Oral health promotion in children — the use of fluoride

Abstract
Good dental health practices that begin in childhood are a crucial contributor to good overall health as the child ages and becomes an adult. Thereby, the maternal and child health nurse (MCHN), along with oral health promotion strategies, plays a large role in promoting these health practices for children under the age of five years. The use of fluoride and its effect on the developing tooth has been well researched; however, with increasing fluoridated products available in the market, the extent of its safety in children less than five years of age has gained a larger focus of more recent research. This review will look at the safety of fluoridated water, fluoridated toothpaste and fluoridated supplements in the use of children under five years of age, giving recommendations to health care professionals such as MCHNs for their use and promotion.

Keywords: Oral, health, promotion, fluoride, child.

Introduction
Health promotion is a worldwide strategy used in primary health care to optimise health outcomes for individuals, and improve population health for the long term. Of particular importance is the advocacy of good oral health practices beginning in the first five years of life, as they are regarded as the building blocks for a healthy future (Kok & de Vries, 2015, p. 620). This review will discuss why oral health promotion is crucial for the wellbeing of children under five years of age, considering the role the maternal and child health nurse (MCHN) plays in promoting good dental health practices. The use of fluoridated water, fluoridated toothpaste and fluoride supplements, and the impact they can have on the health of children will then be critically appraised, looking at current research and practice guidelines.

Oral health promotion
Health promotion is a means of empowering people to improve their health and prevent poor health, with priority being placed on health policy, healthy lifestyles and health education (World Health Organization, 2017). Health education is a planned activity which stimulates learning through communication and handouts, promoting good health behaviour (Kok & de Vries, 2015, pp. 620–621). Peterson-Sweeney and Stevens (2010, pp. 246–247) concur with this definition, stating that MCHNs are one of the drivers of health education. They state that providing developmentally appropriate education to parents reinforces learning and enhances health outcomes, for both the parent and child. In Victoria, the 2009 Maternal and Child Health Service Practice Guidelines (p. 4) outlines that oral health promotion must take place at the eight-month, eighteen-month and three and a half year old visits; however, Mitchell and Shoemaker (2017, p. 70) argue that oral health promotion should be occurring at all health check-ups for children, beginning from birth.

Dental health is identified as one of the essential aspects of a child’s overall health and wellbeing (Dental Health Services Victoria, 2010, p. 8). The deciduous teeth commence forming in utero, begin erupting at six months of age, and can last until 12 years of age. The deciduous teeth help develop speech, chewing ability, and influence the position of the permanent teeth (Dental Health Services Victoria, 2010, p. 5). Poor oral health can significantly impact all developmental domains for the child and lead to dental decay, known as caries. Caries are a condition of the hard tissue of the teeth, and if not properly treated can diminish overall quality of life as the child ages (Peterson-Sweeney & Stevens, 2010, pp. 244–245). Walsh et al., (2010, p. 1) identified that a diet high in sugar can lead to dental decay, with Peterson-Sweeney and Stevens (2010, p. 244) adding that infants from a low socioeconomic background are three times more likely to suffer from dental caries. With half of all Australian children between zero and five years having experienced dental decay, the World Health Organization has flagged poor dental health in children as a severe public health problem, with widening inequities between different social groupings. (Australian Institute of Health and Wellbeing, 2014, p. 3; World Health Organization, 2010, p. 160). To eliminate these social inequalities, Australian policy makers have recognised fluoridated water as a health policy which actively promotes population health for the long term (Peterson & Kwan, 2011, p. 481).

Fluoridated water
There is a significantly high amount of research concurring that artificially raising the level of fluoride in water to a range of 0.5–1.1 milligrams per litre (mg/L), ensures a low level of fluoride is constantly maintained, drastically reducing the incidence of dental caries. However, much of this research has been undertaken several decades ago, with very little research being performed within the past 10 years (Harrison, 2005, p. 1448; World Health Organization, 2003, p. 19; Whitford, 1996, p. 11). Fluoride was first introduced within the Victorian water supply in 1962 (State Government of Victoria, 2015), where it demonstrated a significant reduction in dental caries in children less than five years of age (Whitford, 1996, p. 11). Research continued to show that when a sufficient amount
of fluoride is integrated into the developing tooth, it builds the enamel immunity to acid later in life. Once teeth are erupted, fluoride acts by constantly re-mineralising damaged enamel, replacing lost minerals, and decreasing the capability of plaque to produce acid, thereby repairing teeth (Dental Health Services Victoria, 2010, p. 46). When first introduced, the reduction in dental decay was recorded as being between 50% and 60%; however, the Australian Research Centre for Population Oral Health (2006, pp. 195–196) now reports this reduction to be 20–40%. This decline may demonstrate a changing demographic over time, or may be the result of decades of fluoridated water taking effect from utero. However, with a current rise in dental decay, fluoridated water remains a crucial health policy to continue to improve child dental health (Australian Research Centre for Population Oral Health, 2006, p. 196).

The most recent review on water fluoridation occurred in 2008 by Yeung (p. 40) who undertook a systematic review and included 77 articles. Yeung (2008, p. 40) included studies from around the world, and different population groups, such as children. Many potential confounding variables resulted from this worldwide research, including differing environmental factors, climates and lifestyles. However, all these variables were adjusted for accordingly and it was concluded that the existing evidence, regardless of where it was collected, remains strong. Yeung (2008, p. 41) argues that fluoridation of water to a level of approximately 1 mg/L remains the most productive means of reducing dental caries within the community, increasing the proportion of caries-free children.

With limited research occurring within the 21st century, however, it is difficult to say if water fluoridation is still at its most appropriate level within Australia. Goodwin et al., (2016, p. 1) is currently aiming to answer that, undertaking a prospective study over the next five years. Goodwin et al., (2006, p. 1) is assessing the likelihood of caries in two areas in the United Kingdom, one where the water is fluoridated, and one that is not. They will include infants from nine months of age and will follow prospectively, aiming to complete in the year 2021. The results will make major improvements to understanding the costs and impacts of fluoridated water in this decade, and may have a crucial effect on health policy here in Australia.

It is clear that fluoridated water promotes the oral health of children, and with new research available in the near future, its use will continue to be monitored appropriately. It is the MCHN's role to discuss the use of fluoridated water within the child's diet, commencing from birth. This discussion may include using boiled tap-water to make up a formula bottle, or promoting the consumption of 250 millilitres of water daily from 12 months and every visit thereafter. In addition, the promotion of fluoridated toothpaste is another important health policy promoted by the MCHN (Dental Health Services Victoria, 2010, p. 42).

**Fluoridated toothpaste**

Fluoridated toothpaste is regarded as being another highly effective health policy in decreasing the number of dental caries in children, much in the same manner that fluoridated water does. However, with a high rate of children less than five years of age accidently ingesting fluoridated toothpaste, more recent research has focused on the safest level of fluoridated toothpaste for this age group, as the benefits must outweigh any risk of fluorosis (Dental Health Services Victoria, 2010, p. 47). Dental fluorosis occurs from an over-exposure of fluoride and is a developmental defect of the tooth enamel, whereby hypo-mineralisation occurs (Harrison, 2005, p. 1452). Fluoride has been available in toothpastes since the 1970s, and with strengths available in Australia from 500 parts per million (ppm) up to 2000 ppm, parents are often referring to their MCHN for advice in choosing the safest concentration (Harrison, 2005, p. 1450).

A study undertaken by Jiménez-Farfán, Hernández-Guerrero, Juárez-López, Jacinto-Alemán and Fuente-Hernández in 2011 (p. 148) evaluated the effectiveness of fluoridated toothpaste of 2000 ppm in Mexican children under six years of age. It was argued that the risk of dental decay had dramatically reduced for this demographic; however, a high prevalence of dental fluorosis was also recorded. This is questionable data and could be the result of multiple factors, including the small sample size, the notably high strength of toothpaste, and the geographic location in which the research was completed. Without additional studies investigating the use of 2000 ppm toothpaste in children, its lack of relevance within the Australian context, and the limitations noted, further high-quality research would be needed before toothpaste of this strength could be promoted for Australian children. These results indicate that fluoride concentrations at this high level can cause an overexposure to children and have health repercussions (Jiménez-Farfán, Hernández-Guerrero, Juárez-López, Jacinto-Alemán & Fuente-Hernández, 2011, p. 157).

A systematic review was then undertaken by Wright et al., (2014) with a strict inclusion criterion, of 17 studies with the same aim. Six of these studies evaluated toothpaste from 1000 ppm to 1500 ppm and, much like the previous study in Mexico, found a statistically high number of children developing dental fluorosis, concluding this concentration to be too high for use in children under five years (Wright et al., 2014, p. 187). Wright et al., (2014, p. 185) then continued to look at the studies of toothpastes with concentrations of less than 1000 ppm. It was found that the lower the level of toothpaste, the less effective it was on dental caries; however, the risk of fluorosis also lessened. It was argued that a concentration of 500 ppm was the safest level possible for children less than five years. Wong et al., (2010, p. 2) concurs with Wright et al., (2014) stating that a level of below 1000 ppm should be used for children under six years of age. Some contention is noted, however, at the safest time to commence using fluoridated toothpaste. Wright et al., (2014, p. 187) states that to further reduce any possible risk of mild fluorosis, 18 months is the optimal time to commence fluoridated toothpaste, whilst Wong et al., (2010, p. 2) argues the best time is between 12 and 24 months, and that no such risk exists. Both reviews included large study samples, with appropriate long-term follow-up, and potential variables accounted for. Additionally, they were conducted in similar developed countries much like Australia, thereby implying that these results can be generalised to the Australian population (Wright et al., 2014, pp. 185–187; Wong et al., 2010, p. 2).

After much examination, it is notable that the conclusion from Wright et al., (2014) and Wong et al., (2010) concurs with the current recommendations within Australia. The Dental Health...
further good-quality research is required before MCHNs can promote the use of fluoride supplements. No conclusion could be reached to make safe recommendations for children under five years of age, and therefore fluoride supplements should not be used (Tubert-Jeannin et al., 2011, p. 2; Australian Research Centre for Population Oral Health, 2006, p. 197). For all children at 18 months, the MCHN should be inspecting the teeth, and if any child is noted to be at high risk of dental decay, a referral to a dentist is recommended (Department of Education and Early Childhood Development, 2009, p. 63).

Fluoride supplements

Dietary fluoride supplements were initially recommended to provide additional fluoride to people where fluoridated water was not available. Coming in the form of tablets and liquids, the Australian Research Centre for Population Oral Health (2006, p. 197) reported that a sodium fluoride supplement of 2.2 milligrams is equivalent to the consumption of one litre of fluoridated water at a level of 1 mg/L. Once popular, the use of fluoride supplements for children younger than five years is now displaying conflicting results within the literature, due to poor-quality research.

A systematic review was undertaken by Rozier et al., in 2010 (p. 1485) and included children from six months of age. They aimed to find out if dietary fluoride supplements are appropriate for use in children. They argued that fluoride supplements are useful in decreasing the incidence of dental caries in children who are at an increased risk of dental decay, for both permanent and deciduous teeth. They did not, however, demonstrate a safe age to begin using fluoride supplements, instead stating that the use of these supplements on deciduous teeth may cause dental fluorosis. Additionally, it is noted that many of the studies used had methodological limitations. The studies were not completed from worldwide; however, they didn’t specifically note which countries they were performed in, making the validity of this study questionable. What they did note was that a lot of the research used was undertaken several decades ago, whereby the rate of caries was higher, and fewer sources of fluoride were available, therefore making the results questionable for use within the Australian context (Rozier et al., 2010, p. 1484).

Tubert-Jeannin et al. then undertook a systematic review in 2011 (pp. 1–2) looking at the safety of all types of fluoride supplements in children. They included randomised controlled trials and quasi-randomised controlled trials which included a total of 7196 children. They found that using fluoride supplements in children, who were not drinking fluoridated water, did decrease the incidence of dental decay in children who had permanent teeth. However, in contrast to Rozier et al. (2010), for children who had their deciduous teeth, the impact of these supplements was unclear. A high number of the studies included were at chance of prejudice and therefore the results provide poor confirmation about the effectiveness and safety of these supplements (Tubert-Jeannin et al., 2011, p. 2). Additionally, Tubert-Jeannin et al. (2011, p. 2) concurred with Rozier et al., (2010) stating that the younger the child is commenced on supplements, the greater the risk of dental fluorosis.

After considering the limited literature available, it is clear that further good-quality research is required before MCHNs can promote the use of fluoride supplements.

Conclusion

With an indicated rise in dental decay among children under five years of age, health policy and the MCHN must encourage good dental practices for this age group to promote long-term health. The importance of good oral health for children less than five years of age was considered in this paper, including the role the MCHN plays. From the above appraisal, it was concluded that fluoridated water at approximately 1 mg/L is safe in reducing the risk of dental caries among children less than five years. The use of fluoridated toothpaste at a level of 500 ppm from 18 months of age is also promoted. However, the use of fluoride supplements is not recommended due to conflicting results and a distinct lack of available research. Through appropriate oral health policy and oral health promotion activities, an improvement in the long-term health and development of a child is seen.

References


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