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FLUORIDATION

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During 1967 members of the Fluoridation Committee of the Queensland Branch of the Australian Dental Association arranged a series of talks to the various study clubs and specialty groups in the State. There were two main reasons for this. First, to reactivate the interest of dentists in fluoridation and to encourage them to talk about it with their patients and friends. Secondly, to find out what issues worry dentists and what problems arise when dentists discuss fluoridation with their patients.

At the end of each talk, dentists were asked to answer a small number of questions. It was hoped that the answers might help the Fluoridation Committee to do a better job than it is doing now. This article is an edited version of the talk given to the Queensland Branch of the Australian Society of Orthodontists.

The Need for a Public Health Measure to Reduce Dental Caries

Recent surveys have shown clearly that the existing dental services in Queensland—both public and private—are able to provide less than half the treatment required for dental caries and much less than this for other conditions. It is also clear that the cost of meeting the problem is beyond the economic and manpower resources of the State

In Queensland 43 per cent of 3 year old children have one or more decayed primary teeth, 85 per cent of 5 year olds have one or more decayed primary teeth, the average number of decayed primary teeth per child is 3 at age 3 and 5 at age 5, 44 per cent of 6 year olds have one or more decayed permanent teeth, 97 per cent of 14 year olds have one or more decayed permanent teeth, the average number of D.M.F. permanent teeth per child is 1.0 at age 6 and 11 at age 14. The gap between the need for dental treatment and the present demand is very large. For every 100 children in the age group 6 to 14 years, 1 is wearing a denture or bridge, 8 have received treatment for traumatised teeth and 319 decayed teeth have been extracted or filled. Against this are the following outstanding requirements: 1 will need a denture or bridge, 3 need treatment for traumatised teeth, 13 need treatment for the removal of calculus, 81 need treatment for gingivitis, 2 need treatment for hypoplasia, 400 teeth need to be filled, 46 teeth need to be extracted and 30 children need treatment for a malocclusion.

The high cost of restorative treatment adds to the difficulty. It has been estimated that it would cost in excess of $5,000,000 to cope with the caries problem alone in children aged 6 to 14 years. The cost of meeting the present demand for treatment by children and adults is unknown but it should be remembered that to the direct cost of treatment it is necessary to add the indirect costs resulting from loss of time from school and industry to keep dental appointments. In the United Kingdom it has been estimated that some nineteen million man hours of work are lost each year through dental appointments. (Moser, Gales and Morpurgo, 1962).[1]

FLUORIDATION AS A SOCIAL ISSUE

Like many public health measures fluoridation has aroused very strong emotional and political reactions. Opinions range from complete endorsement to complete opposition. The main lines of argument centre round the following issues—

Does it work?

Is it safe?

What does it cost?

Are there any alternatives?

Is it legal?

Is it politically expedient?

Is it ethically and morally right?

EFFECTIVENESS

There is very little real argument about the effectiveness of fluoridation. Anti-fluoridationists concentrate on two main lines of attack. The first is that it only benefits children and that it delays but does not confer any permanent benefit. The second is the reliance which is placed on Sutton's book "Fluoridation—Errors and Omissions in Experimental Trials."[2]

The evidence for the effectiveness of fluoridation is based on two sorts of evidence.

1. **Observations in Areas Where Fluoride Occurs Naturally.**

These established:

(a) An inverse relationship between the prevalence of dental caries and the fluoride content of the water supply.

(b) That a comparison between a fluoride city, Aurora, and a non-fluoride city, Oak Park, revealed:

(i) 60% fewer DMF teeth at Aurora.

(ii) 6 times as many children in Aurora had no decayed teeth.

(iii) 95% fewer DMF upper incisors at Aurora.

The results have been confirmed in about twenty other countries including Queensland.

A comparison between the prevalence of dental caries in four high-fluoride towns (Barcaldine, Aramac, Cunnamulla and Quilpie and five low-fluoride towns (Laidley North, Injune, Gatton, Chinchilla and Oakey) showed that the percentage of children with no DMF teeth was much higher in the high fluoride towns (Table 1) and that the average number of DMF teeth per child was much lower in the high fluoride towns (Table 2).

Table 1

Percentage of children with no DMF teeth in 4 high-fluoride and 5 low-fluoride towns in Queensland

	Percentage with no DMF teeth				
	Age				
	6	8	10	12	14
High fluoride towns	60.4	34.7	22.5	19.0	12.0
Low fluoride towns	48.5	11.4	5.0	0.8	0.5

Table 2

Average number of DMF teeth per child in 4 high-fluoride and 5 low-fluoride towns in Queensland

	DMF teeth per child				
	Age				
	6	8	10	12	14
High Fluoride towns	0.66	1.70	2.50	4.00	6.15
Low fluoride towns	1.3	3.37	5.43	8.60	12.49

Observations in areas where fluoride occurs naturally have also shown that adults who lived all their lives in a fluoride city have some 60 per cent fewer DMF teeth than adults living in a low fluoride city. These original observations by Russell and Elvove[3] (1951) have been confirmed in both the United Kingdom[4] (Forrest, Parfitt and Bransby, 1951) and in the United States[5] (Englander, Reuss, and Kesel, 1964).

Observations in Areas Where Fluoride is Added to Water in Controlled Amounts

These studies, many of which have been in operation for more than twenty years, have established:

(a) That fluoride added to water acts in exactly the same way in both a chemical and a biochemical sense as does fluoride which is naturally present.

(b) That fluoride added to water reduces the amount of dental caries to the same extent as fluoride which is naturally present at the optimum concentration.

(c) All studies throughout the world have given remarkably consistent results, e.g. at Grand Rapids[6] in the United States, at Beaconsfield in Tasmania[7], and at Hastings in New Zealand [8].

Sutton's main criticisms of the three original clinical trials at Newburgh, Grand Rapids and Brantford were:

(a) That the reliability of the results was affected by odd experimental and statistical methods, failure to consider random variation and to eliminate examiner bias, omission of relevant data, and arithmetical errors.

(b) That the controls were either doubtful or inadequate.

Some of these criticisms are valid, but not all. For example, random variation was taken into account in all studies and adequate data from the Brantford study were published to show this. In all three studies extensive calibra-

tion trials were undertaken to ensure examiner comparability. Examiner bias could only be eliminated by taking experimental and control subjects to a "neutral" town. This is a counsel of perfection but considering the large number of children involved it is also quite impractical.

There are, however, two important things which Sutton overlooks. The first is the massive and irrefutable evidence from naturally fluoridated areas. The second is the consistently uniform results that have been obtained in at least twenty-five countries. The probability of obtaining consistently uniform results of this type by the operation of chance factors alone is so small as to be negligible.

FLUORIDATION AND MALOCCLUSION

The evidence on the relationship of fluoridation to malocclusion is at best equivocal.

In 1949, Plater [9] claimed that there was 30 per cent less malocclusion in fluoridated areas compared with non-fluoridated areas. Superficially, this seems logical enough. The fact that children who drink fluoridated water from birth do not lose their deciduous teeth prematurely and retain their first permanent molars to a greater extent than those who do not drink fluoridated water, makes it reasonable to suggest that these benefits may reduce malocclusion.

In 1959 Hill, Blayney and Wolf [10] found that in 6-8 year old children in Evanston (fluoridated city) there was 20 per cent less malocclusion after 8 years of fluoride experience and after 10 years of fluoridation the 12-14 year olds had 17 per cent less malocclusion compared with the base line data in 1946. None the less the authors concluded that from their data "no definite statement can be made regarding fluoridation and its effect on the prevalence of malocclusion."

Ast and Fitzgerald [11] (1962) compared the prevalence of malocclusion at Newburgh (fluoridated since 1944) with that at Kingston (fluoride free) and found:

1. that the rate of loss of first permanent molars was much greater at Kingston (61 per 100 children) than at Newburgh (9 per 100 children);
2. that 35 per cent of Newburgh children had a normal occlusion compared with 17 per cent of Kingston children.

In the United Kingdom, Walther (1960) [12] made a more detailed study of the problem in the naturally fluoridated area of Colchester (1.2-2 ppm), Norwich (0.17 ppm) and Chelmsford (0-1.0 ppm). He found considerable differences in the prevalence of Mild Skeletal II skeletal patterns—33 per cent for Norwich and 11 per cent for the continuous residents of Colchester with groups with intermediate exposure to fluoride having intermediate rates. On the other hand the prevalence of patients with Skeletal I dental base relationships was highest in the continuously resident fluoride group at Colchester (49%) and least in the low fluoride Norwich group (29%). He suggests the possibility that these differences may be accounted for by either a difference in ethnic groups or a different fluoride content of the water supply.

Data from the Queensland Survey do not justify any conclusion on the relationship of fluoride to malocclusion (Table 3).

Table 3

Malocclusion in Queensland children from high-fluoride and low-fluoride towns.

Anomaly	Fluoride Status	No. Children	With Anomaly	Requiring Treatment	Receiving Treatment
Maxillary or Mandibular protrusion	High F	583	9.4%	76%	1
	Low F	772	9.1%	56%	2
Overbite or Open Bite	High F	583	27%	34% (54)	0
	Low F	772	17%	30% (39)	1
Crowding or Spacing	High F	583	19%	81% (89)	1
	Low F	772	27%	65% (135)	1

On the other hand the survey does reveal the enormous gap between the need for Orthodontic treatment and the extent to which the need is being met. The other implication, of course, is that a reduction in the size of the caries problem will not only leave more time for dentists to undertake Orthodontic treatment but the increased resistance of the teeth to dental caries will improve the prognosis for Orthodontic treatment.

SAFETY

Opponents of fluoridation tend to use the safety factor as a smoke-screen to bolster an emotional argument which in the final analysis is based upon freedom of choice and the rights of the individual. They will allege that it affects virtually any and all organs and systems in the body but the three main arguments are:

(a) That fluoride is a rat poison.

(b) That it is a cumulative poison.

(c) That fluoridation hasn't been going long enough to be absolutely certain of its safety.

Let us look briefly at these allegations.

Is Sodium Fluoride a Rat Poison? Of course, if you take enough of it. It would be relatively simple for me to eat enough powdered sodium fluoride to kill me but I should need to drink more than 8,000 pints of fluoridated water at one sitting to have the same effect.

Is It a Cumulative Poison? Fluoridated water contains 1 part of fluoride iu a million parts of water. In this concentration it does accumulate in bones and teeth—indeed it wouldn't work unless it did. Far from being harmful this slight accumulation is beneficial. The accumulation in the outer layers of the enamel enhances resistance to dental caries. The accumulation in bone helps prevent osteoporosis and possibly calcification of the aorta. (Bernstein, Sadowsky, Hegsted, Guri and Stare, 1966).[13] The reason for this is that fluoride stimulates the formation of larger and more perfect apatite crystals in bone and enamel.

Furthermore, massive doses of sodium fluoride equivalent to as much as 88 mgms. of fluoride have been administered daily for extended periods for the treatment of metabolic bone disease such as Paget's Disease and Osteoporosis. The result has been a significant reduction in bone pain, increased bone density and the establishment of a positive calcium balance. This is the equivalent of drinking 88 litres of fluoridated water per day. (Purves[14], 1962, Bernstein, et al[15], 1963).

Fluoridation hasn't been going long enough for us to be absolutely sure of its safety? Quite apart from the fact that the initial controlled fluoridation schemes have been in operation for over twenty years, for hundreds of years generations of people have consumed water containing 1 p.p.m. or more of fluoride without any evidence of harm. Such people not only have better teeth but less osteoporosis and a lower incidence of bone fracture in adults.

COST

A common argument against fluoridation is the allegation that it is expensive because only a small part of the water is drunk—the rest goes down the drain, or on the garden.

This, of course, is true but the same situation applies to all forms of water treatment such as chlorination. Even so, the cost is only about 10c - 20c per person per year.

The effect of fluoridation on a public dental health programme can be seen from the following figures.

Newburgh — Kingston (U.S.A.)[16] (Ast. et al. 1965).

	Newburgh	Kingston	Saving
Mean cost/child Initial Care year	$14.16	$32.38	$18.22
Mean cost/child Incremental year	5.90	11.00	5.10

Hastings — Gisborne (N.Z.)[17] (Denby and Hollis, 1966).

	Hastings	Gisborne	Saving
Mean cost General Dental Benefits per post-primary school child per year	£3.14.10	£5.14.5	£2.0.5
Mean number of fillings per child:			
Intermediate School group	1.26	5.37	4.11
Pre-School or Primary School group	3.00	5.07	2.07

ALTERNATIVES

Topical Applications. Best of the current solutions is an acidulated fluoride-phosphate solution marketed as **Orofluor.** It is, however, less effective and much more costly than fluoridation.

Dentifrices. There is reasonably consistent evidence that stannous fluoride and fluoride-phosphate dentifrices will help protect the enamel but absolute reductions are small. While reductions in caries of the order of 20-40 per cent are claimed the absolute reductions amount to no more than one tooth surface per person per year.

In the recently completed clinical trial in Adelaide [18] percentage reductions over a two year period averaged 25% for a stannous fluoride dentifrice and 30% for a sodium mono-fluorophosphate dentifrice. Absolute reductions were of the order of 2.5 tooth surfaces in **two** years. (Fanning et al., 1967).

Tablets: This is clearly the best alternative provided the requisite amount is taken each day and every day during the period of tooth development. There is a systemic but no topical effect from the use of fluoride tablets whereas there is both a systemic and a topical effect from the use of fluoridated water.

It is quite possible for a child to eat a whole bottleful of tablets. This happens quite frequently. If a child eats 150 tablets at once this is the equivalent of drinking 150 quarts of fluoridated water. It is, of course, quite impossible for a child to drink 150 quarts at one sitting. Consequently those who advocate tablets instead of fluoridated water are in fact supporting the only procedure in which there is a danger of over-dosage.

LEGAL POSITION

In Queensland the State Government has passed legislation which leaves the decision to fluoridate or not to local authorities. The legislation also empowers the State Government to indemnify any local authority from any claims for compensation on the grounds of injury or harm to health resulting from the consumption of fluoridated water.

In Western Australia, Act No. 47 of 1966 establishes a Fluoridation of Public Water Supplies Advisory Committee which advises the Minister on any proposal to fluoridate a particular supply. On receipt of a recommendation from the Committee the Minister can send it to the appropriate authority and **direct** it to give effect to the recommendations.

The Privy Council recently upheld the legality of the procedure in a judgment resulting from an appeal by two residents of Lower Hutt in New Zealand.

POLITICAL EXPEDIENCY

Whether we like it or not fluoridation has become a political issue and a sensitive political issue at that. Many City or Shire Councils feel that the responsibility should be accepted by the State Government.

Because of this and because local authority and Shire Councillors are in close contact with the people in their electorates they are reluctant to support issues on which opinion is divided. This, I believe, is the main reason for Councils placing the matter to a referendum. Once an issue is put to a referendum it becomes a political issue and can only be won through the use of political techniques. This places the profession in a difficult position because, by and large, members of the profession have neither the training nor the inclination to conduct a grass roots fight. It takes a lot of time, money and effort to explain a scientific issue to voters. This situation is commonly aggravated by the fact that a referendum is announced at very short notice. This places the opposition at a distinct advantage because they have a hard core of people who can devote their full-time energies to creating doubt. Furthermore, as laymen they do not have to check the validity of any claims they make.

Under these circumstances to win a referendum is quite an achievement but loss of a referendum is no tragedy. In the long run a referendum, whatever the result, creates an interest in dental health that wasn't there before.

THE ETHICAL AND MORAL QUESTION

There is now massive evidence which establishes conclusively that fluoridation is the most effective public health measure for reducing dental caries by more than half, that its beneficial effects continue into adult life, that it will not harm anybody of any age, that the process can be accurately controlled by standard waterworks procedures, that there are no alternatives which are as effective or as practicable, and that it is a legal process.

There are, however, many people who, even if they are prepared to accept these facts, are uneasy about the procedure being in some way an infringement of their personal rights. Although we may disagree with this attitude we should respect it and recognise that in most

cases it is an attitude that is sincerely held. It is wrong in both principle and practice to label the opposition as fanatics or crackpots. To do so merely reinforces the case of some anti-fluoridationists that the Antifluoridation Movement is a cause of the citizen against being pushed around by the "experts".

In facing the ethical or moral question I believe we have to be careful to avoid confusing facts and emotions. We should admit at the outset that this is a debatable issue. It cannot be decided by cold facts — it can only be decided by logical arguments.

In most parts of the British Commonwealth, including Australia, none of our civil rights is absolute and unqualified, e.g., freedom of speech is limited by laws imposing penalties for sedition, obscenity, libel and so on. Because no civil liberty is absolute any objection to fluoridation on this issue must be weighed against the contrary interest of those who will benefit. In this case, those who will benefit immediately will be the children, but ultimately the entire community will benefit as the children carry their increased resistance to dental caries into adult life.

Put another way, if adults insist on their right to refuse fluoridation they must see that they are at the same time insisting that the present children and future generations will have twice as many decayed teeth as they should.

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