes and dietary supplements is incorporated as fluoroapatite in the enamel of the outer surface of the tooth by exchange with hydroxyl ions in the apatite molecule. This fluoride will also be preferentially acquired by porous enamel surfaces such as the 'white-spot lesion' of incipient decay but may also be deposited in plaque in levels high enough to exert an antibacterial effect.

Since children rarely visit a dentist before 3 years of age, the physician is usually responsible for the first prescription of supplemental fluoride. Three steps are involved in prescribing supplements: determining the amount of fluoride in the patient's drinking water, calculating the dosage and choosing the type of supplement. A report on the fluoride content of the patient's drinking water can be obtained by sending 200 ml of water in a plastic bottle to a provincial health laboratory or a dental school. Alternatively, the local health unit may know the fluoride level of the community water supply. The recommended dosages of supplementary fluoride according to community water fluoride levels and age are shown in Table I. Tablets are the preferred form of supplemental fluoride for children who can chew them, as tablets slowly dissolve in the mouth and thus have maximum topical effect. Since little dental mineralization occurs before birth, prenatal fluoride supplemen-

| Table I — Recommended daily dosage of supplemental fluoride
<table>
<thead>
<tr>
<th>Age, yr</th>
<th>Mode of administration</th>
<th>Daily dose of fluoride ion, mg; level of natural fluoride ion in drinking water, parts per million</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2</td>
<td>Drop</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>2–3</td>
<td>Drop or tablet</td>
<td>0.25</td>
</tr>
<tr>
<td>&gt; 3–13</td>
<td>Tablet</td>
<td>1.0</td>
</tr>
</tbody>
</table>

+2.2 mg sodium fluoride = 1.0 mg fluoride ion.

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← For prescribing information see page 558
Supplementation should be continued until the child is 12 to 14 years of age, when all the permanent teeth except the third molars have completely formed. Compliance in taking fluoride systemically for an additional 7 to 8 years, which is necessary to protect the "wisdom teeth", cannot reasonably be expected.

Babies being exclusively breast-fed may need supplements, as human milk contains little or no fluoride. If the infant lives in an area with fluoridated water, and water will be introduced into the diet within the first 6 months, fluoride supplements may not be needed. Otherwise, supplements should be recommended, with the proviso that a change in diet be reported by the parents so that the need for supplementation can be re-evaluated. If the infant lives in an area with nonfluoridated water, and formula is introduced within the first 6 months, the fluoride level in the formula should be obtained from the manufacturer. Fluoride supplements should be given only if the newer fluoride-free formulas are used.

Excessive amounts of supplemental fluoride may lead to a chronic build-up of systemic fluoride and cause dental fluorosis, characterized by areas of chalky white enamel. Mild cases of fluorosis, which are of no aesthetic importance, have been attributed to high fluoride supplementation levels during infancy, but the dosages currently recommended for infants by the Canadian and American dental associations are lower and much less commonly associated with fluorosis.

There has been some concern that infants who consume commercially processed baby food, especially chicken, may receive in their diet more than the optimal amount of fluoride, which has been estimated at 0.5 mg/d. Thus far, however, the fluoride available in an infant's usual diet excluding water has rarely been associated with dental fluorosis. Current dietary studies suggest that the total daily intake of fluoride, even in areas with fluoridated water, does not exceed optimal levels.

An acute toxic overdose of fluoride causes nausea, vomiting, diarrhea and abdominal pain. Owing to rapid absorption of fluoride in the stomach, acute fluoride poisoning should be treated aggressively by immediate oral administration of calcium-rich products, such as milk, which act to bind fluoride. After lavage or emesis, intestinal and intravenous treatment to remove any remaining fluoride should be given along with symptomatic and supportive therapy. For safety reasons no more than 120 mg of fluoride ion, equivalent to 120 2.2-mg tablets of sodium fluoride, should be prescribed at one time. This provides a comfortable margin below the estimated lethal dose of 350 mg of fluoride ion for a 1-year-old.

When one is prescribing a combined vitamin-fluoride preparation, it is important to maintain the proper dosages of both components. However, the limited selection of products in Canada (Table II) could make this difficult. In addition, since fluoride supplementation must be continued long after vitamin preparations are perceived to be necessary, an alternative to the combined product must eventually be offered to provide continued dental protection.

References

7. Council on Dental Therapeutics: Accepted Dental Therapeutics. Drugs used in Dental Practice, Including a List of Brands Accepted by the Council on Dental Therapeutics of the American Dental Association, 39th ed, Am Dent Assoc, Chicago, 1982: 349

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**Table II — Combined vitamin-fluoride preparations available in Canada**

<table>
<thead>
<tr>
<th>Product</th>
<th>Mode of administration</th>
<th>Fluoride ion per dose, mg</th>
<th>Vitamin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tri-Vi-Flor</td>
<td>Drop</td>
<td>0.25</td>
<td>A, C, D</td>
</tr>
<tr>
<td>Poly-Vi-Flor</td>
<td>Drop</td>
<td>0.5</td>
<td>A, C, D</td>
</tr>
<tr>
<td>Tri-Vi-Flor</td>
<td>Tablet</td>
<td>1.0</td>
<td>Multivitamin</td>
</tr>
</tbody>
</table>

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