

Fluoride as Remineralizing Agent is a Boon for Pediatric Dentistry: A Review

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Abstract

Remineralization is described as the method in which calcium and phosphate ions are supplied by external source to the tooth thereby converting ion deposition into crystal voids in demineralized enamel and thus producing net mineral gain. Remineralizing agents have biomimetic ways to settling of bioavailable calcium, phosphate and fluoride ions and fixation of these ions to non-cavitated caries lesions. The motto of this paper is to concise the information about the recent remineralizing agent directing to “treat early lesions” non-invasively.

Key words : Remineralizing agents, fluoride, Dental caries

INTRODUCTION

In 1957, Arnold was the first author to reveal the post-eruptive outcome of fluoride and the capability of topical fluoride present in drinking water to decrease the occurrence of caries. The technique by which fluoride increases caries resistance may occur from both systemic and topical applications of fluoride and can be largely categorized as follows - increase enamel resistance, improved rate of maturation, remineralization of early caries, intervention with micro-organisms and enhanced tooth morphology.¹

against enzymes which are necessary for bacterial growth and metabolism.^{2,3}

Fluoride is at best levels has anticaries effect which is blessing to the preventive dentistry. When salivary pH increases to 5.5 and supersaturated with calcium and phosphate, it pushes back minerals back to tooth, fluoride renders the surface more acid resistant by restoring the calcium and phosphate ions collectively and absorbs into remineralized surface. The sum total of fluoride required for remineralization is F level in saliva/plaque - 0.03 to 0.08 ppm for 2 to 6 hrs. About 3ppm of fluoride is required to maintain the equilibrium from net demineralization to net remineralization.⁴

1. Fluoride Varnish

In 1960s sodium fluoride (Duraphat, Colgate, New York) and in 1970s silane fluoride (Fluorprotector, Ivoclar Vivadent, Lichtenstein, Germany), fluorides are first invented and commercialized. The efficacy and ease of operation and comparative safety of products put forwards major leads over other topical fluorides like gels and mouth rinses. Cochrane evaluates this topic and stated that 'application of fluoride varnishes should be done 2 to 4 times a year that will considerably reduce dental caries in primary and permanent dentition. The suggested

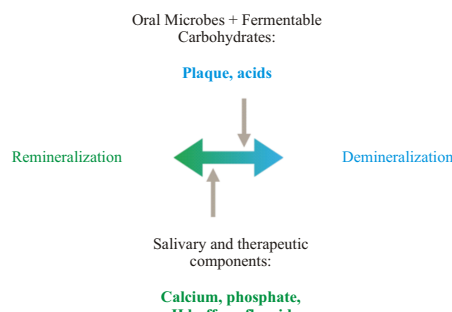


Fig. 1- Oral Equilibrium between Demineralization / Remineralization.

The method of action of fluoride as follows :

- The fluoride ion replaces with hydroxyl group in the apatite crystal and makes fluorapatite which is more stable and less soluble crystal.
- Fluorides imparts to remineralization of incipient lesions, and it go into the void spaces on the apatite crystal and gives stability by the additional bonds.
- Fluoride acts as an antibacterial agent

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incidence of use of fluoride varnish and gels is 2 times per year for moderate risk and 2 to 4 times per year for high risk patients.^{5,6}

	High Risk	Moderate Risk
Under age 6	Fluoride varnish; 2-4 times per year (6 month or 3 month intervals)	Fluoride varnish at 6 month intervals
6 - 18 years of age	Fluoride varnish or gel; 2-4 times per year (6 month or 3 month intervals)	Fluoride varnish or gel at 6 month intervals
Over 18 years of age	Fluoride varnish or gel; 2-4 times per year (6 month or 3 month intervals)	Fluoride varnish or gel at 6 month intervals

Table 1. ADA Council on Scientific Affairs Recommendations

2. Fluoride Gels

In United States, fluoride gels made accessible in the beginning of 1960s. Gels are presented in neutral and acidulated phosphate fluoride (APF) compounds. Gels are typically proposed for elder children, teenagers and adults to avoid the hazard of swallowing. Most commonly used gels is 1.23% F acidulated phosphate fluoride (APF) and supplied in Styrofoam mouth trays.⁷

	Varnish	Gel
Permanent dentition	0.5 ml (11.3 mg F)	4 - 8 ml (49.2 -98.4 mg F)
Mixed dentition	0.4 ml (9.04 mg F)	4 - 8 ml (49.2 -98.4 mg F)
Primary dentition	0.25 ml (5.65 mg F)	Not Remommended
Infants	0.1 ml (2.26 mg F)	Not Remommended

Table 2. Treatment Doses

3. Fluoride Dentrifices

During late 1960s fluoridated toothpaste was manufactured and is today the majority vehicle distributing fluoride to the oral cavity. Stannous fluoride level of fluoride ranges between 500 and 1500 PPM, chiefly in the form of sodium fluoride and sodium monofluorophosphate or their grouping. Toothpastes are also existed as aminofluoride (AmF) or Stannous fluoride (SnF₂). Mouth rinse can be used in combination with toothpaste are suggested for individual having vulnerability to dental caries. Mouth rinses which are normally available that includes 0.05%NaF(equivalent to 226 ppm of F).^{7,8}

4. Fluoride Containing Delivery Devices

These devices aids in preserving a considerably high level of F in dental plaque and saliva.

Mucoadhesive Tablets

For the management of oral cavity bio-adhesives measures plays best role. These measures adheres to tissues like mucosa for a prolong time to prevent against dental caries.⁹

Chitosan Micro-particles

Chitosan is a polymer of chitin formed by fractional deacetylation. It has antibacterial properties against broad range of pathogenic micro-organism. Nano-sized particles and being positively charged it provides fine muco-adhesive properties. As nano-particles contains sodium fluoride acts as reservoir for the early burst and constant release of F.

Elastomeric Rings

During fixed orthodontic treatment, for the prevention of incipient white spot lesions various measures have been available like Fluoridated tooth paste, mouth rinse, orthodontic adhesives and cements releasing fluoride but these have patient compliance issues. To overcome these short comings F releasing biocompatible polyethylene co- vinyl acetate polymer have formed. For well monitored and proficient release of F PEVA is layered with pure polymer.

Polyhydroxy ethylmethacrylate: For restricted release of F in simulated saliva photo polymerized PHEMA membranes are coated with sodium fluoride and surface layered with polyhydroxybutyrate. The quantity of F release is 0.02- 1 mg F/day.^{9,10}

CONCLUSION

Minimal Intervention Dentistry is not a strategy, it is a philosophy. The future of dentistry will rely on regeneration of tooth structure. Understanding the remineralization process allows dentist to treat the lesion before cavitation. More clinical trials are necessary to know efficacy of these newer remineralizing agents. Evidence suggests that initial non cavitated lesions can be remineralized using appropriate technologies, both Fluoride and non fluoride based.

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