THE USE OF PROFESSIONALLY APPLIED TOPICAL FLUORIDES IN THE NORTH YORK PUBLIC DENTAL PROGRAM

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The North York Public Health Department Guidelines for topical fluoride application state that only those children classified as high risk caries individuals will receive treatment. This is a common recommendation in areas with fluoridated water systems such as North York and in communities with a low caries prevalence (e.g. Ripa 1988, 1989, 1991), but what constitutes high risk is loosely defined and varies between different populations. Currently in North York, "high risk" in relatively healthy children is defined as individuals with a DMFT of 4 or greater and/or individuals with a high risk sibling. The appropriateness of these guidelines must be evaluated based on the current scientific knowledge of professionally applied topical fluorides. What type of topical fluoride should be used and the "best" method of application should also be examined.

Background

Topically applied fluoride is believed to reduce caries indirectly and directly. The indirect mechanism is the effect that fluoride may have on plaque. The direct mechanism is the effect that fluoride may have on carious lesions, especially very early carious lesions.

Fluoride may indirectly reduce caries by lowering the cariogenicity of plaque bacteria, inhibiting the glucose uptake of plaque bacteria so that the formation of phosphoenolpyruvate is diminished. By lowering the pH gradient across the bacterial cell wall, fluoride may also inhibit bacterial sugar intake. Prevention or a reduction of extracelluar polysaccharide formation may be another mechanism by which

fluoride indirectly reduces tooth decay (Dawes 1989).

Fluoride may also have a direct effect on caries formation or caries retardation. In the past it was believed that fluoride converted hydroxyapatite into fluroapatite which would then leach into the tooth enamel and help prevent caries formation (Ripa 1987; Dawes 1989). However, it is difficult to increase the fluoride content of enamel and recent findings indicate that fluoride may play a larger role in arresting and reversing caries progression rather than inhibiting caries formation. Fluoride in a fluid phase is now believed to retard demineralization of tooth enamel and promote remineralization (Ripa 1987; Nikiforuk 1988; Dawes 1989).

Calcium fluoride (CaF_2) at concentrations above 100 ppm, as is found in many dentifrices, may act as a slow fluoride release mechanism. Originally, it was believed that this substance was disadvantageous, as it lead to some demineralization of the tooth. However, recent findings have shown that a CaF_2 layer forms on the tooth, which then becomes coated with calcium phosphate and protein from saliva. This coating reduces the rate of (CaF_2) dissolution, allowing the substance to act as a slow release agent for fluoride as it slowly dissolves away (Dawes 1989).

Studies have shown that water fluoridation is a very beneficial and cost-effective means at reducing a community's level of dental caries (Dawes 1989). In areas without water fluoridation, self-administered and professionally administered topical fluorides have proven to be effective at reducing dental caries. The effectiveness of topical fluorides in a fluoridated community is questionable however. Most of the studies investigating this combined effect occurred more than 20 years

ago, when caries were much greater than the present levels, and occurred in low immigration areas where most individuals had received long-term exposure to the fluoridated water system. The results of these studies vary according the type of topical fluoride used and the community tested. Some of these studies showed a significant combined effect, while many showed no effect or a marginal, clinically insignificant effect (Burt 1988).

Few studies have investigated the combined effect of a professionally applied topical fluoride in a fluoridated community. A four-year study by Szwejda (1972) showed low reductions in carious lesions and questioned the practicality of using professionally applied topical fluorides in an optimally fluoridated community. A more recent study by Bagramian (1982), involving the combined application of topical fluoride and pit fissure sealant, showed a significant decrease in caries incidence over 5 years, but most of this decline was attributed to the sealants (Ripa 1989). The National Preventive Dentistry Demonstration Program also investigated the clinical effects of sealants, professionally applied topical fluoride, and prophylaxes over four years and found that "sealants were responsible for essentially all the clinical effect" (Bohannan *et al.* 1985). Today, because of these results, the overall decrease in caries prevalence, and the increased exposure to other sources of fluoride such as toothpastes and beverages made with fluoridated water, it is believed that professionally applied topical fluorides are not an efficacious means of reducing caries in the average low to moderate caries-risk child living in a fluoridated community (Burt 1988; Ripa 1988, 1991; Dawes 1989).

Although the overall prevalence of dental caries in North America has decreased greatly in the past two decades (Newbrun 1989; Ripa 1991), a national survey for the National Preventative Dentistry Demonstration Program found that 20% of the children in the U.S. accounted for nearly 60% of all the decay found (Kandelman & Lewis 1988; Stamm *et al.* 1988; Newbrun 1989). These results indicate that there is a group of children, approximately 20-25% in the U.S., who are at a relatively high risk of decay (Newbrun 1989) and who should be targeted for receiving professionally applied topical fluoride in public dental programs (Lewis 1988; Ripa 1988; Dawes 1989).

The 1989-90 Ontario Ministry of Health (OMH) data for the North York area showed the mean DMFT for children aged 7, 9, 11, and 13 years was 0.20, 0.67, 1.11 and 1.97 respectively, with the D and F elements contributing to approximately 95% or more of the score. Examination of the children enroled in the North York Public Health Department school-based dental program in 1990 showed an incidence of decay of almost one tooth surface per child per year (n=22,446). However, the caries distribution among the North York children was not uniform. Only 31% of the children experienced new decay, and 7% of the children accounted for over 50% of all the new carious lesions (Woodward & Leake 1992). Clearly there is a group of children that are at much higher caries risk than the average child.

Examination of the data from North York's school-based dental program showed that there was an increased probability of new decay in 1990 if the child had a DMFT of 1 or more prior to his or her 1990 clinical exam. Only 24% of the children

with a DMFT of zero prior to their 1990 clinical experience new decay in 1990, but this figure increased to 42% for children with a DMFT of one or more (Woodward & Leake 1992).

The North York Guidelines for the selection of children who should receive topical fluoride treatment and the fluoride application procedure are listed below (North York Public Health Department, Dental Division Policy and Procedure Manual 1990).

(1) Patient Selection

Any child up to Grade 8 who is identified as "High Risk" or is placed on the CINOT program shall be offered preventive care at least once a year (p. 7.2.10).

High Risk Criteria (p. 7.3.12)

- D.M.F. 20% greater than North York average. i.e. DMF of 4 or more.
- C.P.I.T.N. of 1 or greater.
- Siblings of children identified as having rampant caries.
- Children with special medical problems eg: children with heart disease, enamel hypoplasia, on chemotherapy or radiation therapy, diabetics, children on cortisone therapy, cleft palate, etc.
- Special target group including: handicapped, and migrant children from low fluoride areas, and may include preschool children.
- A child identified as urgently in need of care (CINOT).
- Any other person identified by the dentist.

(2) Prophylaxis

Perform prophylaxis and scaling if required. Use a prophylaxis paste or pumice and glycerine or water. N.B. Any child having a prophylaxis must receive topical fluoride application. However, not all children, even High risk, require a prophylaxis. Fluoride can be applied without a prior prophylaxis (p. 7.3.10).

(3) Fluoride Application

Try the (application) tray in mouth and see if child will accept it. Choose the smallest tray that is comfortable. If the tray is acceptable, apply enough gel (APF gel) to cover all teeth, upper and lower. Hold for one (1) minute. Talk to child to keep his/her attention and watch for gagging.

Avoid * excessive gel
* tight pinching or oversize tray
* not relating to child

For children with small mouths, gagging, etc., it may be wiser to use only 1 tray at a time.

Use cotton (Q-tip) applicators , with cotton rolls, to apply gel in very young children or those that will not accept the tray. Retain gel for one minute on teeth.

Allow child to spit out excess gel and saliva, and wipe the mouth with a cotton sponge, especially in the young child.

Explain the need to keep fluoride on teeth for 30 minutes. The time period between fluoride and eating or drinking anything (including water) is a minimum of 30 minutes. minimum of 30 minutes (p. 7.3.10, 7.3.11).

The North York Guidelines state that only high caries-risk children should receive professionally applied topical fluoride. This is a common recommendation in the literature for children in fluoridated areas (Burt 1988; Ripa 1988, 1991; Dawes 1989). Providing routine applications of topical fluoride to all children will not be cost-effective. North York has a high rate of immigration, and many recent immigrants have never been exposed to fluoridated water and are high caries-risk. Unfortunately, no randomized clinical studies have tested the notion that professionally applied topical fluorides are an efficacious means at reducing tooth decay in high-risk individuals living in fluoridated areas.

Purpose

The purpose of this review is to evaluate the scientific basis of the current North York guidelines for topical fluoride use for relatively healthy children (note: special needs children, such as children with heart disease or the handicapped have not been included). More specifically, the purpose of this report is to answer the following questions with respect to North York's Public Dental Program and revise North York's guidelines if necessary.

(1) Who should receive topical fluoride treatment? Although the criteria of "High Risk" is common in the literature, it needs to be more clearly defined according to the public's needs and the resources available to the North York program.
(2) How often should a child receive a topical fluoride treatment, once or twice per year?
(3) Is a prophylaxis needed before application of topical fluoride?
(4) Must a prophylaxis be followed by a topical fluoride application, even if the child is not at a high risk of caries?
(5) What type of topical fluoride should be used?
(6) How much fluoride should be applied to a child's teeth and what general procedure should be used?
(7) How long should gel be applied, 1 minute as suggested by the manufacturer, or 4 minutes as is most common in clinical dentistry?

Methods

The intention of the literature search performed for this paper was to review any current standards and opinions found in the literature. Effort was made to verify that any standards and opinions were based on scientific evidence, but not to include all the published articles and studies that support or review these standards and opinions. Therefore, reference will not be made to all recent publications dealing with topical fluorides.

To identify articles pertaining to the use of professionally applied topical

fluorides, an initial computer-aided literature search was performed using CD/ROM and MEDLINE. Using the major Medical Subject Heading (MeSH) of **topical fluorides**, the literature was searched for articles published from 1987 through 1991. The results of this search were limited to review articles that were written in english and involved human subjects. Relevant papers were obtained, reviewed, and used to locate additional references.

A second computer-aided literature search for articles published in 1990 and 1991 was performed using MEDLINE, and the MeSH of **topical fluorides**. However, this search was only limited to articles written in english and involving human subjects; the limitation of review articles, used in the initial search, was removed. The focus of this search was to locate very recent information not included in the review articles or to locate information pertaining to areas that were still in question. Relevant papers were obtained, reviewed, and used to locate additional references.

Claims made by the authors of the articles included in this paper were examined for scientific support, such as a clinical trial. Studies that, involved root caries, tested other procedures or products concurrently with fluorides (e.g. pit and fissure sealants), were based on personal opinion without clinical evidence, or were *in vitro*, were excluded from this paper. However, when *in vivo* evidence was lacking *in vitro* evidence was included.

The initial MEDLINE search identified articles from 4 recent issues of dental journals that focused primarily on topical fluorides (*Journal of Dental Research* 1987,

1990; *Journal of Public Health Dentistry* 1989, 1991). Thirteen articles were selected from these journals. Citations within these review articles were the source of most of the other references cited in this paper.

The second computer-aided literature search did not result in many more references being found. Of the 43 references listed by MEDLINE, only 8 relevant articles met the inclusion criteria and only one of these articles was not found via the initial search.

Two other sources that were not available through the computer-aided search were also included in this paper, three articles (Burt 1988; Lewis 1988; Ripa 1988) prepared for the Department of National Health Welfare, and a paper presented by Johnston (1992) at the Toronto workshop "Evaluation of Current Recommendations Concerning Fluorides." These articles yielded other relevant references.

Guidelines from the University of Toronto and the University of Western Ontario were also examined. Information on paediatric dentistry, preventive dentistry, and clinics was gathered through teaching manuals and interviews. Further mention of these guidelines is made only when they were found to present opposing views to the findings of the current literature. It should also be noted that the University of Western Ontario's Paediatric Dental Clinic follows guidelines proposed by the American Academy of Pediatric Dentistry (1992).

Some data from North York's school-based dental program and from the Ontario Ministry of Health were also included in this study. North York data were acquired by examining dental records and program summaries.

Using the available scientific evidence, each question posed in the paper's Purpose was answered and practice guidelines for the use of professionally applied topical fluorides were drafted. When scientific evidence was lacking, expert opinion and other existing guidelines were considered.

After drafting the revised guidelines, this critical review of the literature and its guidelines were reviewed by two expert panels. An Internal Staff Panel consisting of three dentists and one hygienist, all of whom work in North York's school-based dental program, initially assessed this report. Concerns and recommendations of the panel were discussed with members of the Community Dental Health Services Research Unit (CDHSRU) and necessary changes were made to accommodate those providing the dental services. The document was then reviewed by an External Panel of experts consisting of the President of the Royal College of Dental Surgeons, the President of the Ontario Dental Association, an Epidemiologist, an Ethicist, a Paedodontist, a General Practitioner, and a member of the Internal Panel. Concerns and recommendations of the External Panel were discussed with members of the CDHSRU and any recommended changes were made. The review and its guidelines were then finalized after approval by both the Internal and External Panels[1].

[1] Final approval was not received by one member of the external panel. Please see Appendix 1 for this member's minority report.

Findings

(1) Who should receive topical fluoride?

Whether or not a child receives topical fluoride should be based on that child's risk of future caries, and only high risk children should receive treatment. Using past caries experience, the 1990 North York data suggest that children with a DMF of 1 or more had a higher probability (42%) of having one or more newly decayed teeth than children with a DMF of 0 (24%). After their 1990 clinical exam, about 56% of the children had a DMF of 1 or more, and these higher risk children could be targeted for fluoride treatment.

However, the decline in dental caries seen over the past two decades has not been uniform to all tooth surfaces. Up to 90% of the carious lesions in U.S. schoolchildren are pit and fissure lesions, and most these carious lesions occur in the primary and permanent molars. Much of the decline in smooth surface caries has been attributed to the increased use of fluorides, but topical fluorides are not believed to be as effective against pit and fissure caries in terms of percent reductions of caries (Ripa 1885; Weintraub 1989; Truhe 1991). Because of the higher prevalence of pit and fissure caries however, the absolute reduction of pit and fissure caries due to fluoride may be greater than the absolute reduction in smooth surface caries.

Because of the decline in smooth surface caries, consideration should be given to the number and type of caries experienced by a child when selecting children for topical fluoride application. Applying topical fluoride to children with a history of only one pit and fissure carious lesion may be of little benefit to the child, may not

be a cost-effective procedure (Murray *et al.* 1991), and could be viewed as overtreatment. These children may only be at risk to caries in the pit and fissure areas because of their tooth morphology, and so may benefit more from the use of occlusal sealants (Ripa 1985; Kandelman & Lewis 1988; Simonsen 1989; Weintraub 1989; Truhe 1991) than the use of topical fluorides.

A recent fluoride workshop in Toronto also addressed the issue of who should receive topical fluoride treatment (Clark 1992). Based on the workshop's findings, it was recommended that the use of professionally applied topical fluoride be based on the patient's caries risk. The age at which a child should receive fluoride treatment was also discussed but no recommendation was made for professionally applied topical fluoride. However, it was recommended that self-applied fluoride gels fluoride mouth rinses should not be used in children below the age of 6.

Children with a DMFT of one or more should be considered for topical fluoride but consideration should also be given to the type of decay experienced. If the child has only experienced pit and fissure decay once or twice topical fluoride may be of little benefit and should not be applied.

Conclusion 1: Children who have only experienced limited pit and fissure decay are not necessarily at high risk for smooth surfaces caries, and should not receive topical fluoride. Use of topical fluoride should be directed toward children with one or more decayed smooth surfaces.

(2) How often should a child receive topical fluoride?

Although insufficient evidence exists from clinical studies, the University of Toronto and the American Academy of Paediatric Dentistry recommend biannual

applications of topical fluoride. Ripa (1988) suggests that 2 applications per year results in a greater reduction of caries compared to 1 application per year. As evidence for his claim, Ripa (1989) published a table of clinical studies that used either annual or biannual application of topical APF gel (Table 1, note: Table 1 has been modified slightly to include Baseline DMFS).

Table 1. Clinical studies of professionally applied APF gel, using schoolchildren in fluoride-deficient communities (Ripa 1989).

STUDY	STUDY DURATION	NUMBER OF APPLICATIONS PER YEAR	DMFS (DFS) REDUCTION (%)	DMFS (DFS) SAVED PER YEAR	BASELINE DMFS (DFS)
Szwejda et al. 1967*	1	1	4	0.04	1.68
Szwejda 1971*	2	1	3	0.04	1.68
Horowitz 1969	2	1	22	0.58	7.93
Horowitz & Doyle 1971	3	1	24	0.70	7.93
Bryan & Williams 1968	1	1	28	1.10	7.72
Ingraham & Williams 1970	2	1	41	0.65	2.32
Cons et al. 1970	**3	1	18	0.23	3.16
Mainwaring & Naylor 1978	3	2	14	0.39	8.19
Cobb et al. 1980	2	2	35	1.44	6.01
Hagen & Bawden 1985	2	2	30	0.66	5.05

* study results were not significant
** study duration was listed as 4 years by Ripa (1989)

The results in Table 1 only marginally support biannual application more than annual application. However, problems exist with Table 1 and it should not be

considered as conclusive evidence for or against biannual application of topical APF gel. Comparing results of different studies does not control for temporal and spacial differences that exist between study sites. Garcia (1989) advocates excluding data from studies of less than 2 years in duration and excluding data on caries experience from the 1960's and early 1970's because of the secular decline in caries over the past two decades. If these 'rules' of exclusion were followed, none of the annual application studies would qualify for Table 1.

Up until very recently, only one study, Horowitz and Doyle (1971), has examined an annual versus a biannual application of topical fluoride (Ripa 1988). Using APF solution, this three year study found no significant difference between the caries reduction of biannual application versus annual application. The authors concluded that APF is cariostatic, but that there is no greater cariostatic effect when applied biannually compared to annually. Horowitz and Doyle's study also included another group of subjects who received APF gel annually with not biannual comparison, and it is this result that is included in Ripa's table (Table 1). Examination of children in this study 2.5-3.5 years after their last fluoride application showed only a slight decline in caries protection, indicating a possible long-term, residual benefit (Horowitz & Kan 1974).

A current study in Ontario by Johnston and Lewis (Lewis 1992, pers. comm.), appears to confirm Horowitz and Doyle's (1971) result. This three year study is examining the effects of annual versus biannual topical fluoride application of topical fluoride, as well as the effects of receiving or not receiving a prophylaxis prior to the

topical fluoride application. After two years, no difference have been found between the caries increments of children receiving annual versus biannual application or between the caries increments of children receiving or not receiving a prophylaxis prior to fluoride application.

Conclusion 2: No scientific evidence exists to support the belief that biannual applications of topical APF gel result in greater caries reduction than annual applications.

(3) Is a prophylaxis necessary prior to the application of a topical fluoride?

At least three studies have reported that a prophylaxis is not necessary before the application of topical fluorides (Houpt *et al.* 1983; Katz *et al.* 1984; Ripa *et al.* 1984). No difference in caries inhibition was seen between patients who received a prophylaxis before topical fluoride application and patients who did not receive a prior prophylaxis. The ongoing study by Johnston and Lewis (see 1b, above) also supports this finding (Lewis 1992, pers comm).

Conclusion 3: A prophylaxis is not necessary before a topical fluoride application.

(4) Must a prophylaxis be followed by a topical fluoride application, even if the child is not at a high risk of caries?

Dental prophylaxis is a common, often routine procedure, used to clean a patients teeth, and is often followed by an application of topical fluoride. Polishing with prophylaxis paste abrades the tooth's enamel resulting in a loss of the fluoride rich surface layer. This loss of fluoride rich enamel is undesirable (Ripa 1988; Murray *et al.* 1991, p.195,196), presumably because it may increase the risk to decay,

and so the use of topical fluorides following or during a prophylaxis is often recommended.

The clinical significance of a post-prophylaxis risk of decay has never been studied directly. However, the cariostatic effect of fluoridated and non-fluoridated prophylaxis pastes has been investigated in several studies (see Ripa 1988, 1990; Mellberg 1990; Stookey 1990). The results from three of these studies were examined to indirectly determine if a prophylaxis without a subsequent topical fluoride application is "undesirable" and increases a child's susceptibility to tooth decay.

Over a three year period, Axelsson & Lindhe (1974), and Lindhe *et al.* (1975) studied the decrease in plaque, gingivitis, and caries in children who received supervised brushing (10X/year with a 0.2% NaF solution, control group) versus children who received supervised brushing plus a professional prophylaxis (20X/year for first two years, 10X per year for third year) using a fluoridated paste (5% NaF, test group). This study found significantly greater caries incidence in the control group, suggesting that a prophylaxis reduces the patients risk of caries. However, the results were confounded because children in the test group and their parents received extensive education on caries prevention and received twice as many supervised brushing sessions. In a second study, Axelsson and Lindhe (1975) found no difference in caries reduction between fluoridated and non-fluoridated prophylaxis pastes, and concluded that education and efficient plaque removal are probably the largest factors affecting the caries reduction.

Ripa *et al.* also conducted a study on the effect of a biannual prophylaxis on

caries in schoolchildren (Ripa *et al.* 1976). An initial problem with this study was that the average age of his control group (11.6 years), who did not receive a prophylaxis, was more than one year older than his test group (10.2 years). However, no significant difference between in the initial DMFT and DMFS of the control group and test group existed, and after two years (4 prophylaxes), still no significant difference in DMFT and DMFS existed between the control and test groups. It was suggested that prophylaxis had no cariostatic effect, and that a fluoridated prophylaxis paste was no more effective in caries prevention than a non-fluoridated paste.

Overall, the results suggest that frequent prophylaxes and intense education may reduce a child's risk of caries, but no evidence exists to suggest that a single prophylaxis increases a child's risk of caries. An intense prevention program as was used by (Axelsson and Lindhe 1974) could not be considered for a public health system such as North York's. When a child will not receive topical fluoride after a prophylaxis, fluoridated prophylaxis pastes are recommended over non-fluoridated pastes (American Academy of Paediatric Dentistry 1992; Johnston 1992). However, annual or biannual use of these fluoridated pastes should not be considered as tool for caries reduction or as a substitute for professional topical fluoride treatments (Ripa 1988, 1990; Mellberg 1990; Stookey 1990). Prophylaxes should only be used as a means of removing stains and exogenous deposits from tooth surfaces, and polishing of dental hard tissues including restorations (American Academy of Paediatric Dentistry 1992; Johnston & Banting 1992)

Conclusion 4: Prophylaxis and topical fluoride use should be considered independently of one another. There is no evidence to suggest that an annual or biannual prophylaxis alone, without a subsequent application of topical fluoride, will increase a child's risk of caries. Therefore, a topical fluoride treatment is not necessary following a prophylaxis.

(5) What type of topical fluoride should be used?

The approved types of professionally applied topical fluoride treatments are: 2% sodium fluoride (NaF); 8% stannous fluoride (SnF_2); and 1.23% acidulated phosphate fluoride (APF). Acidulated phosphate fluoride is the compound most preferred by dentists (Ripa 1988, 1989; Stookey 1990). No clinical trials comparing the effectiveness of NaF and APF exist, but after a review of the relevant literature, Ripa (1990) concluded that there was no difference between the clinical effectiveness of NaF, SnF_2, and APF.

Many vehicles have been used to apply fluoride compounds, such as brush-on solutions, gels applied using trays, and varnishes (Ripa 1989). Of these, 1.23% APF gels and fluoride varnishes are most common (Dawes 1989). Neither APF solution or gels have consistently been found superior to one another, but gels are easier to use and have a lesser treatment time (Ripa 1988, 1990). It is believed that the use of professionally applied APF will result in an average reduction in caries of 20-30% (Ripa 1988, 1989, 1991). However, it is the absolute reduction in the incidence of decay that is most important when determining clinical significance and this will depend on the caries prevalence in the population.

Only one clinical study of fluoride varnishes has been done in North America

(Clark *et al.* 1985, from Ripa 1988). Because of the professional treatment time per child per year (5-6 varnishings per year resulting in a total professional time of about 1.6 to 2 hours per child) in relation to its cariostatic effectiveness, the product is not acceptable for a public health program. Based on the results of clinical studies, varnish cannot be considered superior to APF or NaF gels (Mellberg 1990).

Concern has surfaced regarding the idea that APF may etch the glass filler in composite restorations and crowns. No etching effect by APF was found after one application, but the cumulative effect of several applications may compromise a restoration's aesthetic appearance. Therefore, the use of APF might be reconsidered for patient with extensive porcelain or composite restorations (American Dental Association Council on Dental Materials, Instruments, and Equipment & Council on Dental Therapeutics 1988).

Conclusion 5: Use of APF gel should be continued.

(6) How much fluoride should be applied to a child's teeth and what general procedure should be used?

To reduce fluoride ingestion during application, no more than two 2-2.5 grams of gel should be placed in each styrofoam application tray, or no more than 40% of the tray's capacity should be filled with gel; amounts should be reduced for small children (Lecompte 1987; Johnston 1992). It is also suggested that the patient be seated upright and that suction be used during and after the application. The patient should also be instructed to expectorate for 30 seconds to one minute immediately following the removal of the fluoride trays (Lecompte 1987; Ripa 1987, 1991).

Conclusion 6: To reduce fluoride ingestion only enough gel should be applied to caver all teeth, but this should not exceed 2-2.5 grams of gel per tray or 40% of the tray's volume. Patients should be seated upright, suction should be used during and after the application, and expectoration should occur for at least 30 seconds immediately following the procedure. For young children, the fluoride gel should be wiped off after application.

(7) How long should gel be applied, 1 minute as suggested by the manufacturer, or 4 minutes as is most common in clinical dentistry?

Although some APF gel manufacturers advocate an application time of only one minute (e.g. "Minute Gel"), there have been no independent clinical trials comparing the cariostatic effectiveness of a 1 minute application time versus a 4 minute application time (Lecompte 1987). Wei & Hattab (1988) did look at fluoride uptake of teeth *in vitro* from 2 different gels ("Minute Gel" and "Nupro") and found that fluoride uptake from both gels was 2.4 to 2.8 times greater after 4 minutes than after 1 minute. Wei *et al.* (1988) also looked at fluoride uptake *in vivo*, using the same two gels, and again found fluoride uptake to be significantly greater after 4 minutes than one minute. Both of these studies support the recommendations by Lecompte(1987) and Ripa (1988) that an application time of 4 minutes should be used until further evidence regarding caries incidence is recorded.

Conclusion 7: Topical fluoride application time should be 4 minutes, not 1 minute.

Recommendations (DRAFT)

(1) Children with one or more decayed smooth surfaces should receive annual topical fluoride treatments on the year of diagnosis and the following year.

(2) No prophylaxis is necessary before the application of topical fluoride. A prophylaxis may be required because of extrinsic stains or calculus build up. However, it is not necessary to follow a prophylaxis with a topical fluoride application unless a topical is indicated based on the child's oral health status (see 1). If no topical fluoride treatment will follow a prophylaxis a fluoridated prophylaxis paste is recommended.

(3) APF gel should be used and applied using a styrofoam tray. Enough gel should be used to completely cover the teeth, but this should be no more than 2-2.5 grams per tray or 40% of the tray's volume. Gel should be retained in on the teeth for 4 minutes and suction should be used during and after the application procedure. Patient should expectorate for at least 30 seconds after the fluoride trays are removed, and gel should be wiped from teeth of young patients. All patients should be instructed not to eat or drink anything for at least 30 minutes.

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APPENDIX 1

Dr. Peter Fendrich
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TELEPHONE: 438-9921

January 22, 1995

Graham L. Woodward
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University of Toronto
124 Edward Street
Toronto, Ontario
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Dear Graham:

re: "Minority Report" on "The Use of Professionally Applied Topical Fluorides in the North York Public Dental Program".

I appreciate the opportunity to express my concerns on this subject, delayed as they may be.

One of the stated purposes of this review is to re-evaluate the existing guidelines of the North York Dental Health Unit with respect to the application of topical fluorides. There was certainly generalized concensus of the External Panel that this procedure should target "high caries risk" children. A major point of discussion revolved around the appropriate frequency of this procedure.

In the background material for this report it is revealed that few studies have investigated the combined effect of a professionally applied topical fluoride in a fluoridated community. The report further states that no randomized clinical studies have tested the notion that professionally applied topical fluorides are efficacious in reducing tooth decay in high-risk individuals living in fluoridated areas. In spite of this apparent paucity of definitive data, both Faculties of Dentistry at the University of Toronto and the University of Western Ontario as well as the American Academy of Paediatric Dentistry recommend biannual applications of topical fluoride. Ripa, an acknowledged expert in this field, compared various clinical studies on this topic over a twenty year period and reports (1988, 1989) that 2 applications per year result in a greater caries reduction when compared to 1 application per year. The panel was then presented with a personal communication by Lewis of an unpublished on-going Ontario study (Johnston and Lewis) that was to reveal that no differences have been found between the caries increments of children receiving annual versus biannual topical fluoride applications. This is followed in the report by Conclusion 2 which states that: No scientific evidence exists to support the belief that

biannual applications of topical APF gel result in greater caries reduction than annual applications. This conclusion is unsupported by the information contained in the report. It is an opinion that appears to be heavily influenced by the goal of the North York Dental Health Unit which is to maximize the oral health of its target population given the resources available. Furthermore, it raises the issue of whether we are going to base decisions affecting practice guidelines that are founded on the best available evidence or on opinion. I cannot support this conclusion based on the available evidence.

The third question, "Is a prophylaxis necessary prior to the application of a topical fluoride?" results in Conclusion 3 which is that "a prohylaxis is not necessary before a topical fluoride application". While there may be some studies that have addressed this question from a caries reduction perspective, it does not deal with the broader scope of why a prophylaxis is carried out. This would include stain removal, plaque debridement, and polishing of teeth and restorations. Therefore, this question and conclusion has a particularly narrow scope that may result in a misleading interpretation. Page 15 of the report requires the same clarification and qualification that is expressed on page 21.

The remaining four questions and conclusions are supportable based on the available evidence.

I respectfully submit these comments to the Panel as my minority report.

Sincerely yours,

Peter Fendrich B.A., D.D.S.