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Products available for topical fluoride therapy

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SUMMARY

In view of the absence of water fluoridation in South Africa, topical fluoride therapy plays an important part in preventive dentistry. Various topical fluoride agents available in this country, their mode of application, efficacy and possible advantages or disadvantages are discussed in terms of the current literature.

OPSOMMING

As gevolg van die feit dat daar geen waterfluoriedvermenging in Suid-Afrika toegepas word nie, speel plaaslike-fluoried-terapie 'n belangrike rol in voorkomende tandheelkunde. Daar is verskeie plaaslike-fluoried middele in hierdie land beskikbaar; toedieningsmetodes, die doeltreffendheid en moontlike voor- en nadele word in terme van die huidige literatuur bespreek.

INTRODUCTION

One of the most safe, practical and economical means of combating dental caries is by the fluoridation of the public water supplies to an optimal level of 1 ppm of fluoride. The Food and Nutrition Board of the National Research Council in the United States of America has recently classified fluoride as an essential nutrient because of its critical role in the development of teeth which are resistant to dental caries (Horowitz, 1973). In 1972, 146 million people in 31 countries were supplied with optimally artificially fluoridated water (Newbrun, 1972). These populations are 50 per cent less likely to develop caries, even without renouncing sweets or changing their pattern of oral hygiene (Mühlemann, 1967). In the absence of water fluoridation in South Africa, however, other methods must be considered to obtain the cariostatic benefits of fluoride.

Fluoride may be administered in one of two ways, either systemically or topically. Topical fluoride therapy may be professionally- or self-administered. These methods and the fluoride products locally available are briefly reviewed in this paper.

SYSTEMIC ADMINISTRATION OF FLUORIDES

1. Fluoride-containing tablets

The administration of fluoride in tablet form permits an optimum daily intake of fluoride. This intake is especially valuable during the period of tooth formation, namely from birth to 12 years. Excellent clinical results have been reported and protection against dental caries may range from 20% to 50% depending on the duration of fluoride ingestion (Horowitz, 1973). Several brands of fluoride tablets are available (Table I).

In the case of infants, the tablets can be dissolved in water or juice, or crushed and mixed into food. Once the teeth have erupted, children should be persuaded to chew, and later to suck the tablets, thus achieving an additional topical effect. Appropriate dosages for different ages are prescribed by the manufacturers.

Fluoride is sometimes incorporated into vitamin and mineral pre-natal supplements, but the indications are that this does not affect subsequent caries incidence in the child (Lilienthal and Lang, 1971; Geddes, Jenkins and Stephen, 1973).

The risk of acute toxicity resulting from the accidental ingestion of a large number of tablets exists, and must be stressed. A potentially lethal dose for a toddler is 100 mg of fluoride (Geddes *et al.* 1973) and this amount is the maximum that should be prescribed at a time. The fact that maximum benefit is derived from regular and continuous use makes parental supervision and co-operation essential.

TABLE I

BRANDS OF FLUORIDE TABLETS

Brand	mg fluoride as NaF/tablet	
En-De-Kay[1]	1,0	
Pacemaker[2]	1,0	(flavoured)
Zymofluor[3]	0,25	

1 Commercial and Industrial Dental Company (Pty) Ltd.
2 P. Grant Smith
3 Ciba-Geigy (Pty) Ltd.

TOPICAL ADMINISTRATION OF FLUORIDES

A. Professionally administered

Once crown formation is complete and the permanent teeth have erupted, the enamel fluoride content may be increased by various methods of topical fluoride treatment. Although these procedures are benefi-

cial to patients of all ages, increased benefit may be derived immediately after the eruption of the permanent teeth since at this time the enamel is particularly able to incorporate minerals from the oral environment (Massler, 1970).

1. Fluoride gels

The gels locally available are listed in Table II, together with the type of fluoride used and the concentration of total ionic fluoride. As a rule gels are flavoured and pleasant tasting, which may facilitate their use with young children.

Gels may be applied with an applicator such as a cotton pellet, or using any of the pre-formed trays available for this purpose. Trays may also be individually moulded using disposable wax mouthpieces. This promotes a close contact which may not be achieved from an ill-fitting pre-formed tray. Gel application may be modified using iontophoresis whereby the teeth are charged with a small positive electrical potential thereby attracting the negative fluoride ions from the gel. The manufacturers of Fluocaril and Ion products supply iontophoretic instruments and their gels are specifically suitable for iontophoresis.

2. Fluoride solutions

Solutions for topical application are also available (Table III). These are applied with cotton pellets or in trays lined with filter paper.

The same fluoride composition is used in many of the gels and solutions (Tables II and III). In most

TABLE II

FLUORIDE GELS

Brand	Type of fluoride	% Fluoride ion	Components	pH
Pacemaker[1] En-De-Kay[2,3] Raflour[2,4] Ion[2,4] Luride[5]	acidulated phosphate fluoride (APF)	1,23	sodium fluoride, hydrogen fluoride, phosphoric acid.	3-4
Elmex[6]	amine fluoride	1,25	[bis-(hydroxyethyl) -aminopropyl-N-hydroxyethyl-octadecyl dihydrofluoride], cetylamine-hydrofluoride, sodium fluoride.	4,6
Fluoracil[7]	monofluoro-phosphate (MFP)	2,0	sodium monofluoro-phosphate, sodium fluoride.	6,5

1 P. Grant Smith (Pty) Ltd.
2 Dental Supply and Import Co. (Pty) Ltd.
3 Commercial and Industrial Dental Co. (Pty) Ltd.
4 Protea Surgical and Dental Services (Pty) Ltd.
5 Millner's Dental Suppliers Cape (Pty) Ltd.
6 Oramed (Pty) Ltd.
7 De-Nol Laboratories (S.A.) (Pty) Ltd.

TABLE III

FLUORIDE SOLUTIONS

Brand	Type of fluoride	% Fluoride ion	Components	pH
Rafluor[1,2] Ion[1,2]	acidulated phosphate fluoride (APF)	1,23	sodium fluoride, hydrogen fluoride, phosphoric acid.	3-4
Caulk[3]	stannous fluoride	1,9	stannous fluoride	neutral
Elmex[4]	amine fluorides	1,0	[bis-(hydroxyethyl) -aminopropyl-N-hydroxyethyl - octadecyl -amine dihydrofluoride], oleylamine-hydrofluoride.	4,6

cases this is the acidulated phosphate fluoride (APF) composition originally developed by Wellock and Brudevold (1963). This has repeatedly been shown to be an effective cariostatic agent (Wellock and Brudevold, 1963; Wellock, Maitland and Brudevold, 1965; Horowitz and Doyle, 1971). Horowitz and Heifetz (1970) in their review quote reductions in DMF increments after treatment with APF of 40% to 67%, depending on the design of the clinical study. An 8% stannous fluoride solution (SnF_2) has been shown to be an effective topical agent (Mercer and Gish, 1966). These authors claim that it is superior to APF, while Cartwright, Lindahl and Bawden (1968) found APF more effective than SnF_2. Stannous fluoride has the undesirable effect of staining teeth (Wellock *et al.* 1965), and the additional disadvantage of having to be freshly prepared since it is unstable in solution. On the other hand APF has a good shelf-life.

Gaum, Cataldo and Shiere (1973) found adverse gingival reactions to APF gel. They attributed this to the low pH of the gel rather than the fluoride content. The same effect may be expected from all gels and solutions which are acidic and care should be taken to protect the gingivae from contact with the gel or solution during topical application.

Neutral solutions of sodium fluoride (NaF) have also been used as topical agents, but have been shown to be less effective than APF (Pameijer, Brudevold and Hunt, 1963).

Mühlemann (1967) reported that organic amine fluorides have superior cariostatic effects to inorganic fluorides. In addition, Gülzow and Lang (1967) found that topical applications of amine fluorides caused a greater decrease in acid solubility of human enamel than did NaF.

3. Fluoride-containing varnish

Koch and Petersson (1972) found that the application of a fluoride-containing varnish, Duraphat[1], to extracted teeth significantly increased the fluoride concentration of the enamel up to a depth of 80 μm. Duraphat contains 50 mg of NaF, which is equivalent to 22,6 mg of fluoride ion, per ml. It is recommended for general and secondary marginal caries prophylaxis.

4. Prophylactic pastes

The use of these pastes should not supplant other methods of topical fluoride application but should rather be used in conjunction with them. If cleaning is not to be followed by a topical application, prophylaxis paste should contain fluoride in an effort to replace the superficial fluoride that is removed during prophylaxis (Whitehurst, Stookey and Muhler, 1967; Stearns, 1973).

Caulk Zircate[2] treatment paste containing 9 per cent SnF_2 and Pacemaker[3] prophylaxis paste containing 4,4 per cent NaF are available. Whitehurst *et al* (1967), have shown that Zircate paste reduces enamel solubility. Promising results have been obtained using this paste in mass treatment of children in a caries prevention programme during which the paste was self-applied (Muhler, 1968; Lang *et al.* 1970). Stearns (1973), using a NaF-containing prophylaxis paste, found that the fluoride concentration was maintained in the teeth after prophylaxis. Whitehurst *et al* (1967), comparing a SnF_2-containing paste with one containing NaF, found the former to be more effective in reducing enamel solubility. The NaF in this case was, however, in a much lower concentration than that in the Pacemaker paste.

[2] P. Grant Smith (Pty) Ltd. [3] P. Grant Smith (Pty) Ltd.

B. Self administered

Considering the shortage of manpower in the dental profession and the high cost of topically applied fluoride treatment, self-applied agents offer a promising supplement to a caries prevention programme.

1. Fluoridated toothpastes

The use of fluoridated toothpastes is a practical and inexpensive extension in such a programme. Various formulations of fluoride dentifrices have been shown to reduce dental caries in the range of 15 to 30 per cent (Marthaler, 1968; Horowitz, 1973). Several brands of therapeutic fluoride dentifrices are available on the market (Table IV).

TABLE IV

FLUORIDE-CONTAINING TOOTHPASTES

Brand	% Fluoride ion	Fluoride compound
Fluoro-Gard[1]	0,1	MFP
Signal[2]	0,1	MFP
For Keeps[2]	0,1	MFP
Aquafresh[1]	0,1	MFP
Macleans[3]	0,1	MFP
Fluocaril[4]	0,1	MFP, NaF
Elmex[5]	0,125	Amine fluoride

[1] Colgate-Palmolive Ltd.
[2] Elida-Gibbs (Pty) Ltd.
[3] Beecham S.A. (Pty) Ltd.
[4] De-Nol Laboratories (S.A.) (Pty) Ltd.
[5] Oramed (Pty) Ltd.

Stannous fluoride and sodium monofluorophosphate (MFP) have both been found effective in reducing caries (Fanning *et al.* 1967; Naylor and Emslie, 1967; Mergele, 1968; Møller, Holst and Sørensen, 1968; Thomas and Jamison, 1968). Sodium monofluorophosphate is today generally favoured above SnF_2 which was again reported to cause staining of tooth enamel (Naylor and Emslie, 1967). Sodium fluoride is less frequently used in toothpastes but has also been shown to be effective (Reed, 1973). In Switzerland the amine fluoride-containing dentifrices have given dramatic results in reducing dental caries (Mühlemann and Schmid, 1958; Mühlemann, 1967; Marthaler, 1968).

The low concentration of fluoride ion in toothpastes make them safe for children to use. It should be kept in mind that greater effectiveness of a therapeutic dentifrice may be achieved when frequent use is accompanied by careful and thorough brushing.

2. Mouthwashes

Regular rinsing with a fluoride-containing mouthwash has been shown to be beneficial in reducing tooth decay (Torell and Ericsson, 1965; Horowitz, Creighton and McClendon, 1971; Aasenden, DePaola and Brudevold, 1972; Heifetz, Driscoll and Creighton, 1973; Rugg-Gunn, Holloway and Davies, 1973). Depending on experimental conditions, caries reductions between 25 and 50 per cent have been reported (Horowitz *et al.* 1971; Aasenden *et al.* 1972; Rugg-Gunn *et al.* 1973).

Torell and Ericsson (1965) found the daily use of a 0,05 per cent neutral NaF solution to be more effective than one fortnightly rinse with a 0,2 per cent NaF solution. In general weaker solutions are recommended for more frequent use. As with toothbrushing, regular and continuous use is essential to maintain effectiveness (Koch, 1969). A fluoride mouthrinse manufactured by Pacemaker[3] is available locally and contains 0,2 per cent neutral NaF.

3. Gels

A busy dentist may consider recommending the use of self-applied gels to responsible patients. A kit for self-application is available (Thera-Flur kit)[4] and contains full instructions for use, two pre-formed trays and 24 ml APF gel which has a fluoride ion concentration of 0,5 per cent. This is similar to the kit recommended for use by the U.S. Peace Corps (Law, 1966).

CONCLUSION

The authors do not claim that the products mentioned above are the only ones available for topical fluoride therapy in the Republic of South Africa. These were the products supplied in response to a request which was made to all suppliers known to us. The products have been objectively discussed in terms of the current literature and no preference for any one product is intended. Certain fluoride-containing restorative materials and cements are available, but these fall outside the scope of this article.

We wish to thank the following dental suppliers for their contribution of literature, information and samples.

These firms are listed alphabetically.

Colgate-Palmolive Ltd.
Commercial and Industrial Dental Company (Pty) Ltd.
De-Nol Laboratories (S.A.) (Pty) Ltd.
Dental Supply and Import Co. (Pty) Ltd.
Elida-Gibbs (Pty) Ltd.
P. Grant Smith (Pty) Ltd.
Millner's Dental Suppliers Cape (Pty) Ltd.
Oramed (Pty) Ltd.
Protea Surgical and Dental Services (Pty) Ltd.

[3]P. Grant Smith (Pty) Ltd.
[4]Millner's Dental Suppliers Cape (Pty) Ltd.

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