

Topical Fluoride for Prevention of Dental Caries: A Review

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Abstract

Topical Fluoride has been the primary human action of dental caries hindrance for many decades. There are various mechanisms that kind it advantageous including inhibiting pathology, enhancing remineralization, and inhibiting microorganism maturation. This paper represents the development, mechanism of action, and manner of use of various fluoride products. The comparative study between the different forms of fluoride preparation is over viewed here. Fluoride toothpaste, mouth rinses, varnishes are some of the products usually utilized for caries prevention. The practitioner must ascertain sort of topical preparation suitable for different types of patients who are at different risk levels.

Keyword: Professionally applied topical fluoride; Self-applied topical fluoride; Acidulated Phosphate Fluoride, Monofluorophosphate; Caries prevention.

Introduction

The water fluoridation system is one of the effective and economical measures for caries prevention, but it is available for a small group of people, therefore other method are required for the application of fluoride. The topical fluoride method is one such method in which high amounts of fluoride are ingested topically or locally. When the tooth erupts, the application of fluoride topically should be done, so that the injection of fluoride occurs and the enamel becomes more caries resistant.¹

Table 1. Type of topical fluorides³

Professionally applied topical fluorides	A. 2 percent Sodium Fluoride. B. 8 percent Stannous Fluoride. C. 1.23 percent Acidulated Phosphate Fluoride. D. Fluoride Varnishes a. Duraphat (Sodium Fluoride b. Fluoroprotector (Silane Fluoride) c. Carex. E. Fluoride Foam. F. Fluoride Prophylactic pastes. G. Fluoride containing restorative products.
Self-applied topical fluorides	A. Fluoride Dentifrices. B. Fluoride Mouthrinses. C. Fluoride Gels.

Topical fluorides are of two types:

1. Professionally applied topical fluorides: In the year 1942, Bibby discovered that the use of sodium or potassium fluoride caries can be reduced in the case of children. Mainly 5000-19000ppm i.e, 5-19mgF/ml concentration of fluoride is used.²
2. Self-applied topical fluorides: 200-1000ppm i.e, 0.-1mgF/ml fluoride concentration is used.²

Indications:

1. Patients with a carious tooth.
2. Children just after tooth eruption period.
3. Patients who are under medication to reduce salivary flow or have undergone head and neck radiation.
4. Mentally or physically challenged persons.
5. Patients who have undergone periodontal surgery when the roots have been exposed.
6. Patients having a dental prosthesis.
7. Eating disorder patients.
8. Patients who have undergone any restorative procedures.

Professionally Applied Topical Fluorides:

A. 2 percent Sodium Fluoride: This technique was given by Knutson. Powder and liquid forms are available. It is made by adding 0.2gm of powder in 10ml. of distilled water. 4 weekly applications of 2%NaF at 3,7,11 and 13 ages.³

Method of application: Teeth should be cleaned and polished, Isolate and dry by using cotton rolls, Apply quadrants, Apply for 3 minutes with a cotton applicator, Repeat in remaining quadrants, and Instruct the patient to avoid eating or drinking or rinsing for half an hour.⁴

Mechanism: Sodium Fluoride reacts with hydroxyapatite crystal to form a product i.e, Calcium Fluoride. Then there will be choking off i.e, reduction in the rate. Further Calcium Fluoride reacts with hydroxyapatite to form Fluoridated hydroxyapatite. It leads to an increase in fluoride concentration by converting the tooth surface into the stable in nature and caries resistant.

Advantages: Stable, Acceptable taste, Non-irritating, and No discoloration.⁵⁻⁷

Disadvantages: The patient has to make four visits in a few days.

B. 8 percent Stannous Fluoride: It was given by Muhler. This technique involves the use of Stannous Fluoride in powder form. It is made by dissolving 0.8gms of powder in 10ml. Distilled water. The resultant solution is acidic.⁵⁻⁷

Method of Application: Teeth should be cleaned and polished, Isolate and dry with cotton rolls, Apply the solution using the cotton applicator on all teeth surfaces, Repeated loading is done and swabbing is done for 4 minutes, Patient is allowed to expectorate after removal, and A six-monthly interval should be advised for next appointment.⁵⁻⁷

Mechanism of action: Stannous Fluoride reacts with Hydroxyapatite to form Stannous Tri-fluorophosphate. The product formed is very much useful for the reduction of caries. The stability of the product is also great. Tin hydroxy phosphate is also formed. It is the reason behind the metallic taste which is one of the disadvantages.

Advantages: The frequency of appointments is less.

Disadvantages: Metallic taste, Gingival irritation, Brown pigmentation, and Each time fresh solution has to be prepared.⁵⁻⁷

C. 1.23 percent Acidulated Phosphate Fluoride: The solution is known as Brudevold's Solution. Available as a solution or gel. The solution is made by adding 20 gms of NaF in 1lit. of 0.1M Phosphoric acid and adding 50% Hydrofluoric acid. For the preparation of gel, Methylcellulose gelling agent is added to the solution. Other gelling agents like hydroxyethyl cellulose may be used. Frequency-Twice a year.⁵⁻⁷

Method of Application: Solution: Oral prophylaxis should be done. Isolate and dry with cotton rolls. Then the solution is applied for four minutes. The patient is instructed to keep his/her mouth close and not to eat or drink anything for a half-hour. Gel: Mouth trays are used. The patient should be in an upright position. If we use Suction it can be easier to do the procedure or else it might be difficult and clumsy. The tooth should be dried. Enough gel should be used but not more than 2-2.5gms per tray. Should be applied for four minutes.

Mechanism of action: Initially, dehydration occurs. Shrinkage of hydroxyapatite crystals occurs. Then hydrolysis and Dicalcium Phosphate dehydrate (DCPD). The penetration of fluoride ions occurs and forms fluorapatite.

Advantages: Stable, No staining, and Self applicable.

Disadvantages: Acidic taste and Glass can't be used as a container.⁶⁻⁸

D. Fluoride Varnishes: It is a temporary material that allows the fluoride to adhere to the tooth surface for a longer duration.

Advantages: Well accepted and safe. Requires minimal training.

Duraphat (NaF): First fluoride varnish which was tested. Consists of 2.26 percent Sodium Fluoride or 22.6mgF/ml. In the presence of saliva, it becomes a hard yellowish-brown coating. The effectiveness of Duraphat is between 30 to 45%.

Floor protector (Silane Fluoride): Discovered in 1970. Consists of 70000ppm Fluoride. The main ingredient in this product is Silane Fluoride.

Carex: Tested in Norway. Consists of 1.8% Fluoride. Its efficacy is equivalent to Duraphat.

Method of application: At first oral prophylaxis should be done. Dry and isolated with cotton rolls. First mandibular arch then maxillary arch. Small amounts (0.3-0.5ml or 2drops) of varnish should be dispensed, by using single tufted brush starting proximal surfaces. After that patient is advised to sit opening the mouth for 4minutes. Instruct the patient to avoid rinsing or drinking and also eating any solid food. Advised for taking liquid or semisolid for 18 hours.⁶⁻⁸

E. Fluoride Foam: 0.92% F (9200ppm) at pH 4.5.and Commercially available.

Advantages: Less in density and better flow, Lighter than conventional gel, so an only small amount is needed and Doesn't require suctioning so offers home use.

Disadvantages: Retention is less.

F. Fluoride Prophylactic pastes: Prophylactic pastes containing Sodium Fluoride was developed in 1946. In 1960 Stannous Fluoride containing paste was discovered. Nowadays various new products are available like pastes containing Zirconium silicate and Acidulated Phosphate Fluoride silicone dioxide paste etc.

Functions: These pastes contain abrasive materials which remove the deposits present over the teeth. Polishing the tooth surface as well as the restoration. In the case of periodontal or cosmetic reasons, these pastes are recommended. Various studies demonstrate that alone these pastes can't be the effective cariostatic method.⁶⁻⁸

Table 2. Comparison between the effectiveness of Professionally applied topical fluoride agents

Agents	2% Sodium Fluoride	1.23% APF	8% Stannous Fluoride	Fluoride Varnish
The concentration of fluoride (ppm)	9200	12300	19500	22600
Effectiveness in caries reduction (in %)	29	22	32	38

Self-Applied Topical Fluorides:

A. Fluoride Dentifrices: Fluoride dentifrices play a big role in the reduction of caries in view that it requires lively participation utilizing the patient to have any effect. It has been demonstrated that the patient who brushes twice a day or greater with 1000ppm or 1500ppm or 2500ppm fluoride dentifrices have substantially reduced caries prevalence. Some of the fluoride products which have been examined for use as dentifrices are Sodium Fluoride (0.2%), Stannous Fluoride (0.4%), Sodium monofluorophosphate (0.76%), Acidulated phosphate fluoride, and Amine Fluoride⁶⁻⁸

Mechanism of action: There are two mechanisms of action. One of them is, MFP ions are integrated into the hydroxyapatite crystal. Then there will be the release of fluoride ion, which is further replaced by hydroxyl corporations to form the product called fluorapatite. The second mechanism is, MFP ions itself is integrated into the crystals having alternative products like one or many phosphate groups. As caries activity becomes more in the tooth surfaces, there will be a decrease in

the pH level, but by using the fluoride toothpaste, the enamel which has become demineralized can be made back to the original condition, so it is one of the easy and successful method of dental caries prevention.⁶⁻⁸

How to use the dentifrices: To prevent further caries, people of almost every age group should use the fluoride toothpaste. The kids under the 6 years age group should also be advised to use but under the supervision of an adult otherwise immoderate ingestion of fluoride can occur. In kids, only a very small amount (less than 5mm) approximating the 'pea-size' have to be placed on the brush.

B. Fluoride Mouth rinses: Over the preceding years, fluoride mouth rinsing has flip out to be an effective and important method of prevention of caries. Various fluoride products used as mouthwashes are Sodium Fluoride, Stannous Fluoride, Amine Fluoride, etc. Among all of these, Sodium Fluoride is mainly used. For the school-based programs, 2gm Sodium Fluoride is added in 1-liter water. By its regular use, caries reduction occurs by 20-30 percent. For personal use, tablets are there i.e,

200mg Sodium Fluoride tablets in 5 teaspoons of water. It is best for mouthrinse for a family who uses it regularly.⁶⁻⁸

Recent Advances in Topical Fluoride: At present, there is a drop in the caries prevalence across countries. More and more children are turning caries-free nowadays. Many types of research are also going on in the production and utilization of newer fluoride products. Various fresh and new fluoride products are launched day by day, i.e, fluoride mouth rinses, fluoride whitening agents, toothpaste, fluoride varnishes, etc. Stannous Fluoride Sodium Hexametaphosphate (SFSH), a new fluoride product was presented against the caries problem of various patients. It was used in the mid-2005-2006 year as a composition of the dentifrice. Researches revealed that Silver Diamine also used as an effective material currently. Also, more and more fluoride-containing restorative products are used nowadays rather than usual restorative products. Fluoride varnishes have a higher rate of effectiveness than that of Sodium and Stannous Fluoride.^{9,10}

Conclusion

From the various researches and clinical investigations, it was concluded that topical fluoride is one of the easy to use and effective method of caries prevention. It is cariostatic for all age groups. One of its advantages is fluorosis generally doesn't occur due to topical fluoride application. On the other hand, these products might have some side effects like nausea it is high in cost than water fluoridation. Nowadays newer products are discovered and examined for a better purpose which will be more and more useful for the reduction of caries prevalence.

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