

Guideline on Fluoride Therapy

Originating Committee

Liaison with Other Groups Committee

Review Council

Council on Clinical Affairs

Adopted

1967

Revised

1978, 1995, 2000, 2003, 2007, 2008, 2012

Reaffirmed

1972, 1977

Purpose

The American Academy of Pediatric Dentistry (AAPD) intends this guideline to help practitioners and parents make decisions concerning appropriate use of fluoride as part of the comprehensive oral health care for infants, children, adolescents, and persons with special health care needs.

Methods

A thorough review of the scientific literature pertaining to the use of systemic and topical fluoride was completed to revise and update this guideline. A MEDLINE search was conducted using the terms “fluoride”, “fluoridation”, “acidulated phosphate fluoride”, “fluoride varnish”, “fluoride therapy”, and “topical fluoride”. Expert opinions and best current practices also were relied upon for this guideline.

Background

Use of fluorides for the prevention and control of caries is documented to be both safe and highly effective.¹⁻⁵ Fluoride has several caries-protective mechanisms of action, including enamel remineralization and altering bacterial metabolism to help prevent caries.⁶ Optimizing fluoride levels in water supplies is an ideal public health measure because it is effective and inexpensive and does not require conscious daily cooperation from individuals.^{4,7-10} Daily fluoride exposure through water supplies and monitored use of fluoride toothpaste can be effective preventive procedures. Determination of dietary sources of fluoride before prescribing supplements can help reduce intake of excess fluoride.¹¹⁻¹⁵ Sources of dietary fluoride may include drinking water from home, day care, and school; beverages such as soda¹², juice¹⁵, and infant formula^{11,16,17}; prepared food¹⁸; and toothpaste. Infant formulas (powdered or liquid) and water bottled specifically for infants have varying concentrations of fluoride.¹⁶⁻²⁴ Fluorosis has been associated with cumulative fluoride intake during enamel development, with the severity dependant on the dose, duration, and timing of intake.⁴

Professionally-applied topical fluoride treatments are efficacious in reducing caries in children with moderate or high caries risk.^{5,7,8,25-32} Two percent sodium fluoride (NaF; 0.9% F; 9000 ppm F)¹, 1.23% acidulated phosphate fluoride (APF; 1.23% F; 12,300 ppm F) solution or gel^{1,33-44}, and 5% sodium fluoride varnish (NaFV; 2.26% F; 22,500ppm F)^{1,41,43,45-54} are the most commonly used agents for professionally-applied fluoride treatments.^{1,45} Some topical fluoride products are marketed with recommended treatment times of less than 4 minutes, but the majority of studies suggest that 4-minute applications are more efficacious.^{1,8,36,57,58} Children at higher caries risk may require additional or more frequent fluoride therapies.^{7,59,60} If an individual's caries risk level is uncertain, treating this person as high risk is prudent until further experience allows a more accurate assessment.⁴

Recommendations

Systemically-administered fluoride supplements

Fluoride supplements should be considered for all children drinking fluoride-deficient (<0.6 ppm F) water. After determining the fluoride level of the water supply or supplies (either through contacting public health officials or water analysis), evaluating other dietary sources of fluoride, and assessing the child's caries risk, the daily fluoride supplement dosage can be determined using the Dietary Fluoride Supplementation Schedule (Table 1). To optimize the topical benefits of systemic fluoride supplements, the child should be encouraged to chew or suck fluoride tablets.¹

Professionally-applied topical fluoride treatment

Professional topical fluoride treatments should be based on caries-risk assessment.^{1,4,5,7,60} A pumice prophylaxis is not an essential prerequisite to this treatment.⁶¹ Appropriate precautionary measures should be taken to prevent swallowing of any professionally-applied topical fluoride. Children at moderate caries risk should receive a professional fluoride treatment at least every 6 months; those with high caries risk should receive greater frequency of professional fluoride applications (ie, every 3-6 months).^{7,32,59,62-67} Ideally, this would occur as

part of a comprehensive preventive program in a dental home.⁶⁸ When a dental home cannot be established for individuals with increased caries risk as determined by caries risk assessment, periodic applications of fluoride varnish by trained non-dental healthcare professionals may be effective in reducing the incidence of early childhood caries.^{50-54,69,70}

Fluoride-containing products for home use

Therapeutic use of fluoride for children should focus on regimens that maximize topical contact, preferably in lower-dose, higher-frequency approaches.¹ Fluoridated toothpaste (generally 0.1% F; 1,000 ppm F) should be used twice daily as a primary preventive procedure.^{1,71} Twice daily use has benefits greater than once daily brushing.¹ Parents should be counseled on their child's caries risk, dispensing an appropriate volume of toothpaste onto a soft, age-appropriate sized toothbrush, frequency of brushing, and performing/assisting brushing of young children. A 'smear' of fluoridated toothpaste (see Figure 1) for children less than 2 years of age may decrease risk of fluorosis.⁷² A 'pea-size' amount (see Figure 1) of toothpaste is appropriate for children aged 2 through 5 years.⁷²⁻⁷⁴ To maximize the beneficial effect of fluoride in the toothpaste, rinsing after brushing should be kept to a minimum or eliminated altogether.^{72,75}

Additional at-home topical fluoride regimens utilizing increased concentrations of fluoride should be considered for children at high risk for caries.^{1,4,7,60} These may include over-the-counter (0.02% F; 200 ppm F) or prescription strength (0.09% F; 900 ppm F) formulations. Brush-on fluoride gels (0.5% F; 5,000 ppm F) may be incorporated into a caries-prevention program for a school-aged child at high risk.

References

1. Adair SM. Evidence-based use of fluoride in contemporary pediatric dental practice. *Pediatr Dent* 2006;28(2):133-42.
2. Whitford GM. The physiological and toxicological characteristics of fluoride. *J Dent Res* 1990;69(special issue):539-49; discussion 556-7.
3. Workshop Reports I, II, III from "A symposium on changing patterns of fluoride intake" held at UNC-Chapel Hill April 23-25, 1991. *J Dent Res* 1992;71(5):1214-27.
4. CDC. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep* 2001;50(RR-14):1-42.
5. Facts about fluoride. *CDS Rev* 2006;99(1):44.
6. Featherstone JD. The science and practice of caries prevention. *J Am Dent Assoc* 2000;131(7):877-99.
7. American Dental Association Council on Scientific Affairs. Professionally-applied topical fluoride: Evidence-based clinical recommendations. *J Am Dent Assoc* 2006;137(8):1151-9.
8. CDC. Achievements in Public Health, 1990-1999: Fluoridation of drinking water to prevent dental caries. *JAMA* 2000;283(10):1283-6.
9. Pelletier AR. Maintenance of optimal fluoride levels in public water systems. *J Public Health Dent* 2004;64(4):237-9.
10. CDC. Populations receiving optimally fluoridated public drinking water-United States, 2000. *MMWR Morb Mortal Wkly Rep* 2002;51(7):144-7.
11. Levy SM, Kohout FJ, Guha-Chowdhury N, Kiritsy MC, Heilman JR, Wefel JS. Infants' fluoride intake from drinking water alone, and from water added to formula, beverages, and food. *J Dent Res* 1995;74(7):1399-407.
12. Levy SM, Kohout FJ, Kiritsy MC, Heilman JR, Wefel JS. Infants' fluoride ingestion from water, supplements and dentifrice. *J Am Dent Assoc* 1995;126(12):1625-32.
13. Bowen WH. Fluorosis, is it really a problem? *J Am Dent Assoc* 2002;133(10):1405-7.
14. Heilman JR, Kiritsy MC, Levy SM, Wefel JS. Assessing fluoride levels of carbonated soft drinks. *J Am Dent Assoc* 1999;130(11):1593-9.
15. Kiritsy MC, Levy SM, Warren JJ, Guha-Chowdhury N, Heilman JR, Marshall T. Assessing fluoride concentrations of juices and juice-flavored drinks. *J Am Dent Assoc* 1996;127(7):895-902.
16. Van Winkle S, Levy SM, Kiritsy MC, Heilman JR, Wefel JS, Marshall T. Water and formula fluoride concentrations: Significance for infants fed formula. *Pediatr Dent* 1995;17(4):305-10.
17. Levy SM, Kiritsy MC, Warren JJ. Sources of fluoride intake in children. *J Public Health Dent* 1995;55(1):39-52.
18. Heilman JR, Kiritsy MC, Levy SM, Wefel JS. Fluoride concentrations of infant foods. *J Am Dent Assoc* 1997;128(7):857-63.
19. Erdal S, Buchanan SN. A quantitative look at fluorosis, fluoride exposure, and intake in children using a health risk assessment approach. *Environ Health Perspect* 2005;113(1):111-7.
20. Marshall TA, Levy SM, Warren JJ, Broffitt B, Eichenberger-Gilmore JM, Stumbo PJ. Associations between intakes of fluoride from beverages during infancy and dental fluorosis of primary teeth. *J Am Coll Nutr* 2004;23(2):108-16.
21. Buzalaf MA, Damante CA, Trevizani LM, Granjeiro JM. Risk of fluorosis associated with infant formulas prepared with bottled water. *J Dent Child* 2004;71(2):110-3.
22. Anderson WA, Pratt I, Ryan MR, Flynn A. A probabilistic estimation of fluoride intake by infants up to the age of 4 months from

- infant formula reconstituted with tap water in the fluoridated regions of Ireland. *Caries Res* 2004;38(5):421-9.
23. Buzalaf MA, Granjeiro JM, Damante CA, de Ornelas F. Fluoride content of infant formulas prepared with de-ionized, bottled mineral and fluoridated drinking water. *J Dent Child* 2001;68(1):37-41, 10.
 24. Pagliari AV, Moimaz SA, Saliba O, Delbum AC, Sassaki, KT. Analysis of fluoride concentration in mother's milk substitutes. *Pesqui Odontol Bras* 2006;20(3):269-74.
 25. Lalumandier JA, Rozier RG. The prevalence and risk factors of fluorosis among patients in a pediatric dental practice. *Pediatr Dent* 1995;17(1):19-25.
 26. Beltrán-Aguilar ED, Griffin SO, Lockwood SA. Prevalence and trends in enamel fluorosis in the United States from the 1930s to the 1980s. *J Am Dent Assoc* 2002;133(2):157-65.
 27. Beltrán-Aguilar ED, Barker LK, Canto MT, et al. Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis—United States, 1988-1994 and 1999-2002. *MMWR Surveill Summ* 2005;54(3):1-43.
 28. DenBesten PK, Thariani H. Biological mechanisms of fluorosis and level and timing of systemic exposure to fluoride with respect to fluorosis. *J Dent Res* 1992;71(5):1238-43.
 29. Evans RW, Stamm JW. Dental fluorosis following downward adjustment of fluoride in drinking water. *J Public Health Dent* 1991;51(2):91-8.
 30. Heller KE, Eklund SA, Burt BA. Dental caries and dental fluorosis at varying water fluoride concentrations. *J Public Health Dent* 1997;57(3):136-43.
 31. Ripa LW. An evaluation of the use of professional (operator-applied) topical fluorides. *J Dent Res* 1990;69(Spec No):786-96; discussion 820-3.
 32. Bader JD, Shugars DA, Bonito AJ. A systematic review of selected caries prevention and management methods. *Community Dent Oral Epidemiol* 2001;29(6):399-411.
 33. Rozier RG. Effectiveness of methods used by dental professionals for the primary prevention of dental caries. *J Dent Educ* 2001;65(10):1063-72.
 34. Wei SH, Lau EW, Hattab FN. Time dependence of enamel fluoride acquisition from APF gels. II. In vivo study. *Pediatr Dent* 1988;10(3):173-7.
 35. Wei SH, Hattab FN. Time dependence of enamel fluoride acquisition for APF gels. I. In vitro study. *Pediatr Dent* 1988;10(3):168-72.
 36. Wei SH, Chik FF. Fluoride retention following topical fluoride foam and gel application. *Pediatr Dent* 1990;12(6):368-74.
 37. van Rijkom HM, Truin GJ, van 't Hof MA. Caries-inhibiting effect of professional fluoride gel application in low-caries children initially aged 4.5-6.5 years. *Caries Res* 2004;38(2):115-23.
 38. van Rijkom HM, Truin GJ, van 't Hof MA. A meta-analysis of clinical studies on the caries-inhibiting effect of fluoride gel treatment. *Caries Res* 1998;32(2):83-92.
 39. Truin GJ, van 't Hof MA. Caries prevention by professional fluoride gel application on enamel and dentinal lesions in low-caries children. *Caries Res* 2005;39(3):236-40.
 40. Truin GJ, van 't Hof MA. Professionally applied fluoride gel in low-caries 10.5-year-olds. *J Dent Res* 2005;84(5):418-21.
 41. Marinho VC, Higgins JP, Sheiham A, Logan S. Combinations of topical fluoride (toothpastes, mouthrinses, gels, varnishes) versus single topical fluoride for preventing dental caries in children and adolescents. *Cochrane Data-base Syst Rev* 2004(1):CD002781.
 42. Marinho VC, Higgins JP, Logan S, Sheiham A. Systematic review of controlled trials on the effectiveness of fluoride gels for the prevention of dental caries in children. *J Dent Educ* 2003;67(4):448-58.
 43. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride gels for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev* 2002(2):CD002280.
 44. Marinho V. Fluoride gel inhibits caries in children who have low caries-risk but this may not be clinically relevant. *Evid Based Dent* 2004;5(4):95.
 45. Bawden JW. Fluoride varnish: A useful new tool for public health dentistry. *J Public Health Dent* 1998;58(4):266-9.
 46. Chu CH, Lo EC, Lin HC. Effectiveness of silver diamine fluoride and sodium fluoride varnish in arresting dentin caries in Chinese pre-school children. *J Dent Res* 2002;81(11):767-70.
 47. Klein U, Kanellis MJ, Drake D. Effects of four anticaries agents on lesion depth progression in an in vitro caries model. *Pediatr Dent* 1999;21(3):176-80.
 48. Bravo M, Montero J, Bravo JJ, Baca P, Llodra JC. Sealant and fluoride varnish in caries: A randomized trial. *J Dent Res* 2005;84(12):1138-43.
 49. Lo EC, Chu CH, Lin HC. A community-based caries control program for pre-school children using topical fluorides: 18-month results. *J Dent Res* 2001;80(12):2071-4.
 50. Hawkins R, Noble J, Locker D, et al. A comparison of the costs and patient acceptability of professionally-applied topical fluoride foam and varnish. *J Public Health Dent* 2004;64(2):106-10.
 51. Rozier RG, Sutton BK, Bawden JW, Haupt K, Slade GD, King RS. Prevention of early childhood caries in

- North Carolina medical practices: Implications for research and practice. *J Dent Educ* 2003;67(8):876-85.
52. Quiñonez RB, Stearns SC, Talekar BS, Rozier RG, Downs SM. Simulating cost-effectiveness of fluoride varnish during well-child visits for Medicaid-enrolled children. *Arch Pediatr Adolesc Med* 2006;160(2):164-70.
 53. Petersson LG, Twetman S, Dahlgren H, et al. Professional fluoride varnish treatment for caries control: A systematic review of clinical trials. *Acta Odontol Scand* 2004;62(3):170-6.
 54. Dohnke-Hohrmann S, Zimmer S. Change in caries prevalence after implementation of a fluoride varnish program. *J Public Health Dent* 2004;64(2):96-100.
 55. Kawasaki A, Suge T, Ishikawa K, Ozaki K, Matsuo T, Ebisu S. Ammonium hexafluorosilicate increased acid resistance of bovine enamel and dentine. *J Mater Sci Mater Med* 2005;16(5):461-6.
 56. Knight GM, McIntyre JM, Mulyani. The effect of silverfluoride and potassium iodide on the bond strength of auto cure glass ionomer cement to dentine. *Aust Dent J* 2006;51(1):42-5.
 57. Wei SH, Hattab FN. Fluoride retention following topical application of a new APF foam. *Pediatr Dent* 1989;11(2):121-4.
 58. Wei SH, Hattab FN. Enamel fluoride uptake from a new APF foam. *Pediatr Dent* 1988;10(2):111-4.
 59. Axelsson S, Soder B, Nordenram G, et al. Effect of combined caries-preventive methods: A systematic review of controlled clinical trials. *Acta Odontol Scand* 2004;62(3):163-9.
 60. American Academy of Pediatric Dentistry. Policy on use of a caries-risk assessment tool (CAT) for infants, children, and adolescents. *Pediatr Dent* 2006;28(suppl):24-8.
 61. Johnston DW, Lewis DW. Three-year randomized trial of professionally applied topical fluoride gel comparing annual and biannual applications with/without prior prophylaxis. *Caries Res* 1995;29(5):331-6.
 62. Kallestal C. The effect of five years' implementation of caries-preventive methods in Swedish high-risk adolescents. *Caries Res* 2005;39(1):20-6.
 63. Featherstone JD, Adair SM, Anderson MH, et al. Caries management by risk assessment: Consensus statement, April 2002. *J Calif Dent Assoc* 2003;31(3):257-69.
 64. Featherstone JD. The caries balance: The basis for caries management by risk assessment. *Oral Health Prev Dent* 2004;2(suppl 1):259-64.
 65. Bader JD, Shugars DA, Rozier G, et al. Diagnosis and management of dental caries. *Evid Rep Technol Assess (Summ)* 2001;(36):1-4.
 66. Bader JD, Shugars DA, Bonito AJ. A systematic review of the performance of methods for identifying carious lesions. *J Public Health Dent* 2002;62(4):201-13.
 67. Bader JD, Perrin NA, Maupome G, Rindal B, Rush WA. Validation of a simple approach to caries risk assessment. *J Public Health Dent* 2005;65(2):76-81.
 68. American Academy of Pediatric Dentistry. Policy on the dental home. *Pediatr Dent* 2007;29(suppl):22-3.
 69. McDonald SP, Sheiham A. A clinical comparison of non-traumatic methods of treating dental caries. *Int Dent J* 1994;44(5):465-70.
 70. Wawrzyniak MN, Boulter S, Giotopoulos C, Zivitski J. Incorporating caries prevention into the well-child visit in a family medicine residency. *Fam Med* 2006;38(2):90-2.
 71. Featherstone JDB. Caries prevention and reversal based on the caries balance. *Pediatr Dent* 2006;28(2):128-32.
 72. Scottish Intercollegiate Guideline Network. Prevention and management of dental decay in the pre-school child. A national guideline #83. November 2005;1-44. Available at: "<http://www.sign.ac.uk/guidelines/published/numlist.html>". Accessed February 23, 2008.
 73. Pang DT, Vann WF Jr. The use of fluoride-containing toothpastes in young children: The scientific evidence for recommending a small quantity. *Pediatr Dent* 1992;14(6):384-7.
 74. Ramos-Gomez FJ, Crall JJ, Gansky SA, Slayton RL, Featherstone JDB. Caries risk assessment appropriate for the age 1 visit (infants and toddlers). *J Calif Dent Assoc* 2007;35(10):687-702.
 75. Sjögren K, Birkhed D. Factors related to fluoride retention after toothbrushing and possible connection to caries activity. *Caries Res* 1993;27(6):474-7.

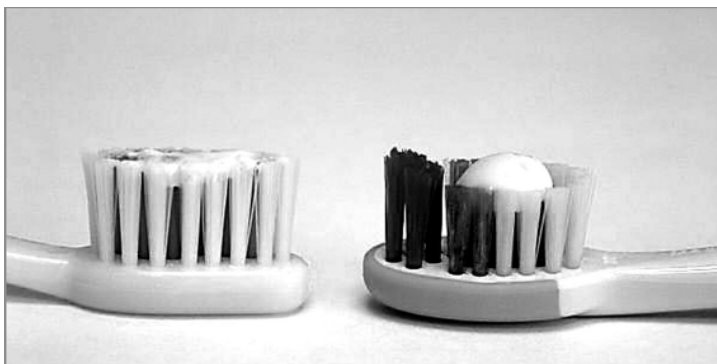


Figure 1. Comparison of a smear (left) with a pea-sized (right) amount of toothpaste.

Table 1. DIETARY FLUORIDE SUPPLEMENTATION SCHEDULE

Age	<0.3 ppm F	0.3-0.6 ppm F	>0.6 ppm F
Birth-6 months	0	0	0
6 mo-3 years	0.25 mg	0	0
3-6 years	0.50 mg	0.25 mg	0
6 y up to at least 16 years	1.00 mg	0.50 mg	0