Fluoridation at community level

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Once it was realized that fluorides have a caries-preventive action, the fluoridation of communal water supplies became standard practice over large areas of the world. Adding fluoride to salt and even to milk supplies has an equally beneficial effect.

One of the important achievements of food technology was modern refining of sugar, both from cane and from beet. Between 1870 and 1910 sugar became a cheap foodstuff, well accepted for its sweetness, available in many forms and useful as a food preservative. However, the then unknown consequence of this easy access to sugar was a strong increase in the carious destruction of teeth. By the 1930s and 1940s epidemiological surveys showed a high prevalence of caries in North America, northwestern Europe, Australia and New Zealand, while in less industrialized nations and remote populations the prevalence was still low but often rising.

Advances in dental research have shown that all fermentable carbohydrates, including sugar, contribute to the development of dental decay. Dentistry was unable to cope with the pace of dental decay and many experts looked desperately for preventive procedures to improve the situation. Toothbrushing, it is true, was encouraged, but dietary recommendations varied widely. At that time, scientific bases were few and unreliable, and the caries-preventive action of fluoride was unknown.

This was the situation when research in the United States and Canada convincingly demonstrated that water fluoridation is an effective and very cheap means of lowering the prevalence of caries. In the early 1950s, this method was called "mass prevention of dental caries". This description is accurate: 120 million of the 250 million population of the USA (1989) benefited from this measure, 25 million in Australia, Canada, Ireland and the United Kingdom, and many millions more in other countries.

Water fluoridation is most useful in countries or regions with centralized water systems, or in city states like Hong Kong where coverage of the population is virtually total. But the majority of mankind, particularly in the developing world, has no access to large-scale drinking-water systems. Of course, in a few areas of the world, the natural water supply may be high in fluoride. In excess, such fluoride can even be damaging to both teeth and bones.

Inhibiting caries

Drinking of fluoridated water acts systemically, whereas fluoride in dentifrices is applied topically, i.e., the fluoride is in direct contact with the teeth in the mouth, but is not intentionally ingested. The distinction systemic versus topical, however, has narrowed for the following reasons.

- Until about 1960 ingested fluoride and its accumulation in the developing teeth was considered to be the main mechanism for the protective effect against caries. Since then, fluoride in water has been found to have a topical effect.
in preventing caries of tooth crowns and even of roots where they are exposed due to gum recession, especially in old people. This topical effect is now documented as the most important preventive mechanism.

Fluoride in dentifrices has obviously a direct protective effect against caries of the erupted teeth, i.e., teeth that have emerged from the gums as children grow. However, a small fraction of the fluoride contained in dentifrice is swallowed during and after toothbrushing. Small children may swallow one-fourth to one-third of the dentifrice, and the ingested fluoride may provide additional effects even before tooth eruption.

Imagine a country which produces its own edible salt from natural resources at, say, three sites. The bigger the country the better, because it is naturally more cost-effective to build three fluoridation units for a population of 30 million rather than for only three million. Brazil is such a country. North of 20°S latitude there is an immense “Amazonian” area having a population of some 70 million. Through the salt consumed there, every individual in an area measuring about 3600 km east-west and 1800 km north-south can be provided with the desired small amount of fluoride — a supplement of 1–2 mg of fluoride per day — at practically no cost. For the 70 million inhabitants, 300 tons of a soluble fluoride compound per year need to be added to some 160 000 tons of edible salt; the supply of the fluoride compound is easily dispatched in a few small shiploads.

Safe and easy prevention

The easy distribution and extremely low cost of salt fluoridation raises hopes for those developing countries in which salt production and distribution is centralized. If handled properly, salt fluoridation will have a similar impact on oral health as water fluoridation: safe and easy prevention of dental caries in tens or hundreds of millions who — if they suffered from dental caries — would have little or no access to modern dental treatment.

In many ways, salt fluoridation is similar to water fluoridation. The fluoride vehicle — water or salt — is ingested virtually every day by everybody. However, controlled trials were begun only in the mid-1960s, in Colombia and Hungary. Based on the predominant topical effect, it is not surprising that the studies showed water and salt fluoridation to be equally effective.

At present, many details regarding salt fluoridation are being studied. When compared to the impressive amount of research data on water fluoridation accumulated during 50 years of research, investigations on salt fluoridation are still comparatively few. Nevertheless, most conclusions drawn from water fluoridation research are also applicable to salt fluoridation: once the solid or liquid food is in the mouth, it mixes with saliva and the fluoride prevents caries whether it originates from water or from salt. In addition, the ingested fluoride is metabolized in the same way, the greater part of it being excreted in the urine.

Several techniques for fluoridating salt have been developed and are in use. The process must fit into the existing salt production plant and therefore needs careful planning. Ensuring that the concentration falls within required limits (220–280 mg of fluoride per kg of salt) needs monitoring at the production site as well as in samples taken from the packaged product as it is sold.

Treating milk and school water

The idea of fluoridating milk had considerable appeal once the efficacy of water fluoridation became known. In fact, most children in the industrialized countries drink milk with remarkable regularity. Research in oral biochemistry revealed that, because of the high calcium content of milk, absorption of fluoride is slower from milk than from water. The beneficial effect in stopping the development of caries has been established in several trials. A special technical apparatus has been developed for milk fluoridation, and the process is usually linked with schemes of milk distribution at school. This is done also in some developing countries to provide children with certain essential nutrients such as calcium and protein.

School water fluoridation was
developed as an alternative to general fluoridation of the water supply where the latter was not feasible. It protects the permanent teeth which erupt between the ages of six and twelve, mainly by its topical effect. Up to now, this procedure and research into it have been limited to the USA.

The daily intake of 1 mg of fluoride after the age of six years (smaller amounts are given to children up to five) is well established as an effective means of preventing caries. While the success of this procedure in those families who adhere to the necessary discipline is well documented, the public health value was found to be small. In many schools throughout the world, the tablets were distributed daily. Such schemes lasted for years, but rarely for decades. Like fluoridation of milk or school water, fluoride tablets may be useful in special situations. But these three methods have limited significance for nationwide public health programmes.

While the daily practice of toothbrushing with a dentifrice relies on the individual, the users of fluoridated dentifrices are in fact the largest community to benefit from fluoride. Their number exceeds a thousand million, which is far above the numbers reached by other fluoridation methods. The beneficial effect has been proved, both on the experimental and the population level. Fluoride dentifrices are the only common cause of the dramatic decline in the prevalence of dental caries which is evident in many highly industrialized countries.

Where there is systemic administration of fluorides by milk, water and tablets, children should start to use fluoride-containing dentifrices at least by six years of age. Recent epidemiological surveys indicate that fluoride dentifrices combined with water or salt fluoridation, both of which provide additional topical fluoride throughout life, impart substantial benefits not only for children, but also for adults.

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What to do?

1. **Clean your mouth.**
   - Do this well once or twice every day. To remove the plaque from your teeth and gums, use a toothbrush or a chewstick — and whenever possible, use fluoride toothpaste. If you have crowns or bridges you also need to use dental floss or interdental brushes to clean between your teeth. These are the basic measures of oral hygiene.

2. **Use fluoride.**
   - Fluoride is a mineral found naturally in many foods and in most sources of drinking-water. It inhibits the ability of bacteria to produce acids, strengthens the enamel of your teeth, and makes them more resistant to decay. When fluoride levels are below optimal, use fluoridated toothpaste. In addition, either drink fluoridated water or milk or use fluoridated salt in cooking and have it available on the table for use with food. If none of these is available, use fluoride tablets or rinses. Fluoride protects teeth throughout life, but it especially protects the teeth of children.

3. **Eat less sugars.**
   - Use sugars intelligently. You can safeguard your teeth by eating less sugar-rich food. Or by balancing with other food. Don’t let snacks take the place of a well-balanced diet; nutritious foods are essential for oral health as well as for overall health. If you really need to nibble between meals, the best snacks are those that contain no fermentable carbohydrates.