RECENT STUDIES CONFIRM OLD PROBLEMS WITH WATER FLUORIDATION: A FRESH PERSPECTIVE

What an end to the millennium! For me it was both exciting and upsetting with respect to the politics of water fluoridation and fluoride research – perhaps a harbinger of things to come. We have all witnessed how the Internet has united scientists, citizens, and groups opposed to water fluoridation with such efficiency that we now interact with each other throughout the world on a daily basis. A new international network, called the Fluoride Action Network, has been organized and keeps us abreast of all the latest developments on the website "www.fluoridealert.org", thanks to the efforts of Professor Paul Connett of St. Lawrence University in Canton, NY, his wife Ellen, and their son Michael. The issue of how safe is water fluoridation appears to be receiving renewed and vigorous scrutiny.

A number of studies published in the last few years in peer-reviewed journals indicate that fluoride in water may be linked to increased bone fracture risk.[1-5] The possible relationship between serum lead levels in children and the chemicals used to fluoridate has also been examined recently. Investigators found that where silicofluorides (fluosilicic acid and sodium silicofluoride) are used to fluoridate water, blood lead levels were significantly higher than in non-fluoridated areas.[6] Another study has linked higher lead levels to an increased risk for dental caries.[7]

Long-term accumulation of fluoride likely also affects thyroid function,[8] may have neurological effects,[9] may induce reproductive problems,[10] and may affect the pineal gland.[11] Fluoride's well-known genotoxic properties may be showing up in the population as an increased risk for various cancers.[12-14] Today, we are witnessing a renewed effort by scientists to examine whether these associations are real and how much fluoridated water has a role to play. While some researchers and government employees are no longer given the opportunity of carrying out research on fluoride toxicity in the US, others have forged ahead and are making important contributions.

A large review has just been completed by an independent team of epidemiologists in York, UK, which was to be an exhaustive, state-of-the-art assessment (meta analysis) of all the water fluoridation studies published to date.[15] It resulted in surprisingly disappointing results for the pro-fluoridationists. It is curious that the British Dental Association and the various print media throughout the world continue to put a positive spin on the review's conclusion. However, Professor Trevor Sheldon, chair of the review committee, felt it necessary to set the record straight. In a letter from him posted on the Internet[16] he was quoted as saying "…the quality of the studies was generally moderate and the size of the estimated benefit, only of the order of 15%, is far from 'massive'" and "the review found water fluori-

dation to be significantly associated with high levels of dental fluorosis which was not characterized as 'just a cosmetic issue'", and, finally, "the review did not show water fluoridation to be safe".

The North American picture at the turn of the century

Despite increasingly active anti-fluoridation movements in the US, the propaganda machine, with seemingly endless publicly-funded resources, is making slow but steady gains towards the year-2000 target of getting ¾ of the American population on fluoridated water. However, local groups are challenging public health officials to re-examine the risks and benefits. Political struggles were never more active. Before the end of the century, the percentage of Americans served by fluoridated water was still only about 65%, well short of the mark. Amidst all these exciting highlights of the last couple of years in fluoridation research, we are all undoubtedly affected by the premature loss of Dr. John Yiamiouyiannis (see In Memoriam, *Fluoride* 33(4)), probably the best-known anti-fluoridation researcher in the world.

Before I got involved in fluoride research, I hid in my biochemistry laboratory studying enamel proteins, dentin, and tooth development. As funding dried up, my interests as a practicing dentist and professor of Preventive Dentistry naturally turned to the effect of ingested fluoride on tooth development, research that did not require huge sums of money. In 1992 and 1997 I helped organize two international workshops sponsored by the Canadian Dental Association. At the end of the first one, it was recommended that no fluoride supplements be given to children from birth to age 3 years. This was in line with the European approach but was somewhat reversed in the second conference, which I chaired. At that conference I reviewed the literature and pointed out, as others have, that fluoride works topically post eruption, not systemically. In other words, it does not need to be swallowed to be an anti-caries agent.

At that meeting, however, I would have to say that politics prevailed over science, and the 1997 CDA recommendations looked more like the ones produced by the American Dental Association in 1994. The only real change to the latter schedule was that newborn infants (birth to age 6 months) should not receive fluoride supplements even in communities where the fluoride level is zero in the drinking water. Both dental associations still endorse water fluoridation at levels ranging from 0.8 to 1.2 ppm.

There is an immediate contradiction here. How can the same authoritative bodies recommend no fluoride supplements for newborn infants and then endorse adding fluoride to tap water which is used by most mothers to reconstitute infant formula to feed their newborn children? Using average fluid intakes for newborns to age 3-6 months, a simple calculation will show that these infants have a much higher fluoride intake (>0.1 mg/kg) than was

generally considered safe (<0.05 mg/kg). The CDA and ADA would have to also recommend the use of distilled or reverse osmosis water for reconstituting all concentrated liquid and powdered infant formula – clearly an expensive and impractical solution to this contradiction.

Another authoritative body in the United States, the Food and Drug Administration (the FDA), now requires a warning statement on all fluoridated toothpastes. The warning states: "If you accidentally swallow more than used for brushing, seek professional assistance or contact a Poison Control Center immediately." The dental associations in North America recommend that, for everyday brushing, patients use a 'pea size amount', or about 0.5 gm. Most toothpastes in North America have 1 mg fluoride per gm of toothpaste. This means that the FDA is recommending that if you swallow the equivalent amount of fluoride found in 0.5 L of fluoridated water (1 mg fluoride/L, or 1 ppm), you should contact a poison control center immediately.

How many people living in a fluoridated community would think to contact a poison control center after consuming 500 mL of their favorite beverage made with fluoridated municipal tap water? Hopefully this glaring contradiction will be resolved sometime in the near future. But is it really such a contradiction? Is drinking 500 mL of fluoridated water on a daily basis perfectly safe? When I found out that the majority of the cities in North America use industrial grade hydrofluosilicic acid or its sodium salt, a highly toxic waste by-product from the manufacture of phosphate fertilizer, as the fluoridation chemical of choice, I was dumbfounded. Even when this commercial grade chemical is diluted to produce 1-ppm fluoride, it adds unwanted arsenic, beryllium, cadmium, lead, silicon, and even radioactive nuclides to the water. Ironically, these relatively impure silicofluorides as additives to drinking water have never been tested for safety. I don't understand how they can be used for mass medication of whole populations and not require FDA approval. Is it any wonder that more people than ever are not drinking tap water in North America?

Are fluoridation studies flawed?

A lot of credence has been given to the recent York review. However, a meta-analysis that mixes 50-year-old studies (pre-fluoride era) with more recent ones and then declares that fluoride has an 'average' benefit today, is obviously flawed. Actually, each and every water fluoridation study conducted to date is flawed since not a single study took into account that ingested fluoride delays tooth eruption by about a few months to over a year.[17,18] This means that the test communities had children who were dentally younger compared to the control communities. The unerupted teeth would not be exposed to the same carbohydrate challenges and may end up with the same dental decay given the same amount of time in the oral cavity. Not a single fluoridation study has examined

this problem in detail. Looking over older data, where there is less influence of other sources of fluoride such as toothpaste, I have discovered that a delay in tooth eruption of one year would account for approximately 15% of the estimated 'benefit' of fluoridated water. This is the same 'benefit' that the York review considered to be the average benefit by lumping all the water fluoridation studies together.

In addition, it is disturbing that the York committee did not consider toxicology studies on animals. Many fluoride toxicology studies on humans were also ignored. This is hardly an exhaustive evaluation of the safety of water fluoridation. Ironically, in the process of trying to be as thorough as possible, the committee of epidemiologists admitted that the science behind the effectiveness of fluoridated water is very weak. The York review is certainly not the last word on water fluoridation, and the committee emphasized that more good quality research was required to be able to state categorically that water fluoridation is safe and effective in today's era of low dental decay rates.

On a personal note, I now feel almost as if I had 'crossed over' to the 'other side' by turning my efforts to studying the toxic side effects of low dose fluoride ingestion on humans. After taking a public stand against water fluoridation in 1999, my life changed drastically. Many of my dentist and research colleagues turned on me asking me to recant. One even asked that I resign from my position as President of the Canadian Association for Dental Research. Our Faculty is still getting e-mail complaints but thanks to academic freedom and tenure my colleagues within my own Faculty have, for the most part, been quite supportive and civil. I am a neophyte at the fluoridation controversy. I had no idea just how difficult it would be to try to convince the 'pro-fluoridation' researchers that we should take a much more cautionary approach to recommending daily fluoride ingestion as a means to reduce dental decay. I was surprised, on the other hand to receive e-mails and phone calls from all over the globe thanking me for taking a public stand against water fluoridation. These were all greatly appreciated when it seemed that my colleagues wanted to distance themselves from me. Since my 'coming out', I have had the distinct pleasure of offering the opposing scientific viewpoint to a fluoride forum set up by the Minister of Health in Ireland, to various smaller communities voting on the fluoridation issue, and at a debate organized in Wellington, Florida, where I took part in a panel opposite a team of delegates from the ADA and the Centers for Disease Control in Atlanta.

We are far from seeing the light at the end of the tunnel. There are so few champion researchers in this area of fluoride research that the challenge

seems insurmountable at times. We need more people like Dr. John Yiamouyiannis. I have a tremendous respect and admiration for Dr. John Y, who, even though he was already showing signs of his illness, helped me make presentations to the City of Toronto and the neighboring region in which I reside. In response to our presentations, the City of Toronto reduced its fluoride level in the drinking water to 0.7-0.8 ppm. The Ontario Ministry of Health then commissioned Dr. David Locker, an award-winning, internationally-recognized public health dental researcher, whose research had been in the geriatric dentistry area, to review the recent literature on water fluoridation and make new recommendations as to whether current government guidelines on fluoridation policy should be updated. His conclusions were much the same as the York study: the risks from fluoridation far outweighed the benefits. This has resulted in a 'downgrading' in Canada of the amount of fluoride recommended as the 'optimum' level in drinking water. Our provincial Ontario Ministry of the Environment now recommends that the 'optimum fluoride level' in drinking water be changed to 0.5-0.8 ppm. In my own region, artificial fluoride levels are down to 0.6 ppm, a level that is not much different from the natural levels found throughout Southern Ontario. While this will serve to reduce the risk of fluorosis, it obviously is no longer worth the effort to artificially fluoridate to these low levels.

John (Dr. Y) was an inspiration to me. Like all committed researchers, he was simply searching for the truth. He was also a well-known anti-fluoridation activist. My personality does not lend itself very well to being as vocal as John was. The public believes that researchers should take unbiased positions and simply report data. However, history has demonstrated that important discoveries are made by researchers committed to their hypotheses, even if these hypotheses are unpopular and contradict established dogma. The last millennium had too many giants to name, but examples which come to mind are: Galileo's challenge of the Ptolemaic view of the solar system; Newton's challenge of the Cartesian mathematicians with his own form of calculus; Harvey's discovery of the circulation system that angered the Galenists; Einstein's challenge of Newtonian physics; and Semmelweis' struggle to convince physicians that disinfecting their hands with bleach would reduce infections in mothers and babies during childbirth. Researchers as committed as these science 'heroes' tend to doggedly pursue the truth and, in so doing, change history. We should all be so lucky!

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