



# NFIS

National Fluoridation  
Information Service

## Does Delayed Tooth Eruption Negate The Effect Of Water Fluoridation?

National Fluoridation Information Service Advisory



Updated October 2011

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## **NATIONAL FLUORIDATION INFORMATION SERVICE**

The National Fluoridation Information Service (NFIS) is a consortium funded by the Ministry of Health, led by Regional Public Health working in partnership with:

- Hutt Valley DHB Community Dental Services,
- Environmental Science and Research,
- Centre for Public Health Research at Massey University and
- National Poisons Centre

Our work includes:

- Following public debate and choices on water fluoridation
- Monitoring international research on the usefulness of water fluoridation
- Critically reviewing emerging research
- Working with District Health Boards and Councils to provide accurate and up-to-date information to their communities
- Providing clinical advice to the Ministry of Health
- Monitoring water fluoridation policy
- Providing access to New Zealand oral health data and research
- Sharing information via quarterly e-newsletters and e-briefings and the NFIS website

## **ACKNOWLEDGMENTS**

This report has been prepared by Dr Robin Whyman, Hutt Valley District Health Board.

## SUMMARY

It has been asserted that the effects of water fluoridation on reducing dental decay severity are overstated. There has been a recent suggestion by Professor Paul Connett that the benefits of water fluoridation are simply the result of late eruption of teeth in children drinking fluoridated water.

However, while there is well established evidence of differences in dental development at similar ages across cultural and ethnicity groups, there is not evidence that water fluoridation is a cause of differential tooth eruption.

Information recently published by the Fluoride Action Network based on Australian data, suggesting a substantial difference in tooth eruption between fluoridated and non fluoridated areas of Australia, have been confirmed as being based on erroneous data.

The Australian research centre (ARCPOH) responsible for these data have confirmed the data error and reported that when the error is corrected there is little variation in the number of permanent teeth present at each age between children in Queensland and all of Australia.

The studies and reports cited by Professor Connett to try and validate an argument for delayed tooth eruption either do not make the claims he suggests, or do not have direct relevance to trying to assess the issue. The claimed association is at odds with the published literature which indicates minimal variation in eruption time of permanent teeth by exposure to fluoride. A rational explanation exists for the minimal variations that have been reported based on the relationship between fluoride exposure, caries experience in the primary teeth and emergence timing for the permanent teeth.

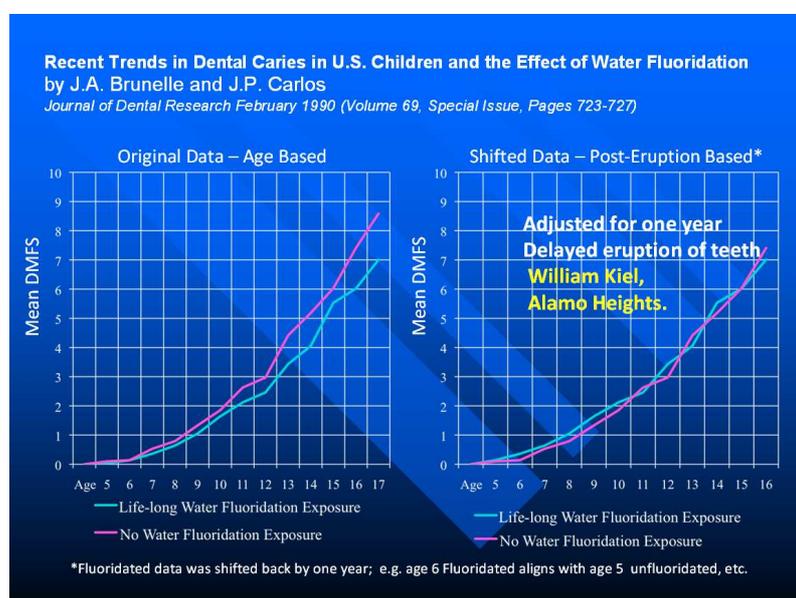
Information on the effect of water fluoridation on adult oral health, when any potential effect from delayed tooth eruption would have disappeared, continue to show a benefit from water fluoridation both in international and in New Zealand data.

## BACKGROUND

During a recent visit to New Zealand Professor Paul Connett asserted that the effects of water fluoridation on reducing dental decay severity are overstated. He suggested that the reported effects are negated if teeth erupt more slowly in areas with water fluoridation and asserted that he believed this was the case from evidence he had read.

In his presentations he cited a number of published papers. In some presentations he also presented a graph that had been drawn by the Fluoride Action Network based on data released as the result of a user request to the Australian Research Centre on Population Oral Health (ARCPHO).

### Brunelle and Carlos (1990)



Professor Connett presented the above slide and suggested that the difference between the level of dental decay in US children with lifelong water fluoridation exposure and those with no water fluoridation exposure would be explained if water fluoridation delaying the tooth eruption by one year. The graph on the right is simply a redrawing of the graph on the left involving moving the blue line data points back one year at each age group.

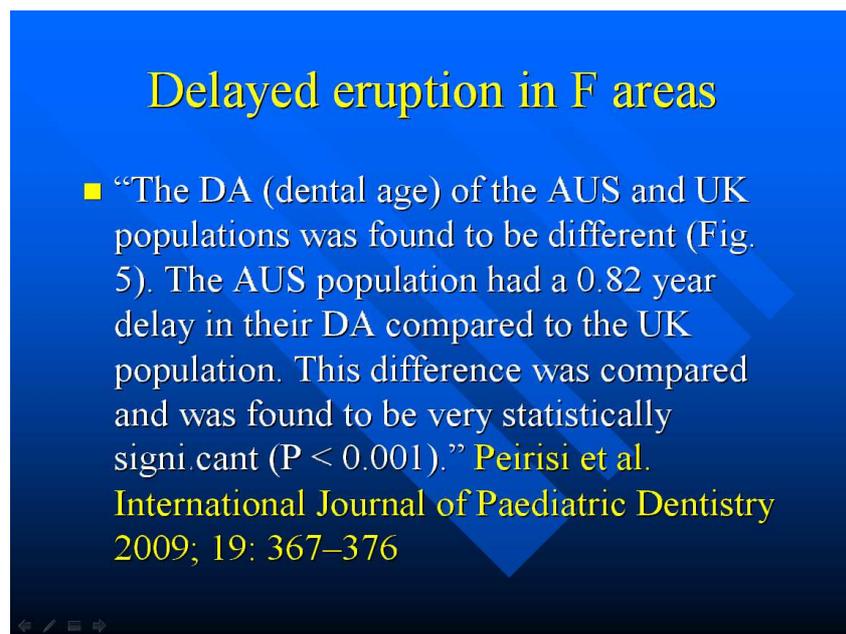
This “reanalysis” does not appear to have been based on any return to the original data. It is effectively a “photoshop” of the graph of the original data to propose a theory from Professor Connett.

There is no evidence that the teeth of the children in the area with lifelong water fluoridation were delayed in their eruption or that the number of teeth erupted was greater or smaller in either of the groups.

The original paper is based on data from the 1987 US national survey of child oral health. It reported that children who had always been exposed to water fluoridation had mean dental decay severity scores that were 18% lower than those who had never lived in fluoridated communities. The study then controlled for the effect that use of other topical fluorides could have played in reducing dental decay in both groups, and found the difference increased to 25%. In other words water fluoridation played a dominant role in the decline in caries.

### Peiris et al (2009)

Professor Connett then cited a paper published in 2009 by Peiris et al. His presentation of the slide covering this paper was immediately before his slide showing the redrawing of the Brunelle and Carlos (1990) data described above. It gave the effect of suggesting that the Peiris et al (2009) paper had shown a difference in dental developmental age based on water fluoridation.



The Peiris et al (2009) paper compared dental development using panoramic radiographs for 77 matched pairs of 4- to 24-year-old UK and Australian people. They did report that the Australian group had a 0.82 years delay in their dental age compared to the UK group based on the age assessment tool used. This finding is potentially important in forensic contexts, in clinical decision making about dental treatments and may have relevance to some social contexts.

However, it is very difficult to find the paper's relevance to water fluoridation. Water fluoridation or fluorides are never mentioned in the paper. The inference from Professor Connett was that this paper is relevant to water fluoridation because of difference in water fluoridation coverage between the two countries.

The assessment between the two populations used a radiographic measure of tooth development. This involved looking at the development of the teeth crowns and roots on the x-rays and comparing the stage of development at the same chronological age. This was legitimate and appropriate for the aims of the paper. However, the paper did not assess the timing of the teeth erupting into the mouth and therefore the amount of time for decay risk.

Studies that appropriately compare the effectiveness of water fluoridation do not compare poorly controlled inter-country population samples. They generally compare age, sex and where possible ethnicity matched groups from similar areas. Inter-country comparisons of health status, including oral health status, are notoriously difficult to interpret for cause and effect, because there are so many environmental, social and contextual differences that need to be considered.

It is inappropriate to draw an inference that a study looking at the developmental age of teeth across two countries explains a difference in dental decay levels based on water fluoridation.

## Important recent studies

- Komarek et al., 2005 (controlled for delayed eruption of teeth in F-communities).
  - Found no difference in tooth decay between F and non-F communities.
- Warren et al., 2009 (measured tooth decay as a function of individual exposure to fluoride).
  - Found no relation between tooth decay and amount of fluoride ingested.

Professor Connett also cited a study by Komarek et al 2005. These researchers undertook a very complex statistical analysis of the effect of tooth emergence time and time to development of first carious lesions.

However, they did not assess in the study, the impact of water fluoridation. They were measuring, using a number of proxy models, the relationship to “fluoride intake”.

The study did find in 7- to 12-year-old children that there was only a positive protective effect from fluoride ingestion for the mandibular teeth of boys. There was no effect for other teeth. The paper supported the generally accepted premise that in fact the caries protective effect from fluoride is topical.

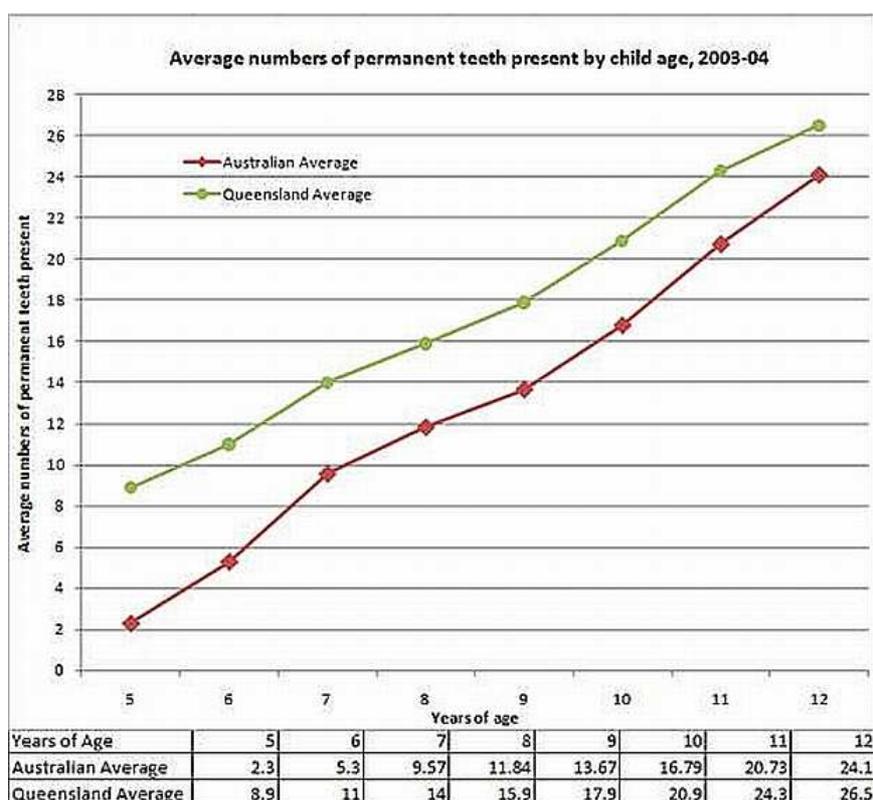
Similarly, Professor Connett’s highlighting of the conclusion from Warren et al 2009 that there was no relationship between fluoride **ingested** and tooth decay levels is unsurprising. It is generally accepted that the principal caries protective effect from fluoride is topical.

## ARCPOH DATA APRIL 2011

In early April 2011 the graph presented in Figure 1 was published as an online news article in *Process and Control Engineering*. Professor Connett used this graph in his presentation to the Hastings District Council on 5 April 2011. He claimed it presented new evidence that the teeth of children in fluoridated areas erupt much more slowly than the children on teeth in non fluoridated areas and therefore supported his above thesis around the Brunelle and Carlos (1990) paper.

The graph purports to compare the average number of permanent teeth present in the mouths of Australian children with those of Queensland children in 2003-04.

**Figure 1**



The National Fluoridation Information Service (NFIS) were concerned to understand the origins of this graph and the data upon which it was based. We contacted Professor Spencer and Dr Armfield at the Australian Research Centre for Population Oral Health (ARCPOH).

Professor Spencer advised that the data originated from ARCPOH under a user request from an Australian member of the Fluoride Action Network.

On 14 April 2011 Professor Spencer provided further information about the data and advised:

“The claimed association is based upon an analysis of 2003-04 data that had an error. ARCPOH found a syntax error in the software program used to read the optical mark read forms for Queensland in the years 2003 and 2004.

This error was subsequently corrected and new estimates of the number of permanent teeth present by age were computed for Queensland and Australia for 2003-04.

These estimates are in-line with those previously published for the Child Dental Health Survey up to 2002 on the ARCPOH website. There is little variation in the number of permanent teeth present at each age between children in Queensland and all of Australia.

ARCPOH has also analyzed eruption times for the four first permanent molar teeth in Queensland children by their level of lifetime exposure to water fluoridation. This ‘higher-level’ analysis does not support the proposition of a delay in eruption due to water fluoridation.

**It is clear that only minimal variation in eruption time and subsequently the number of permanent teeth present at any age among children between those with no exposure and with optimal exposure to water fluoridation. This variation could not account for the reduced dental decay found with exposure to water fluoridation.”**

The data presented in the *Process and Control Engineering* article are very difficult to believe clinically when considered against the general tooth eruption pattern of children and the observed teeth present at these ages.

A logic test alone challenges the likelihood that Queensland 5-year-old children have 9 permanent teeth erupted, when 5-year-old children in the rest of Australia have only just a little over 2 teeth present. At age 6 years the suggestion is that Queensland children have 11 teeth erupted while the rest of Australia’s 6-year-olds only have 5 erupted.

Children aged 5 to 6 years are at the start of the change over from primary to permanent teeth. Generally the primary lower incisor (front) teeth and the upper incisor teeth become loose and then change over to new permanent teeth. Following this stage, or sometimes alongside these changes, the first permanent molar teeth erupt into the mouth behind all the primary teeth.

If all of the incisors have changed over, and all of the permanent molars erupted then there is a possibility of 12 permanent teeth present. These data are asking us to believe that “on average” this has happened almost completely for Queensland 6-year-olds while across the rest of Australia the process is only about half way through.

As a clinician, such a stark difference between fluoridated and non-fluoridated areas is not seen. It is of a magnitude of difference that is much more than has been suggested in papers such as Peiris et al 2009 for differences in stage of development between different groups of the same age.

#### **Delayed tooth eruption as a confounder of water fluoridation effectiveness**

The York Report (McDonagh et al 2000) did point out that there are a number of confounding factors that can potentially affect the assessment of dental caries development in studies. They stated that the *number of erupted teeth per child* is a potentially important issue in child studies. They also identified that it has been suggested that fluoridation may delay the eruption of teeth and thus caries incidence could be delayed as teeth would be exposed to decay for a shorter period of time.

The York report found “only one study compared the number of erupted teeth per child. The difference was very small and in opposite directions in the two age groups examined, however no measure of the statistical significance of these differences was provided. Only one of the studies attempted to control for confounding factors using multivariate analysis”.

There has been little evidence presented that tooth eruption times in children are delayed in association with water fluoridation. In fact the claimed association is at odds with the published literature which indicates minimal variation in eruption time of permanent teeth by exposure to fluoride (Kunzel VW 1976; Tseng CC et al 1989; Leroy R et al 2003). Leroy et al (2003) reported that an impact on the emergence time of permanent teeth from four fluoride exposure parameters was sometimes

observed for some teeth, but even if it did occur, it had minimal impact. A more pronounced impact on the timing of eruption of the permanent teeth was caries experience in the primary molar teeth. The researchers concluded that it could be assumed there is a triangular relationship between fluoride exposure, caries experience in the primary teeth and emergence timing for the permanent teeth.

### **Adult dental decay levels and water fluoridation**

While the potential issue of differences in tooth eruption timing may affect child dental health studies, they are highly unlikely to persist as an effect into the comparison of adult dental decay levels based upon water fluoridation.

In 2007 Griffin et al completed a meta-analysis to assess the effectiveness of fluoride at preventing dental caries in adults. Their paper, which analysed twenty published studies, reported that water fluoridation was responsible for preventing 27% of the dental caries reported in adults and was consistent with fluoride's effectiveness at preventing caries in adults of all ages.

In 2010 the New Zealand national survey of oral health (Ministry of Health, 2010) in adults aged 18 years and over reported that the severity of dental decay was 1.1 times as high for people living in non-fluoridated areas compared with those living in fluoridated areas. They reported that the difference was found despite the majority of people brushing their teeth with a fluoridated toothpaste and migration of people into and out of areas with fluoridated water. The true protective effect of water fluoridation may have been underestimated.

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