

Fluoride Oral Retention After Professional Topical Application in Children With Caries Activity: Effect of the Immediate Water Consumption

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ABSTRACT

Purpose: Since there is no agreement about the time patients must refrain from drinking or eating after a professional application of acidulated phosphate fluoride (APF), the purpose of this study was to evaluate the effect of water consumption on fluoride in saliva.

Methods: This blind randomized crossover in vivo study involved children who received a professional APF gel application followed by either drinking a glass of water (experimental group) or without rinsing, drinking, or eating (control group) for 2 hours. The nonstimulated saliva was collected at 0, 5, 15, 30, 60, and 120 minutes following the professional APF application. After a 7-day washout period, the control and treatment groups were switched.

Results: There was a statistically significant difference in the fluoride retention between groups in the times 0 to 5 minutes ($P < .05$).

Conclusions: The data suggest that the recommendation of asking patients to refrain from drinking water for 30 minutes following the professional APF application is excessive and can be reduced to 15 minutes. (J Dent Child 2008;75:121-4)

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The decline in dental caries prevalence seen in recent decades all over the world has been explained by the widespread use of fluoride.¹⁻⁴ It is well known that low levels of fluoride in long-term use are much better for teeth than high levels used for a short term.^{2,3} In certain individuals or groups, however, the manifestation of dental

decay is still high.^{4,5} In these cases, professionally applied topical fluoride treatment (PATF) has been used as one part of the dental caries control treatment.^{2,4,6} In Brazil, the preventive programs funded by the government in public schools serving mainly low-income children are very important to allow these children access to fluoride sources, including acidulated phosphate fluoride (APF) gel application.⁷

To ensure the anticaries effectiveness of PATF, for many years patients were instructed to refrain from rinsing, eating, or drinking for 30 minutes after the application.^{8,10} This information is also given in manufacturers' instructions, but there are no scientific evidences about the clinical relevance of this practice's ability to control disease. Despite the lack of scientific literature about the anticaries benefit of this widely spread recommendation, it has been suggested that

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increasing the interval between applying fluoride and rinsing with water would result in greater fluoride retention in enamel.^{11,12} This would maximize the absorption of fluoride and ensure that the patients would receive the full benefit of the treatment.¹³ The findings of a recent *in situ* study about the rinsing effect after APF gel application—both in the amount of fluoride formed and in the enamel microhardness—however, suggest that the half-hour drinking abstinence does not seem to influence fluoride anticariogenic activity.¹⁴

The inclusion of a rinse with a controlled amount of water after the professional application of acidulated phosphate fluoride may result in greater compliance and increase the child acceptability of such a treatment.²

Considering that there is no agreement about the period patients should refrain from drinking or eating after APF gel application, the purpose of this study was to evaluate water consumption on the salivary retention of fluoride.

METHODS

EXPERIMENTAL DESIGN

This study was approved by the Research and Ethics Committee of the University Hospital of the Federal University of Maranhão, São Luís, Brazil (protocol no. 1866/2005). The parents or legal guardians each read and signed an informed consent statement, in which all the procedures, possible discomforts or risks, and benefits were fully explained. The research was a blinded, randomized, crossover clinical trial. A pilot study was conducted on 4 subjects (not from the sample) to determine the sample size and the washout period. Fifteen child volunteers were selected for the study. The inclusion criteria were healthy 6- to 8-year-old children with normal salivary flow and with caries activity. The exclusion criteria were children without visible caries activity, disease, or drug use that could interfere with the salivary flow rates (xerostomia), teeth with large cavities that could cause pain during the procedures, and children living outside of São Luís.

The subjects were given oral hygiene instructions and received an unmarked case with a toothbrush and a tube of fluoride toothpaste (Sorriso Dentes Brancos, 1.500 ppm monofluorophosphate, Colgate-Palmolive Company, Brazil). Two toothbrushes colours were used to guide the auxiliaries in the application of the different treatments.

One week before the experiment began and during the whole experimental period, the children used only the fluoride toothpaste from the kit. The parents or guardians were told to deliver the children without breakfast on the collecting days, while at school a balanced and standardized meal was provided. São Luís does not have fluoridated water, therefore, the only probable fluoride source for the participant children was the toothpaste used.

On the collecting day (after the pre-experimental period), the children had breakfast. Under the supervision of the investigator and 2 auxiliaries, they brushed their teeth with a standardized quantity of toothpaste. Water to rinse with was provided in a graded vessel. Each child received

2 mL of acidulated phosphate fluoride (APF) topical gel for 1 minute in disposable trays and was asked to not swallow and to spit all the excess gel into appropriate recipients.

After APF application, the children were randomly divided into 2 groups according to the color of their toothbrush and received the following treatments: no rinsing and no ingestion of liquids or solids for 120 minutes after the application (control group) or after drinking a glass of nonfluoridated water (180 mL) immediately following the procedure (experimental group). Only the 2 auxiliaries were acquainted with the color corresponding to each treatment on that day, so the study was conducted blind. This information was written on a sheet of paper and kept in a sealed envelope until the end of the saliva samples analysis, when the investigator was finally informed about the groups. Approximately 2 mL of non-stimulated saliva was collected into plastic recipients with hermetic covers. Each child's identification and collecting time was established at 0, 5, 15, 30, 60, and 120 minutes after APF gel application. After the washout period (7 days), the control and experimental groups were switched.

ANALYSIS OF THE FLUORIDE CONTAINED IN THE SALIVA

The samples were kept in a freezer at -22°C until they were analyzed in a laboratory, on the 15th day after the beginning of the experiment. To determine the ion fluoride concentration in saliva, the samples were diluted in a total-ionic strength adjustment buffer (TISAB II) at a ratio of 1:1. The samples were analyzed with a fluoride-specific electrode (ISE25F, MeterLab, Radiometer Analytical, Lyon, France), connected to an ion analyzer (PHM240, MeterLab, Radiometer Analytical, Lyon, France), through which the kinetics curve of fluoride was verified. The values were obtained in millivolts (mV) and later converted into ppm using Excel software (v. 2003, Microsoft Corp, Redmond, Wash). Depending on the fluoride concentration in the solution, there is a difference of potential that is the inverse function of the fluoride's logarithm. The greater the difference of potential (given in mV), the smaller the fluoride concentration.

STATISTICAL ANALYSIS

After having checked the equalities of variances and the normal distribution of errors, the data of the control and experimental groups were compared at the different times via the test for paired samples (student's *t* test). For the statistical analysis, BioEstat software (v. 3.0, 2003, IDMS, Belém, Brazil) was used, with a significance limit set at $P < .05$.

RESULTS

The sample was composed of 15 6- to 8-year-old child volunteers (8 girls and 7 boys) of low socioeconomic status. The student's *t* test data showed a difference in the fluoride oral retention in the saliva on the initial times (Table 1), observing highly significant differences in the 0-minute time ($P = .000$) and in the 5-minute time ($P < .05$). An accentuated decrease in the saliva-retained fluoride was observed in

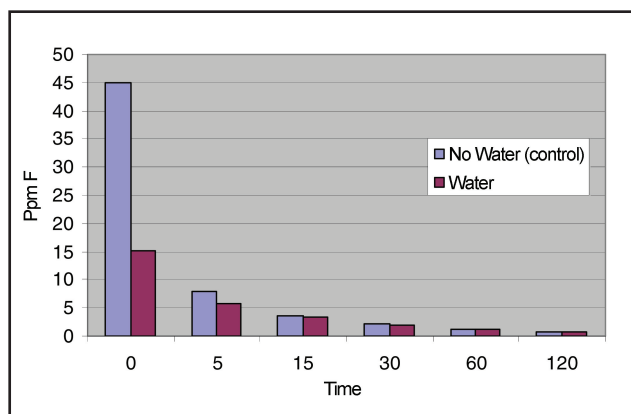


Figure. Mean values of retained fluoride in the saliva (ppm) during the different intervals.

Table 1. Retained Fluoride in the Saliva (ppm) at Each Collection Time, According to Treatment Type (Mean±SD)

Time (min)	Treatment groups		P-value*
	Control	Water	
0	45.06±24.10	15.12±7.98	.000
5	8.02±4.68	5.75±2.88	.002
15	3.62±1.71	3.35±1.90	.20
30	2.09±1.04	1.99±1.71	.30
60	1.26±0.58	1.18±0.77	.30
120	0.82±0.28	0.76±0.46	.47

*(P<.05).

the first 5 minutes in both studied groups (Figure), with a reduction of 8 times for the control group (8.02 ± 4.68) and 3 times for the experimental group (5.75 ± 2.88). During the 5- to 15-minute interval, the retention values became closer (3.62 ± 1.71 =control group and 3.35 ± 1.90 = experimental group), since there was no difference between groups at 15 minutes, as shown in Table 1.

DISCUSSION

The results showed the effect of immediate water consumption on the fluoride retention in saliva until 5 minutes following APF application (Table 1). After that time, drinking a glass of water did not seem to influence the oral retention of fluoride. Such findings at the initial time can justify the results of Stookey *et al*'s in situ study¹, in which they observed a larger amount of fluoride retained in the enamel specimens from the group that did not eat, drink, or rinse for 30 minutes after APF application.

Considering the clinical relevance of the present study findings, since no difference between groups was observed 15 minutes after the gel application, it can be suggested that rinsing with water after that time seems to be clinically irrelevant. Regarding the therapeutic effect of the rinsing practice after using the fluoridated gel, an in situ study showed that

rinsing immediately after APF application did not influence the enamel's mineral incorporation or loss.¹⁴

Such differences between data from the aforementioned studies can be due to the fact that the necessary amount of fluoride to reach the great remineralization ability is still under debate.¹⁵ This necessary amount seems to depend on individual factors of cariogenic challenge that interfere in the exhaustion of the incorporated fluoride pools.

There was a highly significant difference between groups immediately after APF application, and there are indications that the fluoride formed in the enamel immediately after the application may be more relevant for the anticariogenic effect than the residual fluoride concentration in the saliva.¹⁶ Consequently, other studies are necessary to evaluate the effect of rinsing on the firmly and loosely bound fluoride on enamel immediately after an APF gel application.

CONCLUSIONS

The present study's data suggest that the current recommended 30 minutes of no rinsing, drinking, or eating following acidulated phosphate fluoride application seems to be excessive. The abstinence can be justified for 15 minutes, when mouth-rinsing or drinking a controlled amount of water could be allowed. This practice may increase the patients' acceptance of the professionally applied topical fluoride treatment procedure.

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