Review Article

Fluoride Varnish – A Review

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Abstract

The growing emphasis on prevention-based dentistry has led to rapid development of newer and more innovative treatment modalities aimed at early disease prevention. In this context, fluoride varnishes are fast becoming an integral component of prevention-based programs along with patient and parent education. Fluoride varnishes adhere to enamel, and calcium fluoride formed after application acts as a long-term reservoir of fluoride. Four applications per year or three weekly applications once a year have been found to be effective. Application is fast and easy. No acute toxicity has been reported after using any fluoride varnish.

Keywords: Fluoride varnish, fluorides in dentistry, sodium fluoride

Introduction

It is beyond doubt that topical fluoride agents provide effective control and protection against dental caries. They were developed during the late 1960s and early 1970s in an effort to improve shortcomings of existing topical fluoride vehicles, such as fluoride gels or mouth rinses, by prolonging contact of the fluoride with tooth enamel. The active ingredient of fluoride varnish usually is 5% sodium fluoride (NaF). The inactive ingredients in the varnish are there primarily for flavoring and to ensure that the fluoride sticks to the tooth surface. We review the state of the science of fluoride varnishes, including their efficacy, cariostatic mechanism and safety, as well as their potential use to prevent dental caries.[1]

History

In the 1940s, a NaF solution for topical application on teeth was introduced to provide fluoride to individuals in nonfluoridated areas. The first fluoride varnishes were developed during the 1960s (Duraphat® NaF varnish) and 1970s (Fluor Protector® silane fluoride varnish) to prolong the contact time between fluoride and enamel. In 1964, Schmidt[2] presented a method of applying NaF in a natural colophony base, which could adhere to tooth surfaces in the presence of saliva. This product was further developed and registered as Duraphat.[3]

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Mechanism of Action

Fluoride controls caries mainly through its topical effect. Fluoride present in low, sustained concentrations (sub-ppm range) in the oral fluids during an acidic challenge is able to absorb to the surface of the apatite crystals, inhibiting demineralization. When the pH is re-established, traces of fluoride in solution will make it highly supersaturated with respect to fluorhydroxyapatite, which will speed up the process of remineralization. The mineral formed under the nucleating action of the partially dissolved minerals will then preferentially include fluoride and exclude carbonate, rendering the enamel more resistant to future acidic challenges. In addition to fluoride incorporation into the crystalline lattice, fluoride varnishes and other concentrated topical fluorides interact with saliva and form calcium fluoride (CaF2) compounds on enamel. Nevertheless, according to studies from the 1980s, CaF2 is stabilized by pellicle proteins and secondary phosphate at neutral pH. When the pH of plaque drops, CaF2 begins to dissolve and release fluoride ions, thus acting as a prolonged source of fluoride after application. It has also been proposed that the fluoride ion can affect the physiology of microbial cells, including cariogenic streptococci, which

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can thus indirectly affect demineralization. Fluoride exerts its effects on oral bacteria by a direct inhibition of cellular enzymes (directly or in combination with metals) or enhancing proton permeability of cell membranes in the form of hydrogen fluoride.[2,4,5,6]

Technique and Frequency of Varnish Application

Varnish manufacturers recommend professional cleaning of teeth before the application of the product. The varnish is applied on tooth surfaces where caries usually develops by using a brush or applicator. The varnish adheres to the tooth surface, and the patient can leave immediately after application. Brushing has to be avoided for the remainder of the day. The manufacturer suggests avoiding eating for 2 − 4 h after application.[7,8]

The following sequence of steps can be followed to ensure proper varnish application:

a. Prophylaxis (tooth brush or professional)[7]
b. Isolate quadrant that is ready to receive the varnish using cotton rolls
c. Dispense fluoride varnish as per manufacturer's instruction. Usually 0.5–1 ml is more than adequate for the entire dentition
d. Apply varnish on tooth surfaces using a disposable brush or cotton applicator. The entire surface of the tooth must be treated. Avoid getting varnish on the soft tissue. The varnish sets in a few seconds leaving a fluoride rich layer adjacent to the tooth surface
e. The entire process takes 3–4 min.

The most often used regimen seems to be a semi-annual application.

Three trends in application frequencies seem to appear:

1. One application every 6 months
2. One application four times a year
3. Three applications over a 1-week period.

It is important to stress that for fluoride varnishes to be effective, reapplication is necessary. How often this is done depends on the child's caries risk. A semi-annual application frequency, however, is the optimum frequency if any benefit is to be expected.

Types of Fluoride Varnishes

Duraphat (Colgate-Palmolive, Canton, MA; 800.763.0246), a 5% NaF preparation, was the first commercially available fluoride varnish. Other common fluoride varnishes include Fluor Protector (Ivoclar/Vivadent, Amherst, NY, USA; 800.533.6825), Duraflor (Pharma Science, Montreal, Canada; 800.361.2862), CavityShield (OMNII Oral Pharmaceuticals, West Palm Beach, FL; 800.445.3386), Bifluorid 12 (Voco, Cuxhaven, Germany; 0.47.2.719.0) and Carex (Voss, Norway; 0.47.55.58.48.16). Fluor protector is a difluorosaline agent that was introduced in the mid-1970s; Fluor Protector contains 0.7% fluoride in a polyurethane varnish and, unlike Duraphat, has acidic properties. Duraflor is a 5% NaF varnish that is available in 10 mL tubes. It includes xylitol (a sweetener) and bubblegum flavoring to increase patient acceptance.[9,10] CavityShield contains 5% NaF in a neutral resin and is packaged in single-use doses of 0.25 mL and 0.4 mL. Bifluorid 12 contains both NaF (2.7% F) and CaF2 (2.9% F). Carex was developed in Norway and contains 1.8% fluoride prevent and arrest caries in children.[4,5]

Safety and Toxicity

Despite the rapid setting time of the varnish and the small dosage used, the risk exists that young children will ingest some of the product during placement. In addition, as fluoride is released from the varnishes after treatment, some fluoride will be ingested. In addition, overapplication is a common occurrence and one must be careful to apply just the required amount on the tooth surface.[10,11,12,13] Three of the four commercially available fluoride varnishes have a fluoride content of 22.6 mg/ml (22,600 ppm of fluoride ion).[1,4] The probable toxic dose for a child weighing 20 kg is approximately 100 mg (potential toxic dose for fluoride – 5 mg/kg). If 0.5 ml is used in one fluoride application, amount of fluoride ingested could amount to 11.30 mg, well below the toxic dose.

Conclusion

The contemporary view of fluoride varnish is that it is simple to use, takes only a few seconds to apply and is safe for children and other special needs groups. Fluoride varnishes are a safe and efficacious way of delivering and retaining fluoride on tooth structure. In addition, they are effective in controlling caries progression by enhancing remineralization at the tooth surface and inhibiting demineralization.

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Conflicts of interest

There are no conflicts of interest.

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