

Salivary fluoride concentrations in children with various systemic fluoride exposures

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Abstract

Parotid ductal saliva fluoride concentrations were determined as an indication of baseline plasma fluoride levels in three groups of children. Group I had been exposed to drinking water containing < 0.1 ppm F and had not received fluoride supplements. Group II had consumed optimally fluoridated water (1 ppm) since infancy. Group III had consumed water with < 0.1 ppm F but had received a daily fluoride supplement for at least two years. The mean salivary fluoride concentrations in Groups II and III were significantly higher than Group I, but were not significantly different from each other. The findings suggest that peak plasma fluoride concentrations achieved following a daily fluoride supplement dose are higher than previously thought.

Introduction

For children who do not drink fluoridated water, fluoride supplements in the form of drops and tablets have been shown to be an effective caries preventive measure (for review: Binder et al. 1978). However, the pharmacodynamic situations are different in children who obtain their systemic fluoride from fluoridated water and those who are taking a daily fluoride supplement. Subjects who drink fluoridated water consume their daily fluoride dose in increments during the waking hours. Their plasma fluoride levels ([F]) are relatively constant throughout the day (Ekstrand et al. 1977). Adult subjects who receive a single daily dose achieve a rapid peak in the plasma [F] and a return to preingestion levels in several hours (Ekstrand et al. 1977). It is not known if baseline plasma fluoride concentrations in children receiving supplements eventually approach those seen in children who have been drinking fluoridated water from early infancy.

Ekstrand and coworkers (Ekstrand 1977; Ekstrand et al. 1977) have shown that there is a high degree of correlation between plasma [F] and parotid saliva [F] in young adults. That relationship has been confirmed by Whitford (1989).

In this study, parotid ductal saliva fluoride concentrations were measured in children with various systemic fluoride exposures to obtain an indication of the relative baseline plasma fluoride levels achieved.

Materials and Methods

The first group (Group I) included eleven 5- and 6-year-old children who had not been exposed to fluoridated water nor had taken fluoride supplements. The well water to which they had been exposed was assayed and all sources contained < 0.1 ppm F.

A second group of children (Group II) had been drinking optimally fluoridated water (1.0 ppm F) since infancy. The children in Group III had consumed nonfluoridated water (< 0.1 ppm F) since birth, and had received daily fluoride supplements for at least two years. All subjects in Group III had received doses consistent with the schedule agreed upon by the American Dental Association, the American Academy of Pediatric Dentistry, and the American Academy of Pediatrics (Council on Dental Therapeutics 1982). Before a child was accepted for the study, the parent provided assurances that at least 90% of the daily doses had been taken since the supplement was initially prescribed. Subjects were life-long residents of the north central area of North Carolina.

The gender and age distribution for the groups was matched as closely as possible. Group I had five boys and six girls, and Groups II and III had four boys and six girls. The mean ages were: Group I — 5 years, 9 months; Group II — 5 years, 4 months; and Group III — 5 years, 8 months.

The children in Group III had not received a fluoride supplement for at least 24 hr prior to sample collection. Subjects were instructed not to eat or drink for 3 hr prior to sample collection. Each child received five dollars for participation. This incentive apparently resulted in ex-

cellent compliance with these requests. Parotid saliva was collected using a Kirby cup, carefully placed and sealed over the duct. Sugarless lemon drops were used to stimulate saliva flow. A minimum of 3 ml of saliva was collected from each subject.

Saliva samples were assayed in triplicate using the microdiffusion method of Taves (1968) as modified by Whitford and Reynolds (1979). The measurement error was $\pm 2\%$. The data were evaluated by one-way analysis of variance for log (salivary fluoride concentration). The log was used because the standard deviations tended to increase as the means increased, but were homogeneous across groups for logarithms. The Bonferoni method was applied to address multiple comparisons.

The study was approved by the School of Dentistry Committee on the Use of Human Subjects in Research.

Results

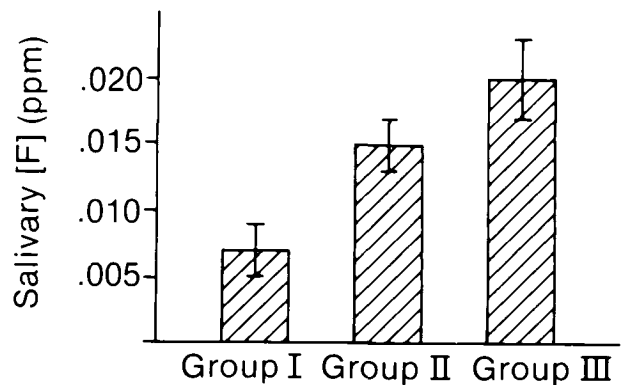
The figure graphically displays the group mean salivary [F] for the groups. The mean value for Group I was 0.008 ppm (± 0.001), for Group II, 0.015 ppm (± 0.002), and for Group III, 0.021 ppm (± 0.003). The mean values for Groups II and III were significantly higher than the mean for Group I ($P < .001$), but were not significantly different from each other ($P = .148$). Individual [F] measurements were possible only to the third decimal point. However, for purposes of statistical evaluation, means were calculated to the fourth digit (not shown).

Discussion

These data show that the mean baseline parotid saliva [F] in 5- and 6-year-old children who had taken a daily fluoride supplement for at least two years was as high as the mean baseline values for children who had consumed fluoridated water since infancy. The mean values for both groups were significantly higher than those observed in children not exposed to fluoridated water or supplements.

Ekstrand and coworkers (1977) reported that plasma and parotid saliva [F] levels are highly correlated. Whitford (1989) subsequently confirmed their observations ($R > .9$). The saliva-to-plasma ratio was about 0.8 but varied slightly from subject to subject. However, such variations should be randomized in groups of reasonable size where the subjects are of similar gender and age. The consistency of the salivary: plasma [F] indicates that salivary flow rate does not significantly affect the ratio under the conditions used for saliva collection in those studies and in this study.

Accordingly, group mean salivary [F] appears to be an accurate indicator of relative plasma fluoride concentrations. If the mean salivary levels reported in this study were indeed about 80% of the plasma levels in each group, the plasma [F] for children drinking



- Group I - n = 11
no fluoride exposure
- Group II - n = 10
fluoridated water
- Group III - n = 10
nonfluoridated H₂O,
fluoride supplements
for at least two years.

Fig. Mean (\pm SEM) salivary fluoride concentrations in three groups of age and gender matched children exposed to different systemic fluoride regimens.

fluoridated water and for children without any systemic fluoride exposure would be similar to those reported in the literature for such subjects (Ekstrand 1977; Ekstrand et al. 1977; Ekstrand and Ehrnebo 1983; Whitford and Reynolds 1979).

We speculate that in the children who had taken fluoride supplements for at least two years, increased fluoride levels in the skeleton slowed the rate of plasma fluoride clearance when peak levels are achieved shortly after administration of a daily dose (Taves and Guy 1979). Whatever the specific mechanisms involved, the mean "baseline" plasma fluoride status, observed 24 hr after the last fluoride dose of the children who had taken fluoride supplements, was at least as high as that seen in children who had consumed optimally fluoridated water since infancy. Under these conditions, the daily fluoride dose would result in plasma F peak values considerably higher than those observed in subjects not previously exposed to significant intake of systemic fluoride or in children consuming optimally fluoridated water (Ekstrand et al. 1977). The findings generated by this study should be considered along with other published reports in re-evaluating the fluoride supplement dose schedule.

Conclusions

The results of this study indicate that children 5 and 6 years old drinking nonfluoridated water and who have

taken a daily fluoride supplement for at least two years, have a baseline plasma [F] similar to children who have consumed fluoridated water since infancy. Peak plasma [F] levels following the daily supplement dose are probably significantly higher than the peak plasma [F] experienced by children drinking fluoridated water.

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Facts about women dentists

The number of women dentists continues to increase, and they are affecting the practice of dentistry, according to a report in the *Ohio Dental Journal*. In the 1988-89 academic year, women represented one-third of the first-year classes in dental schools.

According to the report:

- About 49% of female dentists married a person with a graduate or professional degree, compared to 22% of male dentists.
- Nearly 30% of female dentists are married to a dentist, compared to 2% of male dentists.
- One-third of all female dentists report taking a leave of absence from their dental careers for child rearing.
- Female dentists spend more time taking care of their children and doing housework than male dentists.
- Female dentists spend less time in the dental office than their male counterparts, but spend slightly more time treating individual patients.

In 1987, 6.2% of all dentists — more than 8,500 — were women.

By the year 2000, the report predicts, there will be more than 22,000 female dentists, and in 2020, nearly 30% of all professionally active dentists will be women.