T
his article is the second in a two part series which discuss current concepts in the use of fluoride products.

At-home self-applied fluoride therapies comprise dentifrices (toothpastes), rinses, gels and therapeutic oral care products to which fluoride has been added. Fluoride concentrations in various products vary from 200 or 220 ppm in daily NaF or APF rinses, to 400-550 ppm in child strength toothpaste, to 900 ppm in weekly fluoride mouthrines, to 1000-1100 ppm in adult strength toothpastes, to 5,000 ppm in high strength toothpaste.

The primary action of these various therapies is to enrich the levels of fluoride in the intra-oral fluoride reservoir, which explains why the effects of these measures are additive to those of fluoride delivered through the reticulated water system. Fluoride delivered through toothpastes and rinses works primarily via topical mechanisms (inhibition of demineralization, enhancement of remineralization), whilst when used in gels and high-concentration toothpastes, the major mode of action is inhibition of bacterial enzymes.

For some time after eruption, the enamel remains porous enough to absorb fluoride relatively easily, and throughout life, fluoride can be absorbed readily at any site where the enamel is porous. Not surprisingly, when the acidogenic activity of bacteria in dental plaque leads to demineralization and increases the porosity of surface enamel, the uptake of fluoride is enhanced. If no additional acid is supplied, the pH will rise and dissolved mineral not leached out will re-precipitate. In the presence of fluoride, the precipitated apatite which contains fluorapatite requires a lower pH (greater acid challenge) to dissolve it, and if this occurs it will provide further fluoride ions to again enhance re-precipitation.

This concept underpins the concept of “low concentration, prolonged time” upon which common home care protocols are based. In the remineralization process, saliva plays a key role as a reservoir for ions such as calcium phosphate and fluoride. Low levels of fluoride in the saliva are achieved after use of a fluoride dentifrice or mouthrinse, although only for 2 hours rather than for several hours (in the case of fluoride gels) or days (in the case of fluoride varnish).

Fluoride mouthrines
The effectiveness of rinsing with neutral sodium fluoride solution has been clearly demonstrated in supervised school based programs in children with moderate and high caries risk. Fluoride mouthrinising programs have utilized two different strengths (0.05% for daily use, and 0.2% for weekly use), and have given an average caries reduction of approximately 30%. A major issue with fluoride mouthrinising is compliance. In an assessment of compliance conducted by Geiger et al. (1992), only 13% of the 206 participants fully complied with the rinse protocol; 42% of the subjects used the rinse approximately every other day; and 45% used the rinse less frequently. Importantly, a significant dose response relationship was noted in which those who rinsed at least once every other day had fewer lesions (21%) than those who rinsed less frequently (49%).

Current recommendations are that fluoride mouthrinising be used only when the individual’s caries activity or risk justifies it, and not as a universal measure. This is true whether or not the individual is also receiving the benefits of community water fluoridation.

Over-the-counter daily fluoride mouthrines generally contain 0.05% NaF (200-220 ppm F). A 10 mL volume should be swished around the mouth vigorously once each day for one minute (ideally just before bedtime) and then expectorated. Patients should not rinse afterwards for 30 minutes. Pharmacy-only “weekly” fluoride mouthrines typically contain 0.2% NaF (900 ppm F). They are designed to be used under adult supervision, once each week for one minute. Because children under six years of age and some disabled children may swallow a mouthrinse rather than spit it out, fluoride mouthrines are not recommended for them. Providing that the quantities of fluoride rinse or other products given to older children and adults for home use are monitored carefully and are not excessive (e.g. 200 mL of rinse, or 30 mL of gel), and the rinse is spat out after use, the potential for toxic effects in these patients is minimal. Nevertheless, such products should be regarded as medicines and kept out of reach of young children.

In patients considered to lie above the risk threshold, frequent exposure to low dose fluoride mouthrines which provide readily available fluoride ions able to consolidate the remineralization of enamel is a useful strategy. Patients in this group would include those having fixed orthodontic treatment, where enamel demineralization is a common occurrence. This boosting of salivary fluoride levels is best achieved with mouthrines used at a time of day other than immediately after toothbrushing, although high fluoride dentifrices could also be considered if a chemical plaque control was also desirable or necessary at the same time.

The author prefers neutral NaF rinses to APF rinses for at-home use because the low pH (~2-3) and high titratable acidity of APF rinses can contribute to erosive damage of glass ionomer restorations and the glass-based fillers in composite resin, as well as the loss of glaze of porcelain restorations, if such rinses are used on a daily basis.

Low concentration fluoride dentifrices for children
In fluoridated communities, the use of a fluoride-containing dentifrice from the time the teeth erupt (approximately 6 months of age) to the age of 17 months is contra-indicated because ingestion may increased the risk of mild fluorosis. In non-fluoridated areas, the lack of exposure to optimally fluoridated water poses a different situation in which the use of a low fluoride (child strength) dentifrice may be indicated according to the perceived level of caries risk, as gauged by a dental professional.

From the age of 18 months to 5 years (inclusive), children in both fluoridated and non-fluoridated communities receive the benefits of fluoride from dentifrices, gels and therapeutic oral care products. For some time after eruption, the enamel remains porous enough to absorb fluoride relatively easily, and throughout life, fluoride can be absorbed readily at any site where the enamel is porous.
non-fluoridated communities should use a low fluoride (400-550 ppm) dentifrice. Only a small (pea-sized) amount should be used, and the child should be supervised while brushing to avoid them using or ingesting excessive amounts of dentifrice. After brushing they should expectorate as much as possible but not rinse or swallow.

**Normal concentration fluoride dentifrices**

Fluoride formulations in conventional dentifrices may be NaF, monofluorophosphate (MFP), or stannous fluoride: all have similar cariostatic effects. When fluoride dentifrices are used regularly two or three times a day, they provide a frequent source of fluoride in low concentrations that can inhibit demineralization and enhance remineralization. Fluoride dentifrices constitute greater than 90% of the overall Australian toothpaste market. Normal usage in tooth brushing with a conventional fluoride dentifrice will reduce the incidence of dental caries by some 20–25%. Conventional fluoride dentifrices are considered responsible for low caries incidence in children in many Western countries in recent decades.

Fluoride dentifrices are recommended for patients of all ages, whether or not they live in fluoridated or non-fluoridated areas. One brushing should be done just before bedtime, so that fluoride is present in the intra-oral reservoir prior to a period of low resting salivary flow, thus prolonging its availability. Thus, dentifrices with a fluoride concentration from 1,000-1,100 ppm are suitable for normal twice-daily use in all individuals from 6 years of age. After brushing, patients should expectorate, but not rinse or swallow.

**High fluoride dentifrices**

As noted in the first article in this series, fluoride at a level of 5,500 ppm has considerable properties as an antibacterial agent, and thus providing this level in a dentifrice is ideal for high caries risk teenagers and adults since compliance is achieved easily and there is a very favourable benefit/cost ratio. These products are not indicated for use in children. They should be used in place of a conventional dentifrice at bedtime. After brushing, patients should expectorate, but not rinse or swallow. They should then refrain from eating or drinking for at least 30 minutes.

When used on a daily basis, high fluoride toothpastes are a valuable component of the preventive program for a high caries risk teenager or adult. Their ease of use is a major positive factor, particularly in elderly patients whose dexterity may be impaired. The use of dentifrices containing 5,000 ppm fluoride has been shown to be effective for arresting incipient and leathery root surface caries lesions, when used over a 6 month period.

**Fluoride gels**

The mechanisms of action of these products were discussed in the first part of this series. Home use of gels (5,000-9,000 ppm) may be indicated in adult patients at high risk of dental caries or dental erosion because of salivary dysfunction, where it would normally be used in combination with other measures designed to enhance remineralization, elevate salivary pH, and provide symptomatic relief of symptoms of oral dryness. Its home use is contraindicated in children.

Patients with periodontal attachment loss or sensitive cervical dentine may gain significant benefit from frequent application of a stannous fluoride gel following toothbrushing with a conventional dentifrice. Products of this type, such as Colgate Gel-Kam, contain 1,000 ppm fluoride with 3,000 ppm stannous ion, the latter being responsible for a level of anti-bacterial activity. Some stannous fluoride products contain citric acid as a flavouring agent which presents a potential risk for erosion of dentine if the patient’s salivary parameters are compromised and the gel is used on a daily basis. Stannous fluoride gels are suitable for use in teenagers and adults, and can be used once daily for an anti-plaque action, or twice daily for a desensitizing action. Like other fluoride gels, they are not a substitute for brushing, and are used after completing normal toothbrushing. For maximum benefit, stannous fluoride gel should be left on for 60 seconds, then expectorated. There should be no eating or drinking for 30 minutes afterwards.

Fluoride gels are normally applied at home on a separate (dry) toothbrush (after normal mechanical oral hygiene has been completed). It is not normally necessary to fabricate special trays for home fluoride gel treatment. Trays used for home vital bleaching materials can be used if a more sustained contact time is desired. Customized (vacuum formed) soft trays with 4 or 5 drops of NaF neutral gel are particularly useful for patients undergoing head and neck radiation treatment, bone marrow transplantation, anti-neoplastic chemotherapy, or who suffer from the more severe forms of xerostomia, since they allow greater application time to be achieved in areas of high caries risk, such as proximal surfaces and cervical surfaces.

As a combined preventive and therapeutic agent, self-applied fluoride gels will best benefit patients with high caries activity, salivary flow problems caused by drugs or radiation therapy, Sjögren’s syndrome, root surface caries, dentinal hypersensitivity, over-dentures and recurrent caries around the margins of existing restorations. The trays are made from sheets of 0.5 mm thick clear plastic that are vacuum molded to study models. The boundaries of the trays should extend past the gingival margin by about 1.5 to 2.0 mm. Neutral NaF gel (5,000 or 9,000 ppm F) is placed in the tray for 4 minutes, at night immediately before retiring. When done, the excess should be expectorated. There should be no eating or drinking for 30 minutes afterwards.

**Suggested further reading:**


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