



Fluoride Varnish

Association of State and Territorial Dental Directors (ASTDD)

Adopted by the ASTDD membership: April 28, 2010

Problem:

Dental caries is a chronic, progressive, multi-factorial, infectious disease that can begin in early infancy and that, by the time children reach adulthood, will affect over 92% of the US adult population.¹ A smaller proportion of the US population will develop more moderate or severe dental caries. Dental caries prevalence and severity varies by age, dentition and type of tooth surface.² Historically, dental caries control has been addressed by daily brushing, modifying dietary practices, and improving the resistance of tooth enamel to acid attack. However, only fluorides and dental sealants demonstrate a high degree of scientific evidence for reducing dental caries in populations. Benefiting from fluoride in drinking water and fluoride toothpastes, the baby boomer generation will be the first in which the majority will maintain natural teeth over their entire lifetime, according to the Centers for Disease Control and Prevention (CDC).³

Methods: Fluoride methods, systemic and topical, include: drinking water (natural and adjusted levels), milk, salt, toothpaste, mouthrinse, and the professional application of concentrated fluoride in gels, foams or varnishes. Caries protection, lifetime cost and appropriateness for use in populations will vary by the fluoride method or combination of fluoride methods selected.^{4,5,6,7,8,9,10,11} Fluorides are most effective when used in combination with other modalities to prevent, control and reverse early dental caries.^{12,13,14,15} Fluorides are more effective in preventing dental caries on the smooth surfaces of teeth than in the pits and fissures.¹⁶ However, for the majority of dental caries limited to the pits and fissures of permanent molar teeth, dental sealants, alone or combined with multiple fluoride applications, are more effective than fluoride alone.^{17,18} Fluoride varnish alone may be more effective on pit and fissure caries than other fluoride products.¹⁹

Fluoride varnish like other highly concentrated fluoride products is available only by prescription by authorized health professionals. Fluoride varnish is a resin or synthetic base that contains a high concentration of fluoride. Fluoride varnish sets quickly on contact with teeth in the presence of saliva. Some fluoride remains on caries-free teeth as a temporary layer of calcium fluoride-like material on the enamel surface. The fluoride in the material releases when the pH drops in response to acid production and becomes available to remineralize enamel. This layer slowly disappears over the following months and needs repeated application of the varnish to maintain effectiveness as a primary prevention strategy.^{20,21,22,23} Fluoride varnish enhances enamel remineralization with the initial fluoride uptake in early carious lesions (white spots) until it is brushed or flaked off. The calcium fluoride formed in initial caries is more resistant to future demineralization. Therefore the use of fluoride varnish and other highly concentrated fluorides, as a secondary prevention strategy, is most cost-effective when active, non-cavitated, smooth surface caries are detectable.^{24,25}

Caries reductions attributed to fluoride varnish varies significantly in studies, reflecting the predominance of non-comparable study designs and cross-sectional outcome comparisons.²⁶ Reductions are associated with the caries risk of the population studied and the number of fluoride methods used.²⁷ One study found the incidence of new caries was reduced with a single application in a very young at risk, but caries free population.²⁸ Most studies indicate four applications over two years as the interval that demonstrates overall reductions in caries prevalence of approximately 30% (0-69%) in at-risk populations.^{29,30} When fluoride varnish applications are discontinued, the incidence of dental caries increases.^{31,32} For those with active dental caries, three to four applications annually may be more effective, however the strength of evidence is

limited to few studies and the recommendation is based largely on opinion or information extrapolated from related studies.⁴ Using fluoride varnish based on selection of risk for dental caries, will lower costs and optimize caries prevention using fluoride varnishes.^{33,34} The addition of fluoride varnish in caries prevention programs for low risk individuals and populations, especially those that use water fluoridation and fluoride toothpastes, is unlikely to be cost-effective.³⁵

While caries risk assessment is not yet precise, the American Dental Association (ADA), Centers for Disease Control (CDC), and American Academy of Pediatric Dentistry (AAPD) agree that the single greatest risk factor for future caries is dental caries experience.¹¹ Fluoride varnish may be more effective than other professionally applied fluorides to remineralize early dental caries.³⁶ The Canadian Dental Association recommends targeting programs to low income populations and selectively applying fluoride varnish only to those individuals who have increased risk of caries, as indicated by past or current caries.³⁷ However, the AAPD, the USDHHS Maternal and Child Health Bureau Expert Panel and the ADA also identify low socioeconomic status (SES) of individual children under age six as a high risk factor for dental caries as an indicator for fluoride varnish application in an attempt to reduce caries prior to onset.³⁸ Similarly, the emerging Caries Management by Risk Assessment (CAMBRA) model recognizes the association with low SES yet; individual patients are treated according to their individual oral health environment.³⁹ In either case, prevention programs utilizing fluoride varnish need to begin earlier than later, as even age two is too late for children at highest risk.^{40,41}

Fluoride varnish is the safest choice of professionally applied fluoride for young children, or others, who otherwise could over-ingest fluoride available in gel or foam applications. There have been a few reports of contact dermatitis to the resin base used in fluoride varnish. There have been no reports of acute effects from fluoride varnish application in infants and toddlers.⁴² The fluoride release from fluoride varnish is time- and dose-dependent in plaque up to 7 post-treatment days, peaking in plasma in 24-72 hours. Evidence from blood, saliva, urine and plaque indicate low elevations of fluoride following application of a thin layer of fluoride varnish.^{43,44,45} Therefore, because of the low fluoride elevations following ingestion and relatively infrequent applications, generally at 3-12 month intervals, fluoride varnishes pose little risk for enamel fluorosis, even among patients aged \leq six years.¹¹

Fluoride varnish has an advantage over APF gels or foams, particularly for use in settings outside the dental office since no special equipment is needed. Delegation of the simple application technique to trained individuals must follow the rules and regulations of state practice acts governing prescription, dispensing and application of legend drugs. The cost of personnel required for training, assessment, prescription, and evaluation increases the cost of fluoride varnish applications when used for population-based primary prevention. For earliest prevention, application of fluoride varnish can begin as soon as tooth eruption, dependent on the individual child's caries risk. Data from the 2000-2005 Medical Expenditure Panel Survey revealed that 89% of infants and 1-year-olds had office-based physician visits annually, compared with only 1.5% who had dental visits.^{46,47} Consequently, personnel in public and private medical practices can be a significant contributor in early caries recognition and prevention, when and as allowed by state statute.

Fluoride varnish is effective in preventing dental caries in both permanent and primary teeth of children, adults and seniors.^{48,49,50}

Policy Statement

The Association of State and Territorial Dental Directors (ASTDD) supports the use of fluoride varnish, beginning with tooth eruption, for individuals at moderate to high risk for tooth decay as an effective adjunct in programs designed to reduce lifetime dental caries experience.

References

- ¹ Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat* 11 2007;(248):1-92.
- ² Macek MD, Heller KE, Selwitz RH, Manz MC. Is 75 percent of dental caries really found in 25 percent of the population? *J Public Health Dent* 2004;64(1):20-5.
- ³ U.S. Department of Health and Human Services. Oral Health in America: A report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000.
- ⁴ American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride Evidence-based clinical recommendations, *J Am Dent Assoc.*, Vol. 137 <http://jada.ada.org> August 2006.
- ⁵ Marinho VC, Higgins JP, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2003(4):CD002782.
- ⁶ Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride varnishes for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2002(3):CD002279.
- ⁷ 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 Database Syst Rev.* 2004(1):CD002781.
- ⁸ Marinho VC, Higgins JP, Sheiham A, Logan S. One topical fluoride (toothpastes, or mouthrinses, or gels, or varnishes) versus another for preventing dental caries in children and adolescents. *Cochrane Database Syst Rev.* 2004(1):CD002780.
- ⁹ 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.
- ¹⁰ AAPD Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies 2008. (http://www.aapd.org/media/Policies_Guidelines/P_ECCClassifications.pdf)
- ¹¹ Centers for Disease Control and Prevention. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep.* 2001 Aug 17;50(RR-14):1-42.
- ¹² National Institutes of Health (US). Diagnosis and management of dental caries throughout life. NIH Consensus Statement. 2001 Mar 26-28;18(1):1-23.
- ¹³ Takahashi N, Nyvad B. Caries ecology revisited: microbial dynamics and the caries process. *Caries Res.* 2008; 42(6):409-18. Epub 2008 Oct 3.
- ¹⁴ Beltran-Aguilar ED, Goldstein JW, Lockwood SA. Fluoride varnishes: A review of their clinical use, cariostatic mechanism, efficacy and safety. *J Am Dent Assoc.* 2000 May; 131(5):589-96.
- ¹⁵ Weintraub JA, Ramos-Gomez F, June B. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res* 2006; 85(2):172-176.
- ¹⁶ Van Dorp CS, Ten Cate JM. Preventive measures and caries progression: an in vitro study on fissures and smooth surfaces of human molars. *ASDS J Dent Child*, 1992 Jul-Aug; 59(4):257-62.
- ¹⁷ Hiiri A, Ahovuo-Saloranta A, Nordblad A, Mäkelä M. Pit and fissure sealants versus fluoride varnishes for preventing dental decay in children and adolescents. *Cochrane Database Syst Rev.* 2006 Oct 18 ; (4):CD003067.
- ¹⁸ S.O. Griffin E. Oong, W. Kohn, B. Vidakovic, B.F. Gooch CDC Dental Sealant Systematic Review Work Group, J. Bader, J. Clarkson, M.R. Fontana, D.M. Meyer, R.G. Rozier, J.A. Weintraub, D.T. Zero. The Effectiveness of Sealants in Managing Caries Lesions. *J Dent Res.*, Vol. 87, No. 2, 169-174 (2008) DOI: 10.1177/154405910808700211
- ¹⁹ Bravo M, Garcia-Anillo I, Baca P, Llodra JC: A 48-month survival analysis comparing sealant (Delton) with fluoride varnish (Duraphat) in 6- to 8-year-old children. *Community Dent Oral Epidemiol* 1997;25:247-250.
- ²⁰ Beltran-Aguilar E, Boldstein J, Lockwood S. Fluoride Varnishes, A Review of Their Clinical Use, Cariostatic Mechanism, Efficacy and Safety. *J Am Dent Assoc.* 2000; 131(5): 589-96.
- ²¹ Featherstone JD. Caries prevention and reversal based on the caries balance. *Ped. Dent.* 2006 Mar-Apr;28(2):128-32; discussion 192-8.
- ²² Dijkman TG, Arends J. The role of 'CaF₂-like' material in topical fluoridation of enamel in situ. *Acta Odontol Scand* 1988;46:391-7.
- ²³ Tenuta LM, Cerezetti RV, Del Bel Cury AA, Tabchoury CP, Cury JA. Fluoride release from CaF₂ and enamel demineralization. *J Dent Res* 2008;87(11):1032-6.
- ²⁴ Woodward GL, Lewis DW. The use of professionally applied topical fluorides in the North York Public Dental Program. Quality Assurance Report No. 8, Community Dental Health Services Research Unit, University of Toronto, 1995.
- ²⁵ Zero D, Fontana M, Lennon AM. Clinical applications and outcomes of using indicators of risk in caries management. *J Dent Educ.* 2001 Oct; 65(10):1126-32.
- ²⁶ Helfenstein U, Steiner M. Fluoride varnishes (Duraphat): a metaanalysis. *Community Dent Oral Epidemiol.* 1994;22(1):1-5.
- ²⁷ Seppä L. Fluoride varnishes in caries prevention. *Med Princ Pract.* 2004 Nov-Dec;13(6):307-11.
- ²⁸ Weintraub JA, Ramos-Gomez F, June B. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res.* 2006; 85(2):172-176.
- ²⁹ Adair SM. Evidence-based use of fluoride in contemporary pediatric dental practice. *Pediatr Dent.* 2006 Mar-Apr;28(2):133-42; discussion 192-8.
- ³⁰ Strohmenger L, Bambrilla E. The use of fluoride varnishes in the prevention of dental caries: A shortreview. *Oral Dis* 2001;7:71-80.
- ³¹ Seppä L. Studies of fluoride varnishes in Finland. *Proc Finn Dent Soc.* 1991;87(4):541-7.
- ³² Bravo M, Montero J, Bravo JJ, Baca P, Llodra JC. Sealant and fluoride varnish in caries: a randomized trial. *J Dent Res.* 2005 Dec;84(12):1138-43.
- ³³ Burt BA. Prevention policies in the light of the changed distribution of dental caries. *Acta Odontol Scand.* 1998; 56(6):179-186.
- ³⁴ Kumar JV, Moss ME. Fluorides in dental public health programs. *Dent Clin North Am.* 2008 Apr;52(2):387-401, vi.
- ³⁵ Marinho VCC, Higgins JPT, 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 Database Syst Rev* AB002781.htm <http://www.cochrane.org/cochrane/revabstr/>
- ³⁶ Autio-Gold JT, Courts F. Assessing the effect of fluoride varnish on early enamel carious lesions in the primary dentition. *J Am Dent Assoc.* 2001 Sep;132(9):1247-53; quiz 1317-8.
- ³⁷ Azarpazhooh A, Main PA. Fluoride varnish in the prevention of dental caries in children and adolescents: a systematic review. *J CanDent Assoc.* 2008 Feb;74(1):73-9.
- ³⁸ Altarum Institute, Topical Fluoride Recommendations for High-Risk Children, Development of Decision Support Matrix, Recommendations from MCHB Expert Panel, October 2007.
- ³⁹ Young DA, Kutsch VK, Whitehouse J. A clinician's guide to CAMBRA: a simple approach. *Compend Contin Educ Dent.* 2009 Mar;30(2):92-98.
- ⁴⁰ Tankunnasombut S, Youcharoen K, Wisuttisak W, Vichayanrat S, Tiranathanagul S. Early colonization of mutans streptococci in 2- to 36-month-old Thai children. *Ped. Dent.* 2009 Jan-Feb;31(1):47-51.
- ⁴¹ Ramos-Gomez FJ, Crall JJ, Gansky S, 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.
- ⁴² Bayless JM, Tinanoff N. Diagnosis and treatment of acute fluoride toxicity. *J Am Dent Assoc.* 1985 Feb;110(2):209-11.
- ⁴³ Ekstrand J, Koch G, Petersson L. Plasma Fluoride Concentration and Urinary Fluoride Excretion in Children Following Application of the Fluoride-Containing Varnish Duraphat. *CariesRes.* 1980;14:185-189.
- ⁴⁴ Pessan J, Pin M, Martinhon C deSilva S, Granjeiro J, Buzalaf, M. Analysis of fingernails and Urine as Biomarkers of Fluoride Exposure from Dentifrice and Varnish in 4-7 year-Old Children. *CariesRes.* 2005; 39:363-370.
- ⁴⁵ Skold-Larsson K, Modeer T, Twetman S. Fluoride concentration in plaque in adolescents after topical application of different fluoride varnishes. *Clin Oral Investig.* 2000 Mar;4(1):31-4.
- ⁴⁶ American Academy of Pediatrics. Profile of pediatric visits: Tables 9–10 [based on 2000–2005 Medical Expenditure Panel Survey and 2000–2004 National Ambulatory Medical Care Survey]. Updated June 2008. Available at: <http://practice.aap.org/public/ProfileOfPediatricVisits.pdf>. Accessed July 31, 2008
- ⁴⁷ American Academy of Pediatrics, Policy Statement: Preventive Oral Health Intervention for Pediatricians. *Pediatrics* 2008 Dec:122(6).
- ⁴⁸ Rozier RG. Effectiveness of methods used by dental professionals for the primary prevention of dental caries. *J Dent Educ.* 2001 Oct; 65(10):1063-72.
- ⁴⁹ Beltran-Aguilar ED, Goldstein JW, Lockwood SA. Fluoride varnishes: A review of their clinical use, cariostatic mechanism, efficacy and safety. *J Am Dent Assoc.* 2000 May; 131(5):589-96.
- ⁵⁰ Anusavice KJ. Present and future approaches for the control of caries. *J Dent Educ.* 2005 May;69(5):538-54.