Young infants, infant formula and fluoride exposure

This document provides balanced evidence-based information in relation to young infants and fluoride ingestion. It has been prepared by the Department of Human Services' Public Health Branch in collaboration with the Department of Dentistry at the Royal Children's Hospital, Victorian Government Office for Children, Dental Health Services Victoria, The University of Melbourne School of Dental Science and the Australian Dental Association Victorian Branch Inc.

Following the release of a report from the National Research Council in the United States[1], some members of the community have expressed concern about the potential risk of dental fluorosis due to excessive fluoride ingestion by infants under six months of age. This concern has primarily focused on the reconstitution of infant formula with fluoridated water.

- In 2006, the Australian Research Centre for Population Oral Health published 'The Use of Fluorides in Australia: guidelines'.[2] These were developed by 35 experts from universities, health departments and health organisations. Guideline 6 states: 'Infant formula nowadays is safe for consumption by infants when reconstituted using fluoridated or non-fluoridated water'.
- In Australia, since 1990, the prevalence of dental fluorosis has markedly reduced[2], with no increased risk of fluorosis with infant formula use.[3] A very recent study has shown that regardless of the type of water used to reconstitute infant formula, no significant association exists between use of formula and dental fluorosis.[4]
- Breastfeeding remains the preferred method of infant feeding and provides perfect nutrition to match an infant's needs. It helps protect against infection and other illnesses.[5] Although breast milk is the best feeding choice for babies, infant formula is readily available and nutritionally adequate.[6]

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Dental fluorosis

Dental fluorosis is mottling of tooth enamel, which may result from excessive ingestion of fluoride while teeth are developing, and may be of aesthetic concern. In Australia, if dental fluorosis does occur, it is usually of a very mild or mild form.[7]

With the exception of dental fluorosis, scientific studies have not found any link between water fluoridation and adverse effects.[7]

The pictures below show cases of very mild and mild dental fluorosis (Pictures provided by Drs Evans & Bal, The University of Sydney.)

Very mild dental fluorosis along the lower edge of the upper front teeth

Mild dental fluorosis predominantly on the upper and outer thirds of the upper front teeth

Dental fluorosis in Australia

In Australia, since the mid 1990s, the prevalence of dental fluorosis has markedly reduced, mainly attributable to the use of low-fluoride toothpastes for young children, and awareness raising of correct toothpaste use by children.[8]

Recent studies have further demonstrated the reduction of dental fluorosis in Australia.[3, 4]

Significantly, very recent Australian research has examined the relationship between dental fluorosis and infant formula and found that regardless of the type of water used to reconstitute infant formula, there was no significant association between use of formula and dental fluorosis.[4] Even children predominantly fed with infant formula during the first year of life are not at higher risk of developing dental fluorosis.[4]

How can dental fluorosis be minimised?

The use of fluoride tablets, drops or standard fluoride toothpaste by young children, increases the chance of developing dental fluorosis. The level of fluoride in standard fluoride toothpaste is one thousand times higher than the level in drinking water. For this reason, whether a water supply is fluoridated or not, it is important to:

- discourage children from swallowing toothpaste
- clean children's teeth with water and no toothpaste before the age of 18 months, unless otherwise recommended by a health professional
- use only a pea-sized amount of low-fluoride children's toothpaste, smeared over the toothbrush, for children between the ages of 18 months and five years of age (inclusive), unless otherwise recommended by a health professional
- stop using fluoride drops and tablets
- only use fluoride mouth rinses from the age of 6 years.[2]

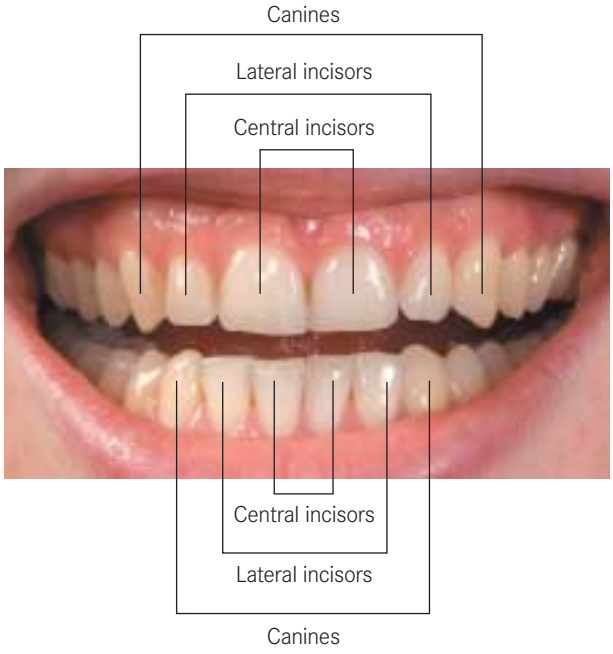
Permanent tooth development

The permanent teeth develop in the jaw bones before coming into the mouth. While this development commences on average at three to four months of age, it can occur earlier or later in some children as part of the normal variation in growth. The table below provides average milestones in permanent tooth development, and the picture explains the anterior (front) teeth names.

Most children, though not all, will have anterior teeth commence development in the first year of life. The first six to 12 months of life is also the age when some children are fed infant formula.

	Central incisors		Lateral incisors		Canines	
	U	L	U	L	U	L
Calcification commences	3–4m	3–4m	10–12m	3–4m	4–5m	4–5m
Completion of calcification of crown	4–5y	4–5y	4–5y	4–5y	6–7y	6–7y
Appearance in mouth	7–8y	6–7y	8–9y	7–8y	11–12y	9–10y

U = upper jaw; L = lower jaw; m = months; y = years.
Table taken from: Berkowitz, Holland and Moxham, 1992. A colour atlas and textbook of oral anatomy. Wolfe Medical Publications.



Dental decay

Dental decay is a disease of the teeth resulting in demineralisation and cavitation of tooth structure by acid-producing bacteria in the mouth. Dental decay is Australia's most prevalent health problem and is the second most costly diet-related disease in Australia, with an economic impact comparable with heart disease and diabetes.[9]

Dental decay can be painful and expensive to treat, with some people, especially young children, requiring general anaesthetics. In 2004–05, across Victoria there were almost 5,000 children under the age of 10, including 250 two-year olds, who required a general anaesthetic for treatment of their dental decay.[10] In the same year, in non-fluoridated areas of Victoria, three times as many people per capita required a general anaesthetic in hospital for treatment of tooth decay than in fluoridated areas.[10]

The pictures below show cases of dental decay in baby and adult teeth.

Significant dental decay in baby teeth

Dental decay in adult teeth

Research summary

Australia

The Australian Research Centre for Population Oral Health

In 2006, the Australian Research Centre for Population Oral Health published *The Use of Fluorides in Australia: guidelines.*[2] These were developed by 35 experts from universities, health departments and health organisations. Guideline 6 states: 'Infant formula nowadays is safe for consumption by infants when reconstituted using fluoridated or non-fluoridated water'.

National Health and Medical Research Council

In 2006, the National Health and Medical Research Council, in partnership with the New Zealand Ministry of Health published *The Nutrient Reference Values for Australia and New Zealand.*[11] This document includes fluoride as a nutrient and provides recommendations by life stage. The recommendations were based on a report by the US Institute of Medicine Food and Nutrition Board, 1997.[12]

For infants 0–6 months of age, an adequate intake (AI) of 0.01mg/day of fluoride is recommended.

This AI is calculated by multiplying the average intake of breast milk (780ml/day) and the average concentration of fluoride in breast milk (0.013mg/L).
So: 780ml/day x 0.013mg/L = 0.01mg/day.

The Nutrient Reference Values document also states that the Upper Level (UL) for fluoride for infants aged 0–six months is 0.7mg/day. This UL was set on the basis of moderate enamel fluorosis.

If an infant drinks exclusively infant formula reconstituted from fluoridated water, the ingested fluoride will be derived from the fluoridated water.[11] In Victoria, water fluoridation programs fluoridate the water up to 1mg/L. So, if a 0–6 month old infant consumes 780ml water/day, 0.78mg/day of fluoride will be ingested. Although this indicates that some infants may ingest fluoride at amounts above the Upper Level of 0.7mg/day, recent Australian research demonstrates that regardless of the type of water used to reconstitute infant formula, no significant association exists between use of formula and dental fluorosis.[4] In Australia, since 1990, the prevalence of dental fluorosis has markedly reduced, with no increased risk of dental fluorosis with infant formula use.[3]

The Nutrient Reference Values document is currently being updated. Although published in 2006, it was endorsed by the National Health and Medical Research Council in September 2005. This was prior to the presentation of recent Australian research used to develop the new guidelines on the use of fluorides in Australia (see previous section).

Infant formulas sold in Australia generally have very low amounts of fluoride.[2] Food Standards Australia New Zealand is an independent statutory authority that develops food standards to protect the health and safety of the public.
Standard 2.9.1 of the 2007 Australia New Zealand Food Standards Code relates to infant formula products, and clause 19 refers specifically to dental fluorosis. It states that infant formula containing more than 17 µg of fluoride per 100 kJ powder prior to reconstitution must include a warning about dental fluorosis on the label.[13] This figure assumed that fluoridated water was used to reconstitute infant formula.[14]

United States of America

The US National Research Council report

In 2006, the US National Research Council (NRC) released a report *Fluoride in drinking water: a scientific review of the EPA's standards*.[1] The NRC also derived fluoride recommendations from the US Institute of Medicine Food and Nutrition Board, 1997 report.[12] The 2006 US NRC report was commissioned by the US Environmental Protection Authority to examine the adequacy of the current guideline levels to protect public health from the effects of naturally occurring fluoride levels greater than 2mg/L. It did not investigate risks associated with the adjustment of fluoride levels in drinking water to 1mg/L for dental health benefits.

The American Dental Association

On 8 November 2006, the American Dental Association issued interim advice[15] based on the report from the US NRC. This interim advice recommended that if infant formula was the predominant food source for infants, it should be reconstituted with non-fluoridated water, to minimise the risk of dental fluorosis. It is important to note, however, that:

- The US documents were written for a US audience: there are some water supplies in the US with naturally high levels of fluoride in the water (2 to 4 times higher than recommended by the World Health Organization and practised across Australia).
- There are no low-fluoride children's toothpastes on the US market, unlike in Australia.[16]

US Centres for Disease Control

Following the American Dental Association interim advice, the US Centres for Disease Control advised that in the US reconstituting infant formula with water that is not optimally fluoridated should be weighed up with the increased risk of developing tooth decay.[17]

In summary

In Australia:

- Studies do not demonstrate that dental fluorosis experience is an issue, instead, dental fluorosis levels have markedly reduced since the mid 1990s.
- The significant risk factor for dental fluorosis is the inappropriate use of fluoridated toothpastes by young children, not the use of fluoridated water to reconstitute infant formula.
- It is safe to reconstitute infant formula with optimally fluoridated drinking water.

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Appendix

Definition of Adequate Intake (AI)—the average daily nutrient intake level based on observed or experimentally-determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate.[7]