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Review Article

Topical fluoride application in dentistry by professionals: A literature review

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ABSTRACT

Dental caries remains a significant public health issue. Using fluoride is the most efficient method of preventing dental cavities. Fluoride is now a crucial component of preventive dental care. The goal of current research is to discover methods for enhancing fluoride efficacy. As a caries-prevention strategy, fluoride therapy in the form of fluoride devices, prophylactic paste, or re-mineralizing agents has been widely employed. This review's objective is to enlighten readers on recent findings about fluoride's potential benefits in preventing dental cavities.

1. Introduction

Fluoride holds a special place in the field of preventative dentistry.[1] At their preventive maintenance sessions, many dentists and dental hygienists currently practice the standard practice of professionally applying topical fluoride treatments to their patients.[2] In 2006 American Dental Association (ADA) Council presented proof; based clinical use of topical fluorides for prevention of caries. The efficacy of various topical fluorides as caries; preventive agents was evaluated. Topically applied fluoride treatments are effective in decreasing the frequency of tooth cavities. Consequently, dental practitioners can now prescribe and employ a wide range of fluorides in restorative materials, prophylactic paste, slow-releasing devices, and remineralizing agents at home in addition to their clinical practice.[3] Thus, more research on "Professionally Applied Topical fluoride in Dentistry" is required.

2. Silver Diamine Fluoride

$Ag(NH_3)_2F$.

In Japan, silver diamine fluoride was first available as Saforide solution in the 1970s (J Morita Company, Japan).[4] An anti-cariogenic drug called silver diamine fluoride (SDF) is thought to be highly beneficial, particularly in pediatric dentistry.[5]

It is employed to encourage the hydroxyapatite (HA) mineral in teeth to remineralize. The progression of caries has been stopped and slowed down with the application of silver diamine fluoride.[6] Its usage as a caries arresting agent in schoolchildren resumed in China at the start of the twenty-first century.[7]

3. Remineralizing Agents

3.1. Casein derivatives

A. Casein Phosphopeptide Amorphous Calcium Phosphate (CPP-ACP) –

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A helpful cario-static agent for preventing dental caries is CPP-ACP. It can be applied as follows:

1. An additional preventative treatment to lower dental cavities in patients at high risk.
2. Minimize tooth erosion in those suffering from acid reflux or other digestive issues, in order to lessen decalcification in orthodontic patients.
3. To desensitize teeth, restore enamel in situations where white spots are present, and treat fluorosis or orthodontic decalcification.[2]

Clinical Application
Varnish™
There is 5% sodium fluoride in it.
Daily Care Products
Paste™ and MI Paste Plus™
It contains 0.2% sodium fluoride.[8]

3.2. Calcium phosphate systems

A. Tri-Calcium Phosphate (TCP)[2]

1. *Clinical Application:* Vanish Varnish 5% NaF& Vanish XT Varnish
2. *Daily Care Products:* Clinpro Toothpaste 5000 (5,000 ppm NaF & TCP) & Prevident Booster Plus (5,000 ppm NaF& TCP).

B. Amorphous Calcium Phosphate (ACP)

1. *Clinical Application:* Enamel Pro Varnish (5% NaF& ACP); Enamel Pro Prophy Paste & Enamel Pro APF (1.23% non-acidulated fluoride & ACP).
2. *Daily Application:* Relief Oral Care Gel (1,000 ppm NaF, KNO_3& ACP).
3. *Whitening Products:* Day white / Night white, only whitening with CP added.[9]

3.3. Pronamel

1. Potassium nitrate (5%) is included to assist reduce tooth sensitivity.
2. Sodium fluoride, which provides 1500 ppm or 0.15% w/v fluoride ion, is the component that gives fluoride.[2]

3.4. Enamelon

1. Enamelon is made up of sodium fluoride and unstabilized calcium and phosphate salts. This product's maker states that the soluble calcium and phosphate, which are the constituents of enamel, are delivered in combination with fluoride in its liquid calcium formula.
2. Previous investigations in both the lab and on humans have demonstrated the benefits of Enamelon toothpaste in minimizing white spot lesions as well as in restoring and remineralizing tooth enamel that has been weakened by acidic beverages.

3.5. Calcium sodium phosphosilicate (CSP)

A. Novamin®

Daily Care Products: SensodyneNupro New Solutions (5,000 ppm NaF& CSP) & Renew Toothpaste (5,000 ppm NaF& CSP).[2]

3.6. Di calcium phosphate dihydrate (DCPD)

1. Regarding fluoride stability, DCPD abrasive is special. To better understand how DCPD contributes to the beneficial effects of fluoride in the mouth, a number of experiments were carried out.
2. After a sucrose challenge in humans, the effect of DCPD or silicon dioxide slurries on the intraoral plaque pH was assessed. The results showed that as compared to silica, DCPD slurries were more successful at preventing plaque pH reduction. Compared to MFP/silica toothpaste, toothpaste combining MFP and DCPD was noticeably more effective.

3.7. Ion exchange resins (IER)

1. Pharmaceutical scientists have been paying close attention to Ion Exchange Resin due to its many uses as a medication delivery medium. In recent years, research has demonstrated that IER are equally appropriate for use with drug delivery modalities such as transdermal, topical, nasal, controlled release, and taste masking.
2. The capacity of a dentifrice containing a combination of ion-exchange resins (referred to as NMTD), which provides calcium, fluoride, phosphate, and zinc ions, to encourage remineralization and/or prevent demineralization of dental human enamel in a pH cycling model. The regulated release mechanism that the ion exchange system offers for the anti-carious therapy of tooth tissues is one of its advantages.
3. The dentin's mineralization is improved and its demineralization is decreased by the fluoride ions that seep into the dentin. As a result, dentin that has been exposed to fluoride ions provides more protection against secondary caries than dentin that has not.
4. There has also been research on topical fluoride gel application as a main caries prevention strategy. Consequently, it is anticipated that the use of fluoride-releasing materials in conjunction with fluoride gel will result in a more effective control of secondary caries.[2]

4. Slow-Release Fluoride Devices

In dentistry, intraoral fluoride release devices have been designed in an effort to address patient compliance problems for high-risk caries populations. [10]

4.1. Types of fluoride-releasing devices

1. The copolymer membrane type
2. The glass bead
3. Sodium fluoride (NaF) and hydroxyapatite.
4. Slow fluoride release tablets for intrabuccal use

4.2. Copolymer membrane device

1. In the United States, Cowsar et al. (1976) created it. Hydroxyethyl methacrylate (HEMA) makes up the inner core of this membrane-controlled reservoir-type device.
2. Comprising a tiny pellet that may be affixed to the surface of the tooth or somewhere nearby. This system is a membrane-controlled reservoir type with an inner core made of a 50:50 copolymer of methyl methacrylate (MMA) and hydroxyethyl methacrylate (HEMA), containing a specific proportion of sodium fluoride (NaF). The rate of fluoride release from the device is regulated by a 30:70 HEMA/MMA copolymer membrane encircling the core. Granulated NaF is diluted in little amounts after the matrix hydrates, until the matrix reaches saturation. The devices function as an exact and dependable release controlling mechanism because of the precise water absorption rates of the inner and outer cores.

4.3. Glass device

Curzon created the glass gadget in the United Kingdom in 1984.When moistened with saliva, the fluoride glass device dissolves gradually, releasing fluoride without appreciably compromising its structural integrity. [Andreadi and others, 2006].

4.4. Eudragit RS100 diffusion-controlled fluoride system with hydroxyapatite

1. It contains 18 mg of NaF and is intended to release 0.15 mg F/day.
2. This is the newest type of slow release F device, which consists of a mixture of hydroxyapatite, NaF and Eudragit RS100. It was demonstrated that the use of this device is able to significantly increase salivary and urinary F concentrations for at least 1 month. [11]

4.5. Slow fluoride release tablets (For intrabuccal use)

Tablets ranging from 160–200 mg were created with tooth-cementing in mind. It is possible to apply sodium fluoride mechanically or by impregnation. In this sense, fluoride can be used to treat any chronic buccal ailment. [10]

Fluoride devices have been proven to be effective in achieving:

1. Caries reduction
2. Remineralization
3. Dental sensitivity reduction [12]

4.6. Fluoride Prophylaxis Paste

1. Dental prophylaxis with a mildly abrasive paste using a brush or rubber cup in a dental hand piece is typically performed before topical fluoride application. This is no longer considered necessary, unless it is done for aesthetic purposes, such as stain removal. All prophylactic procedures on teeth using pumice pastes should ideally be followed by topical fluoride treatments to replenish and enhance fluoride concentrations. Prophylaxis of enamel surfaces results in the removal of the pellicle and the superficial layer of enamel; surface enamel has a higher fluoride content than internal layers. If fluoride-containing prophylactic paste is used, the lost fluoride is replenished and there is a small but significant net gain in the fluoride concentration.
2. According to clinical investigations, using fluoride-containing preventive paste alone without applying a topical solution or gel thereafter does not have a caries-reducing impact that is equivalent to that of using topical solutions or gels. [13]

1. Glitter Prophy Paste
2. ZoobyProphy Paste (Denticator)
3. Hygiene Pro Glisten Prophy Paste
4. Fusion Prophy Paste
5. Glitz Prophy Paste
6. Butler Prophy Paste
7. Defend Prophy Paste [14]
8. Acclean Prophy Paste
9. Ziroxide Prophy Paste
10. Waterpik Soft Shine Prophy Paste [15]
11. Nupro Prophylaxis Paste
12. Quala Prophy Paste

5. Conclusion

It is vital for the dental practitioner to be aware of certain characteristics of the chosen topical agent in order to determine the formula and concentration that will work best for treating a particular dental issue for a given patient.

Despite the lengthy history and widespread use of these medications, doctors should be familiar with their fundamentals and safe usage. Keeping the patient informed is a crucial supplement to optimize the advantages and reduce the hazards.

In conclusion, it is possible to state that:
"An Ounce of Prevention is Worth a Pound of Cure."

6. Source of Funding

None.

7. Conflict of Interest

None.

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