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The use of fluorides in Australia: Information for Dental Practitioners

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Fluoride use has long been the foundation of preventing dental caries, not only in Australia but also around the globe. While community water fluoridation and fluoride use are central to caries prevention, self-use fluoride products other than toothpastes and professionally applied fluoride products have evolved over the years with a varying degree of risk-benefit balance. In this context, the first national workshop to review the evidence for caries preventive effect of different fluorides and to formulate national guidelines for use of fluorides in Australia was convened in 2005.¹ Concomitant with the evolving national and global evidence on fluorides, a second national workshop was held in 2012 to review those guidelines, and subsequently six recommendations from the first workshop were amended.² Emerging evidence on risk-benefit balance of different fluorides since 2012 has necessitated further updates to the guidelines and accordingly, a third national workshop was summoned in 2019.³

The information presented here is based on the recommendations of the third national workshop on ‘The use of Fluorides in Australia’ in 2019³, herein after referred to as the third workshop.

Dental caries and dental fluorosis in Australia

Dental caries

Any preventive program involving fluorides focuses on dental caries, which is ubiquitously prevalent, inflicting a substantially high disease burden among both children⁴ and adults⁵ in Australia. Currently available national data speak volumes of the dental caries status of Australians. For example, according to the National Child Oral Health Study⁴ the prevalence of dental caries in the primary dentition of children aged 5-10 years was 41.7% with 27.1% and 5.6% of these children having untreated dental caries and losing at least one tooth in their primary dentition due to caries, respectively. The respective proportions for children aged 6-14 years with their permanent dentition were 23.5%, 10.9% and 0.8%.⁴

Dental caries is robustly age-correlated with DMFT/S reflecting cumulative experience of dental caries over lifetime. Accordingly, nearly 9 in 10 dentate adults aged 15+ years in Australia had dental caries whereas the prevalence of dental caries among adults aged 15-34, 35-54 and 55+ years was 74.4%, 95.4% and 100%, respectively, in 2017-18.⁵ Virtually one third of the Australian dentate adult population aged 15+ years had at least one tooth with untreated dental caries.⁵ On average, the number of teeth affected by dental caries (mean DMFT) was 11.2 among these adults, which increased almost six times, from 4.1 at 15-34 years to 24.4 at 75+ years, across age groups.⁵

Dental fluorosis

The national guidelines for use of fluorides in Australia aims to maximise dental caries reduction with a minimal level of undesirable dental fluorosis. However, given that almost 90% of Australians consume fluoridated drinking water with most of them having access to fluoridated toothpastes and other fluoride sources, a potential increase in fluorosis of any form could occur.⁶ Against this backdrop, actions taken by some Australian jurisdictions since the 1990s to reduce exposure to discretionary fluoride use have shown promising results in lowering the levels of dental fluorosis in fluoridated as well as non-fluoridated areas.^{7,8}

Several indices such as Dean’s Index (DI), the Thylstrup & Fejerskov (TF) Index, the Tooth Surface Index of Fluorosis (TSIF) and the Fluorosis Risk Index (FRI) have been used by researchers to measure dental fluorosis.⁹ Of these indices, the Thylstrup & Fejerskov (TF) Index, which is a diagnostic scale based on clinical appearance of tooth surfaces to classify dental fluorosis¹⁰, has been widely used in Australia. The TF index assigns scores on an ordinal scale ranging from zero to nine, allowing the detection of mildest to most severe forms of dental fluorosis.^{9,10} While a score of zero represents normal translucency of enamel, increasing scores indicate an increase in dental fluorosis severity. Scores 1-4 denote increasing degrees of opacity with no loss of outermost enamel whereas scores of 5+ represent increasing degrees of loss of outermost enamel.

National findings on dental fluorosis among children aged 8-14 years revealed that the prevalence of any fluorosis (TF score of 1+) was 16.8% while that of more definite dental fluorosis (TF score of 3+) was only 0.9%.⁴ These findings also suggested that the moderate to severe dental fluorosis (TF score of 4-5) was virtually non-existent among Australian children. On the other hand, 9.4% Australian adults aged 15-44 years had TF score of 2+ (very mild or higher), apparently without any variation across age groups, which might have suggested that the population exposure to fluoride available during the period where the study participants were born was equal.⁵ Overall, the currently available information indicates that the prevalence of dental fluorosis ranges from very mild to mild, which is not aesthetically unacceptable to those who are affected, whereas occurrence of moderate to severe fluorosis among Australians is rare.^{4,5}

The National Guidelines on Fluoride Use 2019

The third workshop adopted 16 recommendations for the use of fluorides in Australia under the subcategories of community water fluoridation (5), self-use fluoride products (8) and professionally applied fluoride products (3).

1. Community water fluoridation

Preventive programs on dental caries in Australia over the past five decades have predominantly evolved around community water fluoridation. This has been established by community-based oral health research in Australia and endorsed by a series of reviews conducted by the National Health and Medical Research Council (NHMRC) in 1991¹¹, 2007¹² and 2017.⁶ National-level evidence emanating from children⁴ as well as adults⁵, points to the substantial effect of water fluoridation in decreasing dental caries. NHMRC reviews, in particular the latest one carried out in 2017, have consistently supported both the effectiveness and safety of water fluoridation in Australia as practised at the currently recommended level of fluoride (0.6 - 1.1mg/L) in drinking water.^{6,11,12} More recently, a population-based follow-up study conducted in Australia has consistently proved that exposure to fluoridated water during the first 5 years of life is not negatively associated with child emotional, behavioural development, and executive functioning in their adolescent years.¹³ As such, the current evidence affirms that community water fluoridation in Australia has not only reduced the prevalence and severity of dental caries, but it has also not been associated with unacceptable levels of fluorosis or other adverse health outcomes including (but not limited to) cancer, hip fracture, cognitive dysfunction and Down syndrome.

Whilst endorsing the continuation of water fluoridation in Australia at current levels, the third workshop reached a consensus to recommend the following:

- Water fluoridation should be continued as an effective, efficient, socially equitable and safe population approach to the prevention of caries in Australia.
- Water fluoridation should be extended to as many non-fluoridated areas of Australia as possible, supported by all levels of Government.
- The level of fluoride in the water supply should be within the range 0.6–1.1 mg/L. Note to Recommendation # 3: Depending on the average maximum daily temperature, individual states and territories have set targets and tolerances for fluoride in their water supplies with all

being within the range 0.6–1.1 mg/L.

- For people who choose to consume bottled or filtered water containing fluoride, manufacturers should be encouraged to market bottled water containing approximately 1.0 mg/L fluoride and water filters that do not remove fluoride. All bottled water and water filters should be clearly labelled to indicate the concentration of fluoride in water consumed or resulting from the use of such products.
- People in non-fluoridated areas should obtain the benefits of fluoride in drinking water using bottled water with fluoride at approximately 1.0 mg/L

2. Self-use fluoride products

Fluoridated toothpastes, fluoride supplements and fluoride mouth rinses are included under self-use fluoride products.

Fluoridated toothpaste for children, adults, and older adults

Fluoridated toothpastes are available in three concentrations in Australia: standard (for people aged 6+ years), high fluoride and low fluoride (for children aged 18 months to 6 years).¹⁴ Standard and high fluoride toothpastes contain 1.0-1.5 mg/g fluoride (or 1000-1500 ppm) and 5 mg/g fluoride (or 5000 ppm), respectively, while low-fluoride toothpastes contain 0.5-0.55 mg/g fluoride (or 500-550 ppm).¹⁴ Reports indicate that virtually 97% of Australian children and adults brushed their teeth daily using a fluoridated toothpaste¹⁵, although only 68.5% and 51% of Australian children aged 5-14 years and adults aged 15+ years, respectively, brushed their teeth twice a day with a fluoridated toothpaste in line with the recommended guidelines.¹⁶ Steady increases in the population of older Australians, together with increases in tooth retention into old age, pose particular challenges for the oral health care system, especially in the prevention of caries among this group. Accordingly, the third workshop highlighted the importance of using high-fluoride toothpastes as opposed to standard fluoride toothpastes for older Australians who are at a higher risk of developing both coronal and root caries. They also discussed the possibility of involving trained health professionals including allied health practitioners, registered/enrolled nurses and Indigenous health workers in providing toothbrushing and toothpaste advice to individuals and/or groups of older Australians. Accordingly, at the third workshop it was decided to continue the below recommendations (#1-5) from the second workshop with minor modifications.

- From the time that teeth first erupt

- (about six months of age) to the age of 17 months, children’s teeth should be cleaned by a responsible adult, but not with toothpaste.
- For children aged from 18 months to five years (inclusive), the teeth should be cleaned twice a day with toothpaste containing 0.5–0.55 mg/g fluoride (500–550 ppm). Toothpaste should always be used under the supervision of a responsible adult. A small pea-sized amount should be applied to a child-sized soft toothbrush and children should spit out, not swallow, and not rinse. Young children should not be permitted to lick or eat toothpaste. Standard toothpaste is not recommended for children under 6 years of age unless on the advice of a dental professional or a trained health professional.
- For people aged 6 years or more, the teeth should be cleaned twice a day or more frequently with standard fluoride toothpaste containing 1–1.5 mg/g fluoride (1000–1500 ppm). People aged 6 years or more should spit out, not swallow, and not rinse.
- For people who do not consume fluoridated water or who are at elevated risk of developing caries for any other reason, guidelines about toothpaste usage should be varied, as needed, based on the advice of a dental professional or a trained health professional. Variations could include more frequent use of fluoridated toothpaste, commencement of toothpaste use at a younger age, or earlier commencement of the use of standard toothpaste. This guideline might be applied particularly to preschool children at elevated risk of caries.
- For teenagers, adults and older adults who are at elevated risk of developing caries, the advice of a dental professional or a trained health professional should be sought to determine if they should use toothpaste containing a higher concentration (5 mg/g or 5000 ppm) of fluoride.

Fluoride supplements

Given no updated evidence on the effectiveness and safety of fluoride supplements has emanated since the last workshop, the following recommendation was retained:

- Fluoride supplements in the form of drops or tablets to be chewed and/or swallowed, should not be used.

Fluoride mouth rinses

It has been revealed that a majority of mouth rinse products purchased by Australians for daily and weekly use do not contain the recommended

fluoride concentration of 200-900mg/L.³ Approximately 3 in 10 Australian children aged 5-14 years have used a fluoride mouth rinse, with the proportion of children using a fluoride mouth rinse consistently increasing across the age groups from 10.9% at 5-6 years to 45.6% at 13-14 years.⁴ As such, the third workshop noted that a fluoride mouth rinse could be used as an additional source of fluoride, which should not be substituted for toothbrushing with a fluoridated toothpaste, for adolescents who are at an increased risk of developing caries. Subsequently, the following recommendations on the use of fluoride mouth rinses from the second workshop were continued.

- Children below the age of 6 years should not use fluoride mouth rinse.
- Fluoride mouth rinse might be used by people aged 6 years or more who have an elevated risk of developing caries. Fluoride mouth rinse should be used at a time of day when toothpaste is not used, and it should not be a substitute for brushing with fluoridated toothpaste. After rinsing, mouth rinse should be spat out, not swallowed.

Professionally applied fluoride products

These products include fluoride varnishes, fluoride gel and foam and silver diamine fluoride.

Fluoride varnishes

Fluoride varnishes that contain 22.6 mg/ mL fluoride ion suspended in an alcohol and resin base has been shown to reduce dental caries in children, adolescents and adults while preventing coronal caries of all tooth surfaces and root caries.¹⁷ Moreover, there has been no increased risk of dental fluorosis associated with application of fluoride varnishes up to 4 times/ year, which is the usual practice.¹⁸ Discussions at the third workshop also included the possibility of applying topical fluoride varnish by non-dental professionals, including dental assistants, registered/enrolled nurses, rural/remote health workers, Aboriginal health workers and residential aged care workers with appropriate training. Nonetheless, it was decided to continue the following recommendation from the second workshop:

- Fluoride varnish should be used for people who have an elevated risk of developing caries, including children under the age of 10 years.

Fluoride gel and foam

Fluoride gels containing a high concentration of fluoride up to 12.3mg/g fluoride have been effective in reducing caries in children although these are not indicated for children under 10 years who are at a risk of ingesting large amounts of fluoride. The efficacy of fluoride gels has been shown to be greater in permanent teeth than in primary teeth¹⁹ whereas

use of foam is not supported by evidence.²⁰ Accordingly, the recommendation on the use of fluoride gel and foam from the second workshop was changed as follows:

1. High concentration fluoride gels (those containing more than 1.5 mg/g fluoride ion) might be used for people aged ≥ 10 years who are at an elevated risk of developing caries.

Silver diamine fluoride

Therapeutics Goods Administration (TGA), Australia has approved Silver diamine fluoride (SDF) as a desensitizing agent to treat dentine hypersensitivity.^{3,17} Although SDF has been used in the form of Silver Fluoride (SF), particularly by public dental services for school children since the 1980s^{21,22} neither SDF nor SF has been included as a professionally applied fluoride product in the previous guidelines for fluoride use in Australia. Nonetheless, recent evidence suggests that bi-annual application of 38% SDF can effectively arrest active carious lesions in the primary dentition as well as root caries in the permanent teeth of older people^{3,18} and, that SDF in the form of SF was effective as an atraumatic restorative technique (ART) among remote Indigenous children.²³ Consequently, the third workshop decided to update the guidelines on fluoride use by including SDF/

SF despite black staining of carious lesions, which is regarded as the main drawback of SDF/SF. Consequently, SDF/SD has been precluded from using for anterior teeth. Currently available SDF products in Australia contain SF, ammonia as well as water and potassium iodide (KI) to minimise staining.¹⁸ Ammonia in SDF causes an odour that may make SDF less accepted by young children as opposed to SF.²⁰ The 2019 recommendation for the use of SDF/SF is as follows:

1. Silver diamine fluoride or silver fluoride might be used for people with caries in situations where traditional treatment approaches to caries management might not be possible.

While endorsing the guidelines for fluoride use in Australia discussed hitherto, the third workshop highlighted the importance of regular reviewing and updating of these guidelines where appropriate. It should be in line with new evidence emanating from clinical trials, variations in fluoride exposure subsequent to changes in behaviour patterns and, emerging evidence on epidemiology of dental caries and fluorosis. Moreover, the third workshop underlined

the requirement of identifying and evaluating all caries preventive strategies, both fluoride-based and non-fluoride based, including calcium-phosphate caries preventive agents, xylitol and chlorhexidine. Accordingly, the following recommendations were made in regards to monitoring and developing caries prevention strategies in the population:

1. There is a need to support further studies that examine the impact of fluoride vehicles in the Australian population including: studies of the epidemiology of dental caries and dental fluorosis; investigations of the impact of both conditions on people's well-being and quality of life; risk factors for dental caries and dental fluorosis; the use of fluoride vehicles in dental practice and the population; and the efficacy, effectiveness and cost effectiveness of fluoride vehicles.
2. Research is needed to develop new preventive interventions including new vehicles for fluoride delivery as well as other preventive strategies that are not based on fluoride. New interventions should be judged for their equivalency or superiority to existing preventive approaches that have documented efficacy.

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