



Community Water Fluoridation and Testing: Recommendations for Supplementation in Children and Adolescents

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History

- ▶ Frederick McKay opens dental practice in Colorado Springs and notes widespread brown stains on residents' teeth (“Colorado Brown Stain”)
- ▶ 1909 Dr. G.V. Black is persuaded to look into the disorder, and together with McKay find that only children without calcified permanent teeth develop the disorder



- ▶ 1923 McKay realizes brown stains are caused by water supply after observations in Oakley, Idaho, and similar reports in Bauxite, Arkansas
- ▶ McKay and Dr. Grover Kempf of the PHS publish a report that sparks research by H.V. Churchill who assays Bauxite's water samples collected by McKay, finding high levels of fluoride
- ▶ By late 1930s, NIH finds that fluoride up to 1.0 PPM does not cause enamel fluorosis in most people (mild cosmetic fluorosis in some)

Intervention

- ▶ By 1944, the City Commission of Grand Rapids, Michigan, votes to add fluoride to its water supply after discussions with the NIH and Michigan Department of Health (first city in the world to fluoridate its drinking water)
- ▶ 15 year project by the National Institute of Dental Research demonstrates a 60% reduction in caries in 30,000 school-age children in Grand Rapids

Why fluoride? Early caries prevention

- ▶ Fluoride is negatively charged, has a high affinity for cations like calcium, the major mineral in tooth enamel
- ▶ Inhibits demineralization of sound enamel when concentrated in saliva and plaque



How?

- ▶ Enhances remineralization of damaged enamel
 - ▶ Bacteria metabolize carbohydrates, produce various acids, drop pH
 - ▶ Fluoride gets released from dental plaque at the tooth-plaque interface
 - ▶ This along with fluoride in saliva gets taken up along with calcium and phosphate by enamel and improves enamel crystal structure
 - ▶ Improved crystal structure is more acid-resistant, has more fluoride and less carbonate
- ▶ Affects activity of cariogenic bacteria (slows carbohydrate metabolism and decreases bacterial production of adhesive polysaccharides)

What's the situation in Vermont?

- ▶ All towns and public water systems have some level of fluoride in the water, though many are below the recommended level
- ▶ Fluoride has been a successful public health measure here since 1953
- ▶ Currently, 252,430 residents are served by public water supplies with enough fluoride to protect teeth
- ▶ Well water may have none, too little or even too much fluoride depending on prevalence of sedimentary rock (especially shale) and water flow rates through the aquifer
- ▶ VDOH produces a guide to fluoride levels every three years (last edition November 2012)

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, school, or other locations they spend most of their time 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. These will be located in a divider in the same drawer as vaccination forms.
- ▶ Refer to the Dietary Fluoride Supplement Schedule for prescription guidelines.

What doses are 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

Treatment Options

- ▶ Fluoridated tooth paste
- ▶ OTC mouth rinses like sodium fluoride
- ▶ Gels/foams or fluoride varnish, mostly applied in a dental office (for high risk individuals)
- ▶ Dietary supplements (tablets, lozenges, or liquids)

Is fluoride safe?

- ▶ The CDC lists community water fluoridation as one of the top ten successful public health interventions in the 20th century
- ▶ The main risk is mild dental fluorosis

Fluorosis



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

A bit on the perpetual cancer debate...

- ▶ 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.

This information and more available at

- ▶ <http://www.ilikemyteeth.org/>
- ▶ <http://www.fluoridescience.org/>
- ▶ <http://www.cdc.gov/fluoridation/>
- ▶ <http://fluorideworks.org/>

Works Cited

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6. GG Franklin, Hicks MJ. Maintaining the integrity of the enamel surface. *Journal of the American Dental Association* 2008;139(2): 25-34.
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9. National Institute of Dental and Craniofacial Research. The story of fluoridation. Retrieved from <http://www.nidcr.nih.gov/oralhealth/topics/fluoride/thestoryoffluoridation.htm>
10. “Vermont’s Guide to Fluoride Levels in Public Water Systems.” Vermont Department of Health. (November 2012).

