



Why Fluoridate?

Price
30p

The once passionate fluoridation debate still burns from time to time. Extension is in limbo. The broad consensus is that both harm and good are overstated. Even so the arguments are important and relevant to other proposals like adding folic acid to bread or flour.

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 it was concluded that mottled teeth had less decay. Later it was discovered that mottling rarely occurred with less than 1.5 milligrams/litre (mg/l) fluoride in the water whilst protection was given at 1 mg/l.

In 1945 1 mg/l 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 mg/l in ground waters 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 were common as were rickets (a calcium/vitamin D deficiency). The poor health of men presenting for war service shocked the government. Nutrition policy became a 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 many trace minerals to thrive. Iron deficiency leads to anaemia (a risk especially for vegans who forgo the rich source in meat). Iodine is needed to produce the thyroid hormone thyroxine. Insufficiency leads to the thyroid 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. Adding 3 mg/l of folic acid to flour and bread, under consideration since 1996 and recommended by the Food Standards Agency in May 2007 is expected to reduce the number of babies born with spina bifida and hydrocephalus by between 77 and 162 each year. When fluoridation was first considered in the '50s the idea 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 weak the 5th, relating to civil liberties, and 2 others are important. The first 4 are:

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 lesser amounts. US anti-fluoridation campaigners have demanded the limit be set at one tenth of that where some harm has been detected failing to admit this will also reduce the benefits. 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 contain some 500 mg/l of dissolved chemicals and will be mildly alkaline.

Treatment itself adds chemicals such as lime to adjust the acidity and others to produce a clear, bright, ‘potable’, ie acceptable to drink, and safe water.

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 but

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This briefing note has been prepared for ALDES by Richard Balmer. It should be factually accurate but the opinions expressed are his own. If you see errors or have comments please contact him at 79, Links Drive, Solihull, B91 2DJ or email richard_balmer@blueyonder.co.uk

Indian research suggests above average cases of brittle bones can arise in high fluoride areas. Natural waters can contain up to 30 mg/l fluoride. On the other hand a Finnish study⁷ suggested fluoride at 1mg/l *reduced* bone fractures by strengthening the bone rather than making it brittle. Mottling is the more common problem. In America over 200,000 people drink water *naturally* containing 4mg/l or more of fluoride, the 'safe' limit set by the US Environment Protection Agency. The water for 1.4 million more contains 2-3.9 mg/l. In an important study published in March 2006 the US National Research Council found that 15% of the 4mg/l group showed fluorosis of the teeth but that this was rare below 2 mg/l. Of course the risk of mottling 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.* Any 'waste' safely used is good recycling. At 1 mg/l fluoride exists as a separate 'ion' irrespective of its original chemical make up. Any concern is not about fluoride but the potential co-existence of trace contaminants from industrial 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 is widely dispersed. Sea water naturally contains 1.27 mg/l.

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 dental care would help. Also fluoride could 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.

Education 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 (children drink 3 to 4 times more per unit of bodyweight and athletes also drink more) and temperature. Intake from food varies even more widely. 6 cups of tea provide 1 mg F as do 60 gm of sardines. All that can be said is that fluoride is not toxic within the range of likely intakes and even in fluoridated areas mottling remains rare.

The pro fluoridation setback

In 1974 fluoridation was unwittingly set back by 2 linked changes. Health and Water Authority (HA 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. The target for 2003 - an average of < 1 dental carie/5 yr old with 70% having none - was not met. Anglesey ended fluoridation and dental caries increased. Fluoridation is a no-win policy.

The cost-benefit case

The 7th argument is usually missed. It is simply "is it worth the money?". Fluoride must be added at each treatment point. This is cheap at big works like Frankley in Birmingham but costly at boreholes and other small works. Fluoridation would save NHS dental costs but in 1997 York University⁸ found it was not always cost effective. It would save money where works served 200,000+ people and an average of 2+ dental caries in 5 year olds, but not for populations below 50,000 and less than 1.5 caries. The cost-benefit would rise of course if a value for pain and the stress of dental treatment was added. It is said toothache is the cause of half of all pain!

Conclusion

Fluoridation has the potential to raise intense passion. Unhappily it is 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 at 1mg/l, a single grain of salt (NaF) in each litre of water (Note 2). Yet it is not *essential*: apart from the pain saved, the incidence of sickness and death from dental decay is extremely rare.

It seems to the author that a compromise could be reached. He would personally support fluoridation in socially deprived areas such as 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 Jyvaskyla (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