



Fluoride Varnish – A Review

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ABSTRACT

This review article provides an overview of the use of fluoride varnish in dental practice. Fluoride varnish is a topical fluoride treatment that has been shown to be effective in preventing dental caries, particularly in children and adolescents. The article discusses the mechanism of action of fluoride varnish, its application techniques, and its safety profile. The review also covers the evidence supporting the use of fluoride varnish in various patient populations, including high-risk individuals and those with special needs. Additionally, the article explores the potential side effects of fluoride varnish, as well as strategies to minimize these effects. Finally, the review highlights the importance of incorporating fluoride varnish into a comprehensive preventive oral health program.

Keywords: *Fluoride, fluoride varnish, novel, early childhood caries, dental caries*

INTRODUCTION

The application of fluoride was introduced into clinical practise of dentistry in the 1940s in a view to decrease dental caries.(1) Many fluoride products (such as sodium fluoride gels and stannous fluoride solutions) are aqueous formulations. Non-aqueous topical fluorides have been developed to promote longer retention times. In 1964, it was reported in the literature that he used a 2% sodium fluoride varnish in an alcoholic solution of natural resins (2). This varnish was fluoride varnish used to increase contact time between fluoride and enamel. The first clinical study of fluoride varnish was published four years after him, showing that the product had significant effects

in preventing tooth decay (3). (4) The Active ingredient in fluoride paints is typically 5% sodium fluoride (NaF). Additives in varnishes are mainly used for aromatization and ensure that the fluoride adheres to the tooth surface. The most commonly used ingredients typically include sodium saccharin (used as a sweetener), beeswax and ethanol (to form a gel-like structure to stabilize the sodium ions), and shellac and mastic (soft and permeable). to provide a durable hard surface). It prevents the paint from quickly dissolving in saliva). It also contains flow improvers such as rosin. Duraphat (Colgate-Palmolive, Canton, MA;800.763.0246), with 5% NaF, was the first commercially available fluoride varnish. Although fluoride varnishes have been used extensively in many countries

for decades, the FDA did not approve the use of fluoride varnishes for dentistry in the United States until 1994. A number of clinical studies with Duraphat have shown the product to be effective in preventing cavities in children (see table). (5-10) Duraphat is now used in over 40 countries. Vivadent, Amherst, NY; 800.533.6825), Duraflor (Pharma Science, Montreal, Canada; 800.361.2862), CavityShield (OMNII OralPharmaceuticals, West Palm Beach, FL; 800.445.3386), Bifluoride 12 (Voco, Cuxhaven, Germany) 0.47 .2.719.0) and Carex (Boss, Norway; 0.47.55.58.48.16). Fluor Protector is a difluoro salt agent introduced in the mid-1970s. A 1983 study claimed that Fluor Protector may increase fluoride uptake by tooth enamel. Available in 1.0ml ampoules and 0.4ml unit doses. Used in the US at 0.1% fluoride concentration, it is marketed as a cavity varnish to seal and prevent intrusion of liquids and metal ions. Duraflor is a 5% NaF varnish in 10ml tubes. It contains xylitol (a sweetener) and bubblegum flavoring, which increases patient acceptance. It has been reported to prevent tooth decay and stop the progression of tooth decay.(12,13) CavityShield contains 5% NaF in a neutral resin and comes in 0.25ml and 0.4ml disposable jars. The Fluoride content is said to be more consistent than Durafat.(14(Ganapathy and Others 2022; Akshayaa, Ravindran, and Madhulaxmi 2021)) A touted advantage of CavityShield is that unit doses can be easily mixed and applied to the teeth, thus reducing unknown doses(Mohanty and Ramesh 2020). No more worrying about administering fluoride. Bifluoride (12) contains both NaF (2.7% F) and calcium fluoride (CaF₂) (2.9% F). A 1995 study reported that this CaF₂/NaF varnish of his deposited more fluoride on the surface of demineralized enamel than NaF varnish alone (15) Carex was developed in Norway. , contains 1.8% fluoride. A 1991 study showed Carex and Duraphat to be equally effective in children(Bramhecha and Sandhya 2021; Baskran, Nivethigaa, and Balaji Ganesh 2021) (16).

Another experimental fluoride varnish is an NaF-ethanol varnish called CDB. In 1990, Acuna et al reported that using this experimental varnish led to a high fluoride uptake in both the enamel and dentine of extracted human canine teeth.(17)

Sodium fluoride varnish is advocated for moderate and high-risk children, particularly children younger than 5, as well as for children who are receiving orthodontic treatment.(18) It also is used to prevent and arrest caries in children.(19) The manufacturer of Duraphat suggests using the product for preventing caries, promoting remineralization of caries, and treating tooth hypersensitivity. More than 90% of the municipal caries-preventive programs in Denmark provided fluoride varnish for children up to 18 years of age.(20) However, children who are at low risk, are caries-free, and live in a fluoridated community may not require fluoride varnish for caries prevention.18 Sodium fluoride varnish can be applied topically two to four times a year. This regimen was the most common professionally applied fluoride measure in the Nordic countries for individuals at high risk for caries.(5,9,21-24) Pienihakkinen and Jokela conducted a three-year clinical study with young children in Finland in which high-risk children received Duraphat four times a year for risk-based management of caries; this administration was determined to be effective and practical.(25)As there are no consistent results of enhanced effectiveness of caries prevention with fluoride application every three months biannually, the frequency of sodium fluoride varnish application currently is under debate for cost-saving reasons.(4) Even so, two applications of fluoride varnish per year is the schedule recommended most commonly, possibly because it matches the standard dental office schedule of two recall visits per year. Fluoride varnish mode of action The mechanism of fluoride action in dental caries still is being researched, although it has been reported that the concentrated fluoride ions in fluoride varnish cause globules of a calcium fluoride-like material to form on the tooth surface.(26)

These globules are stabilized by protein phosphate in the mouth and act as an insoluble reservoir of fluoride at neutral pH. When there is a cariogenic challenge such as sugar consumption, the pH is lowered and the dissolution rate of these globules increases. This response lowers the solubility constant of calcium and phosphate ions, releasing fluoride and increasing the saturation of calcium and

phosphate ions in plaque fluid as a result. This reaction helps to prevent the dissolution of calcium and phosphate from the tooth mineral and/or increases the rate of remineralization or precipitation of the lost minerals. This mechanism can explain how topical application of a fluoride varnish two or three times a year can result in long-term caries reduction.(26) Advantages and disadvantages of fluoride varnish Fluoride varnish offers the theoretical advantage of prolonged contact time, acting as a slow-releasing reservoir to prevent the immediate loss of fluoride after application.(21) The varnish can be applied quickly and easily and sets rapidly on teeth; gagging and swallowing are unusual.27 The simplicity of its application makes it suitable for special-needs populations—including very young children, patients with autism, and patients with management problems (such as mental or physical disabilities)—as well as for outreach dental services. A professional prophylaxis before varnish application has no additional effect on its caries prevention property and thus is not necessary; as a result, the chairside application time of fluoride varnish is short.(28) Application of fluoride varnish to four first molars may take less than half a minute. Warren et al. Both patients and surgeons report a preference for fluoride varnish over fluoride gel.(29)

Of utmost importance, Bowden's study from 1998 revealed that fluoride varnishes are safe for young children.(30) Fluoride varnishes are a superior choice for preventing tooth decay when compared to other types of topical fluoride treatments, such as gels or rinses, and other caries management methods due to their effectiveness, ease of application, and safety.(4) Bader et al's systematic review of caries management methods reported that fluoride varnish was "fair" at preventing dental caries, while the evidence for other methods, including sucrose-free gum and combined chlorhexidine-fluoride methods, was incomplete.(31) Furthermore, Petersson's recent review found that fluoride varnish had an average preventive fraction of 30% (0–69%) in children.(32) Given its benefits, it is likely that fluoride varnishes will become the most commonly used form of topical fluorides applied by dentists for public health dentistry.(30)

However, one disadvantage of Duraphat is its poor esthetic effect. After application, a yellow film of varnish remains on the teeth for several hours unless removed by brushing, and there may be temporary discoloration of teeth.(29) While most patients tolerate the presence of varnish on their teeth, some may dislike its thin film or find the taste objectionable. Safety is a critical concern when using fluoride varnish, as Duraphat varnish contains either a 5% NaF ion or 2.26% fluoride ion, making it a concentrated fluoride therapeutic agent delivered by dental professionals. It is essential to prevent excessive ingestion of fluoride, especially for preschool children receiving topical fluoride treatment, as it can be hazardous. According to a report on fluoride toxicity by Shulman and Wells, a child who weighs 10 kg and ingests 50 mg of fluoride is likely to have ingested a toxic dose.(33) However, Roberts and Longhurst's clinical evaluation of the amount of fluoride applied to children with Duraphat in the United Kingdom found that the average amount of fluoride applied was 5.2 mg per child, which varied little regardless of the children's ages, and no child received the level of fluoride ion quoted for toxicity.(34) Fluoride varnish sets quickly when applied to teeth, and most of the sodium fluoride applied will remain on the tooth surfaces in the natural resins. A study of Swedish children by Ekstrand et al indicated a plasma fluoride peak of 3.2–6.3 $\mu\text{mol/L}$ after fluoride varnish was applied.(35) By contrast, a later study noted that a four-minute acidulated phosphate fluoride (APF) gel application produced a plasma fluoride peak of 16–76 $\mu\text{mol/L}$.(36) By comparison, a 1983 study on preschool children reported that the mean plasma fluoride peak level after brushing with fluoride toothpaste was 3.6 $\mu\text{mol/L}$, while ingesting a 1.0 mg fluoride tablet produced a peak level of 4.5 $\mu\text{mol/L}$.(37)

Two cases of contact sensitization to Duraphat have been reported in the literature; the first caused dermatitis on the dental assistant's hand and the second stomatitis in a patient.(38) These allergic reactions are believed to be related to the rosin component of the hairspray.(39) According to the manufacturer, edematous swelling and vomiting occur in i patients with sensitive Stomach side effects have been reported as rare.

(40) Recent studies show that fluoride varnish is safe for dental care and the risk of serious reactions to fluoride varnish is minimal. (4,30,39) The risk of dental fluorosis is minimal because children are not exposed to fluoride dyes as often as fluoride supplements.(4.39) Clinical studies with fluoride varnish in caries The most widely used fluoride varnish in dentistry, Duraphat, has been the subject of several reviews (4.41-48).The table contains a summary of clinical studies on the use of fluoride dyes in children. Duraphat has been shown to be effective in preventing tooth decay in most clinical trials, with an average reduction of approximately 30%.(32) A meta-analysis was performed using a randomized fixed-effects fitted model. The overall effect size of caries reduction was approximately 0.38 in both models (49.50) Fluor Protector deposited more fluoride in and on enamel and was more effective than Duraphat at in situ enamel protection; however, it has not been clinically proven to be more effective.(43,46) Some studies have found NaF to be more effective than difluoroaniline, while others have reported that both are equally effective in reducing tooth decay.(26) Topical application of sodium fluoride paint is applied with a small brush and a very small amount of paint (especially for small children). One study found that, on average, 0.17 mL of Duraphat was used for each topical application. (51) The teeth should not be very dry and the patient should not eat for about two hours after the application. (4) Because brushing teeth can remove fluoride varnish, varnish should be used every time to avoid brushing teeth on the day of application.(4) In a two-year randomized study in Finland, Seppa and Tolonen studied 300 children at risk of caries and found no significant differences in a% increase in tooth decay between those who received two applications of sodium fluoride varnish per year and those who received four.(52) The study also showed that children with very high tooth decay experience did not benefit from more frequent use of fluoride would benefit.Modeer et al. studied the progression of proximal caries of premolars and molars using Duraphat varnish four times a year; reported a significant reduction in tooth decay in their 194 adolescents.(22) Ripa and Newbrun

recommended four fluoridation sessions per year for patients at high risk of tooth decay.(53,54)

SUMMARY

Fluoride varnish can be an effective tool in the treatment of tooth decay. Fluoride paint is considered an excellent topical fluoride agent for young children and its use has several advantages over other fluoride agents. 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.

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