Preventing Dental Caries Through Community Water Fluoridation

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Heralded as 1 of the 10 greatest public health achievements of the 20th century [1], community water fluoridation is a safe, effective, and cost-effective strategy for reducing the incidence of dental caries in people of all ages. In 1949 Charlotte became the first municipality in North Carolina to adopt this preventive measure [2]; at that time, its water system was the largest in the world to adjust fluoride to the optimal level of 1 part per million. Since then, community water fluoridation has expanded; currently, 87.5% of North Carolina residents who access water from a community water system—about 63% of the state’s total population—receive the benefits of drinking fluoridated water [3]. Nationally, North Carolina ranks 18th among the states in terms of the percentage of community water systems with added fluoride [3]. A broad range of dental and nondental health organizations support community water fluoridation, including the North Carolina Department of Health and Human Service’s Division of Public Health [4].

Dental caries result from bacterial metabolism in biofilms and the interaction of these biofilms with the tooth structure [5]. All humans have this biofilm, which usually forms within 20 minutes after brushing. When the pH of this biofilm drops below 5.5, minerals in the tooth enamel—especially calcium—leach out. When the pH of the biofilm rises again, the enamel will remineralize. This cycle of demineralization and remineralization happens constantly in all people with natural teeth. When demineralization exceeds remineralization, there is a net mineral loss, which results in white spot lesions, cavitation, and potential tooth loss.

Diet has a dramatic effect on dental caries. Every time a person eats or drinks something that contains sugar or starches, the bacteria in the teeth’s biofilm convert these foods to acids, the pH of the biofilm drops below 5.5, and demineralization begins; demineralization continues until the pH rebounds above 5.5. Frequent eating, especially of starch and sugar, results in more acid in the biofilm and longer periods during which the pH of the biofilm is below 5.5. The pH of the most popular cola drinks is 2.5–3.0 [6, 7].

Community water fluoridation provides teeth with frequent, low-dose exposure to fluoride throughout life [2, 8]. This fluoride is concentrated in the biofilm and saliva, where it inhibits demineralization of enamel and enhances remineralization. Fluoride also inhibits bacterial production of acid, and it decreases the ability of bacteria to adhere to the tooth surface. Finally, fluoride that is taken during tooth development incorporates into the tooth structure, making the enamel harder and more resistant to cariogenic bacteria.

Community water fluoridation has resulted in substantial improvements in oral health. In a 2007 report [9], the National Research Council and the Institute of Medicine of the National Academies identified fluoride as a mineral that can positively influence human health; this report concluded that fluoride is essential for human life based on its role in cellular functions involving metabolic or biochemical processes. The report further stated that fluoride in drinking water has 2 beneficial effects: preventing tooth decay (dental caries) and contributing to bone mineralization and bone matrix integrity. Community water fluoridation is a method of fluoride delivery that benefits all people—regardless of age, income, educational level, or socioeconomic status.

The weight of the scientific evidence in peer-reviewed literature does not support an association between community water fluoridation and any adverse health effects or systemic disorders, including an increased risk for cancer, Down syndrome, heart disease, osteoporosis, bone fractures, immune disorders, low intelligence, renal disorders, Alzheimer disease, or allergic reactions [10]. Not only is community water fluoridation safe and effective [11], it is...
also cost saving [12], and it is the least expensive way to deliver the benefits of fluoride to all residents of a community [13]. For communities of more than 20,000 people, it costs about 50 cents per person per year to fluoridate the water, and every $1 invested in community water fluoridation saves approximately $38 in dental treatment costs [12].

North Carolinians who do not live in an area with fluoridated water can still benefit from fluoride. Most people obtain fluoride by brushing with a fluoride-containing toothpaste and/or by using an over-the-counter mouth rinse containing fluoride. Individuals who are at high risk for dental caries may need more fluoride than they receive through incidental exposure; they can get extra exposure through fluoride gels or varnishes, prescription fluoride tablets or mouth rinses, or high-strength fluoride toothpastes.

Decisions about starting, continuing, or stopping community water fluoridation are made at the local level, and health care professionals can play an important role in educating patients, the general public, and community leaders about the benefits of this public health measure. Resources and strategies for communicating these benefits are available from a variety of organizations, including the National Institute of Dental and Craniofacial Research, the National Institutes of Health, and the American Dental Association. NCMJ

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References

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