



Why Fluoridate?

Price
30p

Some History

By 1906 it was recognised that water supplies in some areas were associated with brown spots or “mottling” of teeth. In 1931 mottling was linked to fluoride in the water and in 1938 concluded that mottled teeth had less decay. Later it was discovered that mottling rarely occurred with less than 1.5 ppm (parts per million by weight) fluoride in the water whilst protection was given at 1 ppm.

In 1945 1 ppm fluoride was added to public water supplies in 3 American communities with 3 others used as controls. The trials lasted 10 years. The general as well as dental health of school age children was monitored. It was found fluoridation reduced dental caries by 60-70% compared to both the control communities and the prior record. There were no apparent side effects.

Widespread fluoridation began in the USA in 1952. By 1959 a total population of 36 M. Americans and 1.2 M. Canadians were being fluoridated and the 60-70% reduction was confirmed. 210 M. people worldwide now receive fluoridated water including 60% of Americans. Fluoridation has since gained the official support of the World Health Organization¹ though not of all countries.

In the UK fluoride occurs naturally above 1 ppm in groundwaters in parts of Buckinghamshire, Bedfordshire, Cleveland, Derbyshire, Dorset and Essex. It was first added to supplies in Anglesey in 1955 and later to Birmingham and others in NE England, supplying about 5.5 M. people.

How does fluoride work?

Fluoride works in two ways. First, it improves the quality of the enamel on the surface of teeth. Fluoride changes apatite ($\text{Ca}_5(\text{PO}_4)_3\text{Cl}$), the chief constituent of tooth enamel, into fluoroapatite ($\text{Ca}_5(\text{PO}_4)_3\text{F}$) which has greater resistance to acids in the mouth. Second, it is thought fluoride inhibits the bacterial action which converts sugars to acids in the mouth, and may re-mineralise the teeth. As teeth start to form before birth the greatest benefit arises if fluoride is available from or within 6 mths of birth. The benefits extend through life².

The effect of dietary deficiencies on health

It was only in the '30s that links between diet and health began to be understood. Dental decay (and false teeth) was common as were rickets (a calcium/vitamin D deficiency). The poor health of men presenting for war service shocked the government. Nutrition became an important feature of the war effort. Milk was already being given to school children but chalk (to provide calcium), iron, and the vitamins thiamine and niacin were added to white and brown flour.

The body needs a regular intake of a large number of trace

minerals to thrive. Iron deficiency shows up as anaemia (a risk taken especially by vegans). Iodine is needed to produce the thyroid hormone thyroxine. Insufficiency leads to the thyroid gland compensating by enlarging (up to 100 times) causing a swelling, or ‘goitre’, at the neck. Goitre was common in Derbyshire where the local limestone is deficient in iodine, hence ‘Derbyshire neck’. Iodine is now added to all table salt³. Many cereals are “fortified” with vitamins. The addition of folic acid (again to flour) to reduce the number of babies born with spina bifida has been under consideration since 1996. In the UK in the ‘50s, when fluoridation was first considered, the *principles* that government (a) had a *responsibility* to improve the nation’s health and (b) might supplement food or water to do so, were firmly established.

The anti-fluoridation arguments

A backlash against fluoridation began in the 1960s. 5 main arguments were used. Though 4 are badly informed the 5th, relating to civil liberties, and 2 others are important. The first 4 are as follows:

1. *Fluoride poisons ‘pure’ water.* To label fluoride a poison is to misunderstand chemistry. Most substances, including vitamins, medicines, even common salt and *water*, are toxic if consumed in excess but beneficial, even essential, at the appropriate amount. Moreover it is a fallacy to believe natural water, even a Highland stream, is ‘pure’. Rain contains carbon and sulphur dioxides and is effectively a dilute mix of acids. As water runs over or through soil it picks up chemicals, becomes more acid and often brown in colour and cloudy in appearance. Where it percolates through rock it dissolves calcium, magnesium, sodium, potassium and so on in their sulphate, chloride, bicarbonate, carbonate and sometimes fluoride forms. Borehole water from a chalk aquifer will typically contain 500 ppm of dissolved chemicals.

Water treatment adds chemicals such as lime to adjust the acidity and to produce a clear, bright, ‘potable’ (acceptable to drink) and safe water. The chemical range of treated waters is *less* than those occurring naturally.

Chemical free water can be made by distillation but generally tastes “flat”. It is considered unpalatable except in Hong Kong where, for some reason, much is drunk.

It is difficult to advance the ‘poison’ argument and not demand that fluoride be removed from ‘natural’ waters.

2. *Fluoridation has undesirable side effects.* It has been claimed that fluoride is carcinogenic and causes brittle bones. Studies in the UK and USA^{4,5,6} show the first claim to be unfounded. On the other hand Indian research suggests above average cases of brittle bones can arise in high fluoride areas. Natural waters can contain up to 30 ppm

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fluoride. At 1 ppm however a Finnish study⁷ suggested fluoride *reduced* bone fractures by strengthening the bone rather than making it brittle. Mottling is a more common consequence though the risk needs to be set against the cosmetic disadvantage of filled or missing teeth.

3. *Fluoridation is only promoted to get rid of an industrial waste product.* Industrial waste is one source though this could be considered as useful recycling. At the dilution of 1 ppm fluoride exists as a separate 'ion' irrespective of its original chemical make up. The real concern is not about the fluoride but the potential existence of trace contaminants from the waste such as lead. The issue is one of quality control.

4. *Fluoridation discharges large volumes of fluoride to the environment.* Fluoride is a small part of the earth's crust, but still the 13th most common element and widely dispersed. Sea water naturally contains 1.27 ppm.

Civil liberties - the matter of 'choice'

However one disguises it, fluoridation amounts to universal medication of a population. Perceptions have changed since the deferential '50s and today's citizens expect to give specific consent to all medication. The 5th argument then is that an individual must have the right to choose. This obviously poses a problem: at its extreme one person could deny a benefit or impose costs on all others. Recognising this objection the 'anti' lobby argue there are alternatives. For example, both better diet and better dental care would help. Alternatively fluoride can be ingested as tablets or drops, or added (like iodine) to salt, school milk, or even school water supplies.

In theory tablets could be a good solution. However they can not be given to babies (where a main benefit lies) and have to be taken daily. Some years ago a big campaign in Gloucester invited 3500 children to take tablets. Only 759 started and only 70 continued more than 9 months.

Better care and increased fluoride intake from other sources have improved dental health. The initial benefits of fluoridation in the UK were variously estimated at between 50 and 25% reduction in caries but a York University study in 2000 concluded they were barely 15%. Unhappily dental health remains bad in poorly educated areas.

The 6th 'anti' argument is that fluoridation is an imprecise way of providing the daily dose (1.5 mg from water plus some from food). This is true. Though water intake averages 1.5 litres/day (Note 1) it varies by individual and temperature. Intake from food varies even more widely. 6 cups of tea provide 1 mg F as do 60 gms of sardines. Other foods contain none. All that can be said is that fluoride is not toxic within the range of likely intakes and even in fluoridated areas mottling remain rare.

The pro fluoridation setback

In 1974 fluoridation was unwittingly set back by 2 linked changes. Health and Water Authority (HAs and WA) quangos were created. Directors of Public Health (previously responsible for seeking fluoridation) moved outside local authority democracy. Simultaneously WAs, who were now in a position to integrate separate water supplies to improve reliability, were frustrated by the need to keep fluoridated and unfluoridated areas separate.

The outcome was that WAs had no enthusiasm for, and the HAs no democratic mandate for, extending fluoridation, so

nothing was done. In truth during the 1976 drought fluoridated water went all over the place but no one picked this up. The 1985 Water (Fluoridation) Act tried, but failed, to find a way forward. Although 50 District HAs sought fluoridation following 'consultations' with the public, the WAs and then the Water PLCs dug their heels in. They didn't want the hassle. One outcome was that the oral health target for 2003 (an average of < 1 dental caries / 5 yr old with 70% having none) was not met. Anglesey stopped fluoridation and dental caries increased. Government is currently trying again, this time accepting the need for democratic legitimacy.

The cost-benefit case

An argument which is usually overlooked is whether fluoridation is worth the money. Fluoride has to be added at every treatment point. This is cheap at big works like Frankley in Birmingham but expensive at boreholes and other small works. Fluoridation would save NHS dental costs but in 1997 York University⁸ concluded it was not always cost effective. It would save money where works served 200,000+ people and an average of 2+ dental caries occurred in 5 year olds, but not for populations of less than 50,000 and less than 1.5 caries. The cost-benefit would improve of course if a value for pain and the stress of dental treatment was added. It is said teeth are the source of half of all pain!

Conclusion

Unhappily fluoridation raises intense passions. It is also a dismal example of the inability of our political system to take decisions. As far as can be judged fluoridation is safe and has modest benefits. It requires the addition of a single grain of salt (NaF) to each litre of water (Note 2). Yet it is not essential: apart from the small amount of pain saved, the incidence of sickness and death from dental decay is extremely rare.

It seems to the author that the arguments have to be resolved within a democratic forum. He would personally support fluoridation in socially deprived areas such as the inner cities where the costs would be low and the greatest improvements to dental health and savings to the NHS would occur, but not elsewhere.

References:

1. "Operation and Control of Water Treatment Processes" by Charles Cox, WHO
2. Journal of the Royal Society of Health 1977, 97, No 2, p. 45-59, 63 (4 papers)
3. Illustrated Family Medical Encyclopaedia, Readers Digest
4. Journal of Epidemiology and Community Health, 1981, 35 No.4. "Fluoridation of water supplies and cancer mortality. I. A search for an effect in the UK on risk of death from cancer" by P. Cook-Mozaffari, L. Bulusu, R. Doll (Studied trends in cancer rates in Birmingham (fluoridated) and 6 other UK cities from 1964)
5. Journal and issue as 4. "Fluoridation of water supplies and cancer mortality. III A re-examination of mortality in cities in the USA" by L. Kinlen and R. Doll (Similar study to 4 in a number of US cities)
6. Journal as 4, issue 1985, 39. "Fluoridation and cancer mortality in Anglesey" by G.W. Griffith (Cancer mortality for 1949-53 (before fluoridation) and 1973-83 (after) compared to rates for similar periods in other UK cities. No link found)
7. Lancet 1985, No.8452 "Does fluoridation of drinking water prevent bone fragility and osteoporosis" by O. Simonen and O. Laitinen (Study showed fewer fractures in Kuopio (fluoridated) than Jyväskylä (not) in over 50 year olds)
8. York Health Economics Consortium "Water Fluoridation - An Economics Perspective" 1997

Notes:

1. 1 ppm applies to temperate climates. In hotter climates more water is drunk and doses need to be lower
2. Nowadays hexafluorosilicic acid (H₂SiF₆) or sodium hexafluorosilicate (NaSiF₆) are more commonly used