
A pilot study of preschoolers' use of regular-flavored dentifrices and those flavored for children

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Abstract

Ingestion of fluoride dentifrice by preschool children recently has been implicated as a risk factor for dental fluorosis. The availability of dentifrices flavored for children could increase fluoride ingestion by young children at risk for dental fluorosis. This article reports results of a pilot study of use of regular-flavored dentifrice and those flavored for children among 29 preschool children. Using a crossover design, larger quantities of fluoride dentifrice specially flavored for children were used compared with the quantities of regular-flavored dentifrice. Pediatric dentists and other health care providers should advise parents to supervise preschoolers' toothbrushing. Preschoolers should use only small, pea-sized quantities of dentifrice to avoid increased risks of dental fluorosis. (Pediatr Dent 14:388-91, 1992)

Introduction

Along with the generalized decline in dental caries among children in the United States and other developed countries¹ is evidence of an increase in the prevalence of dental fluorosis.² Recent evidence shows that teeth are most susceptible to dental fluorosis during the maturation stage of enamel formation rather than the earlier secretory stage.^{3, 4} For maxillary incisors, cosmetically the most important teeth, the most vulnerable age is believed to be approximately 22 to 25 months.⁴ Thus, since most children use fluoride dentifrice by the age of 18 to 24 months,^{5, 6} ingestion of fluoride dentifrice by preschool children could be an important factor contributing to dental fluorosis. Although increased water fluoride levels^{3, 4} and use of dietary fluoride supplements^{7, 8} generally have been considered to be major risk factors for fluorosis, several studies recently identified fluoride dentifrice as a potential risk factor as well.^{7, 9-12} It is important to emphasize that total fluoride ingestion is the "true risk factor." Total fluoride ingestion is very difficult to assess accurately due to varied fluoride intake from water, foods and beverages, dentifrice, and other fluoride products. Thus, researchers traditionally have focused only on fluoridated water and dietary fluoride supplements, and more recently on dentifrice, which are easier to assess.

The proceedings of two recent workshops concerning fluoride and fluorosis have recommended that preschoolers' teeth be brushed under parental supervision using small (pea-sized) quantities of fluoride dentifrice.^{13, 14} They also recommend that dentifrices that may increase ingestion, such as those specially flavored for children (e.g., bubble gum, fruit) not be used by preschoolers because of the potential for increased fluoride ingestion.^{13, 14} If preschoolers brush more frequently and/or with larger quantities of dentifrice flavored for children than they would with regular-fla-

vored dentifrice, then ingestion of fluoride probably would be increased.

This article reports results of a pilot study of dentifrice use by preschool children according to dentifrice flavor.

Materials and Methods

Parents of 59 preschool children, 1 to 4 years of age were recruited with appropriate informed consent to participate in a study of use of fluoride dentifrice. Parents and the children were interviewed and observed during a single brushing at the University of Iowa College of Dentistry in June, 1991.¹⁵ During this observation, all children were provided and used the brand and flavor of fluoride dentifrice that they used most often at home. It was found that many children used substantial quantities of fluoride dentifrice, with a mean of 0.43 g of dentifrice (approximately 0.43 mg of fluoride) used per observed brushing.¹⁵ Parents also completed a diary during a one-week period detailing their children's toothbrushing habits. The quantity of dentifrice used during the week's toothbrushing was calculated by comparing the weights of the toothpaste tubes at the beginning and end of the week. Parents were instructed to follow their children's normal brushing routines. Patterns of use during the week agreed well with those from the observed brushings, with a mean of 0.47 mg of fluoride used per brushing during the diary week. Mean daily number of brushings was 1.6 and mean daily dentifrice use was 0.77 g.¹⁵

Thirty-one families agreed to participate in an extension of the main study investigating the effect of dentifrice flavor on dentifrice use by preschoolers. In this substudy, after the one-week main diary study, parents switched flavor of dentifrice used with their child in the study. The parents kept a diary of the use of the new

dentifrice, in this case for an additional two weeks. Thus, if their child usually and during the one-week study used a regular-flavored dentifrice, then they "crossed over" during the next two weeks to use a dentifrice flavored for children, and vice versa.

The mean quantities of daily dentifrice use during the diary periods were calculated by dividing the total dentifrice used during the period by the number of days. For each preschool child, the difference between daily quantity used with regular and flavored for children dentifrice was calculated. Comparisons also were made using results from the diaries concerning use of different flavor dentifrices, specifically frequency of brushing and estimated length of brushing (in seconds). An exact binomial test assessed statistical significance of increases vs. decreases in daily dentifrice use among groups. Because of the small sample size and lack of normality of the data, nonparametric tests (Wilcoxon two-sample test and Wilcoxon signed rank test) assessed the statistical significance of differences among groups.

Results

Two families attempted to crossover from dentifrice flavored for children to regular-flavored, but reported that their children were so used to the flavoring for children that they could not complete the crossover substudy successfully. Thus, a total of 29 families completed the crossover study, with children's ages ranging from 17 to 59 months (mean = 37 months). Specifically, 16 switched from regular to flavored for children and 13 switched from flavored for children to regular-flavored dentifrice.

The table summarizes the distribution of daily use of dentifrice among the 29 preschool children, and shows substantial variation in quantities used as seen in the wide ranges and large standard deviations relative to the means. The medians were generally lower than were the means.

The mean daily quantities of regular-flavored dentifrice used by those beginning with and those crossing over to regular flavor dentifrice were similar (0.688 g vs. 0.624 g), as were the quantities used of dentifrice flavored for children (0.842 g vs. 0.776 g). The differences in quantities used were also very similar (0.155 g vs. 0.152 g).

Among those switching from regular to children's flavored dentifrice, 11 of 16 preschoolers (69%) used more children's flavored dentifrice (exact binomial: $P = 0.04$). Similarly, 69% (nine of 13) of those switching from children's flavored to regular-flavored dentifrice used more children's flavored dentifrice (exact binomial: $P = 0.13$).

The 16 children switching over from regular to children's flavored dentifrice, used 0.155 g more children's flavored dentifrice per day on average. A Wilcoxon signed rank test showed this difference not to be significantly different from zero ($P = 0.26$). Similarly, the 13 children switching from children's to regular-flavored dentifrice, used an average of 0.152 g more children's flavored dentifrice per day ($P = 0.15$).

Because a Wilcoxon two-sample test comparing the distributions of differences among the two groups failed to show a significant difference ($P = 0.55$), results were combined with the resultant sample size of 29. Thus, the order of use of the different flavors of dentifrice did not appear to affect the general pattern of increased dentifrice use.

Twenty of the 29 children (69%) used more children's flavored dentifrice while nine (31%) used more regular-flavored dentifrice (exact binomial: $P = 0.03$). Overall, the 29 preschool children used a mean of 0.153 g more dentifrice flavored for children than they used regular-flavored dentifrice, with the difference statistically significant ($P = 0.03$, Wilcoxon signed rank test). No statistically significant differences in the age distributions, frequency of brushing, or duration of brushing among the preschoolers when using regular-flavored dentifrice vs. flavored for children were noted.

Table. Daily use of dentifrice among preschool children by dentifrice flavor (in grams)

Group	Flavor	Mean	Median	Range	Standard Deviation
Regular to children's (N = 16)	Regular	0.688	0.789	0.030 — 1.746	0.418
	Children's	0.842	0.533	0.036 — 3.229	0.782
	Difference*	0.155 [†]	0.063	-0.483 — 1.483	0.465
Children's to regular (N = 13)	Children's	0.776	0.419	0.075 — 2.502	0.674
	Regular	0.624	0.667	0.113 — 3.033	0.781
	Difference*	0.152 [†]	0.108	-0.531 — 0.572	0.299
Total (N = 29)	Regular	0.659	0.483	0.030 — 3.033	0.596
	Children's	0.813	0.605	0.036 — 3.229	0.723
	Difference*	0.153 [‡]	0.094	-0.531 — 1.483	0.392

* Excess of use with flavored for children over regular flavored.

[†] Not statistically significant ($P > 0.05$).

[‡] Statistically significant ($P < 0.05$).

Discussion

The results of the pilot study support previous statements^{13, 14} made without supportive data that use of dentifrices flavored for children could result in larger quantities of dentifrice being used by preschool children at risk for dental fluorosis. In the crossover study, more than two-thirds of the preschoolers used more children's flavored dentifrice per day than they did regular-flavored dentifrice. This pattern and the distribution of the differences in quantity used were similar for those switching from regular to children's flavored dentifrices and those switching from children's to regular.

The statistically significant mean difference of 0.153 g dentifrice used (approximately 0.153 mg of fluoride) per day could be an important difference clinically for some children, since young preschool children have been shown to ingest substantial quantities of the dentifrice used (approximately 20-50% on average, with some ingesting almost all of the dentifrice).^{5, 16-22} Although the magnitude of the additional quantity of fluoride ingested with children's flavored dentifrice appears small, it must be remembered that this quantity is "in addition to" the fluoride ingested from regular-flavored dentifrice, water, beverages and food prepared with water, and dietary fluoride supplements. It should be emphasized again that *total* fluoride ingestion is the most important consideration. Thus, in some cases, use and ingestion of increased quantities of dentifrice flavored for children could put children over the "safe" threshold level and cause dental fluorosis. Although the size of the dentifrice tube orifice has been shown to be related to quantity of toothpaste used,²³ the dentifrices flavored for children used in this study had slightly smaller orifices, not larger ones.

When interpreting the results of this study, several caveats should be noted. First, the study was conducted with a small, convenience sample of volunteer families in the Iowa City area and not a more diverse, random sample. Second, study participants from the university community were generally of higher than average educational and socioeconomic status levels. Third, no quantification of actual dentifrice *ingestion* was included — only dentifrice *use* was studied. However, increased ingestion is assumed to occur with increased use. Fourth, it is possible that in some cases individuals other than the study children used the study dentifrices intended only for their use. However, parents received written and verbal directions emphasizing that the products were to be used only by the study child. Also, the sample size did not permit analysis of differences according to brand or flavor of dentifrice.

For these reasons, and because this is the first published study of the effect of dentifrice flavor on use of dentifrice, additional research is necessary into the effects of flavor on dentifrice use and ingestion by preschool children who are at risk for fluorosis. Ideally, such studies should be conducted with larger, more representative samples. Crossover designs should be used so that children can serve as their own controls. And, as was done in this study, children should be provided their typical brands and flavors of dentifrice to use as their baseline product and parents should be encouraged to follow their normal toothbrushing routines. Studies that "control" the baseline dentifrice brand/flavor choice or prescribe a toothbrushing routine would create undesirable artificial conditions that probably would bias the results.

Based on these findings, physicians and other health care providers of young children should be recruited by the pediatric and public health dental communities to educate parents to direct and supervise their preschool children's toothbrushing and to be sure to use only small, pea-sized quantities.^{8, 13, 14, 24-26} Young children ingesting fluoride dentifrice probably should not brush more frequently than twice per day.¹⁴ These cautions may be particularly important for those using children's flavored dentifrice. In addition, dentifrice with lower than conventional fluoride concentrations should be evaluated further for use by preschool children.^{13, 14, 24-26}

In some cases, the use of dentifrice flavored for children could put preschool children at increased risk for dental fluorosis. However, in other cases, the special flavors could enable children to better accept having their teeth brushed regularly with fluoride dentifrice, thus enhancing their caries prevention. A continuing challenge to the profession is to ensure that the dental caries preventive benefits of fluoride dentifrice are best realized while minimizing unnecessary risks of dental fluorosis.

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