

Hinesburg Family Practice Fluoride testing and supplementation

Dental caries is still a major public health concern and affects 90 percent of late adolescents and young adults in the US (Maintaining Integrity). While it is a complex disease, fluoride added to community water supplies has been widely practiced since 1944 in Grand Rapids, Michigan, where it was shown to have decreased dental caries in 30,000 school-aged children by 60 percent in a 15 year period. More recently, the CDC published several studies showing that even in small communities (<5,000 people), every \$1 invested in water fluoridation yields between \$5 and \$16 in long term dental care treatment cost savings. Fluoride is a simple fluorine anion, making it have a high affinity for molecules like calcium, the major mineral in tooth enamel. It has several properties that contribute to strengthening permanent teeth, both while they are growing in children as well as helping to maintain them throughout adulthood.

How does it work?

- Fluoride enhances the remineralization of enamel damaged by the activities of oral flora like *Streptococcus mutans*. As bacteria ferment carbohydrates in the mouth, they produce acids that drop the pH and damage tooth structure. This drop in pH also releases fluoride from dental plaque at the tooth's surface.
- If adequate amounts of fluoride exist in dental plaque and saliva it is taken up into the tooth along with calcium and phosphate to improve and strengthen the enamel's crystal structure. Teeth with more fluoride are more acid-resistant and experience less erosion and damage.
- Fluoride also affects the activity of cariogenic bacteria, slowing their ability to metabolize carbohydrates as well as decreasing bacteria's production of adhesive polysaccharides that contribute to dental biofilm. This balance helps to negate the deleterious effects of bacteria on the teeth throughout a lifetime of wear and tear.

What's the situation in Vermont?

Towns and nearly all other public water systems (systems with at least 15 "connections" or 25 yearly residents) have some level of fluoride in the water which has been the case since 1953. Currently, 252,430 residents have access to water supplies with fluoride levels high enough to provide protection. However, a significant number of residents have well water which may not have any fluoride or may naturally contain more than is recommended. Wells in the region of sedimentary rock (especially shale) are especially susceptible to high fluoride levels. The Vermont Department of Health produces a guide to fluoride levels every three years, with all major towns and systems listed. If residents live outside of these known areas, the Department of Health offers free well water testing for all families with children under the age of four.

Health care providers should:

- Determine the existing fluoride content in the families' primary source of water prior to prescribing fluoride supplements.
- Consider the water source for infants and children in daycare facilities and school prior to prescribing supplements.
- Use the booklet to locate their town, then the water system name.
- Go to the result column where the fluoride levels will be found in parts per million (ppm). Highlighted are the systems with fluoride levels equal to or greater than 0.30 ppm.
- Provide the form requesting water fluoride testing if needed.
- Refer to the Dietary Fluoride Supplement Schedule for prescription guidelines.

What dose is appropriate?

Table 1. Dietary Fluoride Supplement Schedule Approved by the American Dental Association, American Academy of Pediatrics, and American Academy of Pediatric Dentistry.²¹

Age	Fluoride ion level in drinking water (ppm)*		
	<0.3 ppm	0.3 ppm to 0.6 ppm	>0.6 ppm
Birth to 6 months	None	None	None
6 months to 3 years	0.25 mg/day**	None	None
3 years to 6 years	0.50 mg/day	0.25 mg/day	None
6 years to 16 years	1.0 mg/day	0.50 mg/day	None

*1.0 part per million (ppm) = 1 milligram/liter (mg/L) **2.2 mg sodium fluoride contains 1 mg fluoride ion

Is fluoride safe?

The CDC lists water fluoridation in its top ten most successful public health interventions in the twentieth century. However, some individuals have been concerned with possible effects too much fluoride can have on the teeth as well as the rest of the skeleton and bone health.

Dental fluorosis:

- Caused by ingesting too much fluoride while the developing adult teeth have not yet erupted (children under the age of eight with ages 15 to 30 months at highest risk).
- Severity of fluorosis depends on the dose, duration, and timing of fluoride exposure.
- Mild form is a barely noticeable lacy white marking on the tooth.
- Severe form can range from simple heavy staining to pitting and enamel erosion.
- In areas where water already has the recommended level of 0.7 ppm no supplementation should be given in order to prevent mild fluorosis.

Does fluoride cause cancer?

It can be hard to prove a negative, but...

- Kim FM, Hayes C, Williams PL et al. An assessment of bone fluoride and osteosarcoma. *J Dent Res.* 2011;90(10): 1171-6.
 - Case control study matching for age, gender, and bone fracture history found no significant difference in osteosarcoma incidence between cases (N = 137) and other tumor controls (N = 51).
- Blakely K, Feltblower RG, Parslow RC et al. Is fluoride a risk factor for bone cancer? Small area analysis of osteosarcoma and Ewing sarcoma diagnosed among 0-49-year olds in Great Britain, 1980-2005. *International Journal of Epidemiology.* 2014;10(1093): 224-234.
 - Huge study analyzing 2566 osteosarcoma and 1650 Ewing sarcoma cases. Showed that there is no evidence that fluoride in drinking water was associated with either cancer (RR = 1.001 with 90% CI 0.871, 1.151 and RR 0.929; 90% CI 0.773, 1.115).
- Levy M, Leclerc BS. Fluoride in drinking water and osteosarcoma incidence rates in the continental United States among children and adolescents. *Cancer Epidemiol.* 2012;36(2):e83-8.
 - A more recent study looking at the cumulative incidence of osteosarcoma in children and adolescents over 1999-2006 in the continental US. Categorized states according to low or high in terms of population percentage with community fluoridated water between 1992-2006. Males age 15-19 did have an increased risk of osteosarcoma over females of the same age, but this was not associated with fluoride status. Suggests no association between osteosarcoma incidence and fluoride exposure at recommended doses in any age subset under age 19.

Sources:

American Academy of Pediatric Dentistry. Policy on Use of Fluoride. *Pediatric Dentistry* 2013;35 (special issue): 167-70.

Arthur JS, "Two is too Late." Vermont Department of Health. (May 2012).

CDC. Community water fluoridation. Retrieved from <http://www.cdc.gov/fluoridation/>

CDC. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep* 2001;50(RR-14):1-42.

GG Franklin, Hicks MJ. Maintaining the integrity of the enamel surface. *Journal of the American Dental Association* 2008;139(2): 25-34.

National Institute of Dental and Craniofacial Research. The story of fluoridation. Retrieved from <http://www.nidcr.nih.gov/oralhealth/topics/fluoride/thestoryoffluoridation.htm>

"Vermont's Guide to Fluoride Levels in Public Water Systems." Vermont Department of Health. (November 2012).