

## Effect of mouthrinsing with a 0.2 per cent neutral NaF solution on the deciduous dentition of first to third grade school children

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### Abstract

*Benefits to the deciduous teeth of first to third grade elementary school participants of a weekly 0.2% NaF mouthrinsing program in a fluoride-deficient community ( $F \leq 0.1$  ppm) are presented seven years after the program's initiation. At the last examination, there was a reduction in caries prevalence of 42.5% (dfs/child) compared to baseline caries scores of children who never rinsed. The greatest percentage reduction (49.3%) occurred on proximal surfaces.*

**T**he benefits of fluoride mouthrinsing to the permanent dentition of children have been documented extensively.<sup>1,2</sup> Little attention, however, has been paid to the effects of fluoride mouthrinsing in deciduous teeth.

In 1975 a fluoride mouthrinsing demonstration program was initiated in the Three Village Central School District, Long Island, New York. Dental examinations have been conducted annually on participants of this program, making it the longest continually monitored fluoride mouthrinsing program in the United States. Since both the permanent and deciduous teeth were examined, this study affords the opportunity to ascertain the benefits that fluoride mouthrinsing provides to deciduous teeth.

Previous reports from this program, after up to four years of rinsing, demonstrated a cariostatic benefit to deciduous teeth from fluoride mouthrinsing.<sup>3-5</sup> This report presents the caries prevalence in the deciduous teeth of first to third grade children seven years after the fluoride mouthrinsing program began.

### Methods and Materials

#### The Rinsing Program

Rinsing was conducted in five elementary schools located in three contiguous fluoride-deficient ( $F \leq 0.1$

ppm) communities located on Long Island, New York. (The program was originally in six schools, but one was closed due to a decline in enrollment.) Children in kindergarten through sixth grade who returned consent forms signed by a parent or guardian, participated in this voluntary program. At the beginning of each academic year, new kindergarten children are enrolled while those who have been graduated to the seventh grade leave the program. After seven years, more than 6,000 children have participated.

Rinsing was performed once a week using a 0.2% neutral sodium fluoride (NaF) solution. The solution was prepared each rinsing day by trained project personnel and distributed to homerooms where teachers supervised rinsing. Kindergarten children rinsed with 5 ml (one teaspoonful); all others used 10 ml. After 60 seconds the solution was expectorated into paper cups.

During the first year of the program 19 rinse sessions were scheduled; approximately 30 sessions were scheduled for each succeeding year.

#### Caries Examinations and Analysis

Examinations were conducted at the beginning of each academic year. Approximately 125 children were selected randomly from each grade level to receive a mirror and explorer examination for dental caries. The criteria used were those recommended at the American Dental Association's Conference on the Clinical Testing of Cariostatic Agents.<sup>6</sup> The examinations were conducted in the schools using a portable dental chair, light, and air compressor. All examinations were performed by the same examiner using front surface mirrors and Starlite MG #23 explorers.<sup>a</sup> Examination forms were processed by the Biometry Section of the National Institute of Dental Research.

In order to extend the benefits of this proven caries preventive technique to all the children, there was no concurrent nontreatment or placebo control group. Instead, caries prevalence scores were established from examinations conducted before the rinsing program. These data served as a baseline against which the results of subsequent examinations were compared.

Detailed descriptions of the rinsing program, examination procedures, and use of a retrospective baseline design to assess success of the program have been provided elsewhere.<sup>5,7</sup>

### Relationship Between Rinse Sessions and Caries Examinations

Figure 1 shows the relationship between the scheduled rinse sessions and the caries examinations for the seven years covered by this report. Since examinations were conducted at the beginning of each academic year, the number of rinses in which children participated is based on their participation in previous grades. Thus, first graders will have rinsed for one year by the time they are examined; second graders for two years. Since rinsing was introduced simultaneously in all grade levels rather than incrementally, it was not until the beginning of the third year of the program (1978-79) that third graders had participated for three years. However, because only 19 rinses were scheduled in the first year of the program, it was not until the 1979-80 academic year that first, second, and third graders had participated in the rinse program to the maximum level possible; that is, first graders had 30 scheduled rinses, second graders had 60, and third graders had 90.

ACADEMIC YEAR	75/76	76/77	77/78	78/79	79/80	80/81	81/82	82/83
EXAMINATION	baseline	1 <sup>st</sup> YR	2 <sup>nd</sup> YR	3 <sup>rd</sup> YR	4 <sup>th</sup> YR	5 <sup>th</sup> YR	6 <sup>th</sup> YR	7 <sup>th</sup> YR
SCHEDULED RINSES/YEAR AT TIME OF EXAMINATION	0	19	30	28	32	30	31	31
RINSING EXPERIENCE OF GRADES K-3*	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>	K <sub>0</sub>
	1 <sub>0</sub>	1 <sub>1</sub>	1 <sub>1</sub>	1 <sub>1</sub>	1 <sub>1</sub>	1 <sub>1</sub>	1 <sub>1</sub>	1 <sub>1</sub>
	2 <sub>0</sub>	2 <sub>1</sub>	2 <sub>2</sub>	2 <sub>2</sub>	2 <sub>2</sub>	2 <sub>2</sub>	2 <sub>2</sub>	2 <sub>2</sub>
	3 <sub>0</sub>	3 <sub>1</sub>	3 <sub>2</sub>	3 <sub>3</sub>	3 <sub>3</sub>	3 <sub>3</sub>	3 <sub>3</sub>	3 <sub>3</sub>

\* Subscript denotes number of years of rinsing at time of examination.

FIGURE 1. The examination and rinsing schedule for the seven-year report. The box indicates the academic years in which the examined children had fully participated in the rinse program. The 1978-79 academic year is not included because the third grade children had only 19 scheduled rinse sessions as kindergarteners.

## Results

### Caries Prevalence of Kindergarten Children

The caries prevalence (dfs/child) of newly enrolled kindergarten children is presented in Table 1. Except for two years, 1975 and 1978, the mean caries prevalence scores of these new entrants into the rinsing program have remained relatively constant.

### Caries Prevalence of First to Third Grade Children

The caries prevalence (dfs/child) of first, second, and third grade children is presented in Table 2, with figures for the baseline year and for each year of the rinsing program. The caries prevalence scores for all three grades had declined by 42.5% during the seven-year rinsing period.

Figure 2 compares the caries prevalence reduction for all three grades at each academic year. The average number of scheduled rinse sessions in which the children participated also is presented. Children examined in the 1979-80 school year had participated for the first time in the maximum possible number of rinse sessions. The caries reduction observed at this time was 32.6%. All future examinations were conducted on children who had participated for a similar number of scheduled rinses. At the last examination, the observed caries reduction was 42.5%.

### Caries Prevalence of Site-Specific Tooth Surfaces

Table 3 shows the effect of fluoride mouthrinsing on site-specific tooth surfaces; the greatest percentage reduction was for proximal surfaces.

PERCENT CARIES PREVALENCE REDUCTION IN PRIMARY DENTITION OF FIRST TO THIRD GRADE FLUORIDE MOUTHRINSE PARTICIPANTS RELATED TO THEIR LEVEL OF RINSING PARTICIPATION

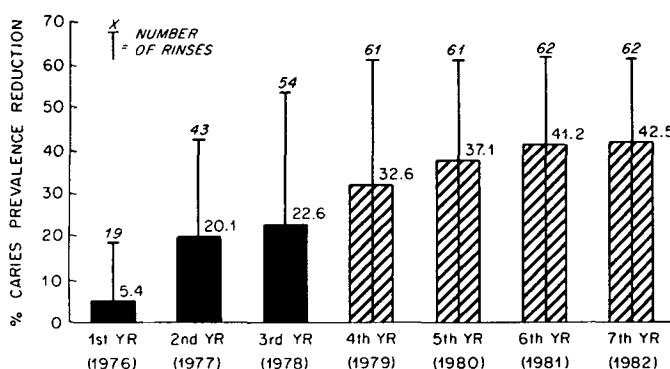


FIGURE 2. The percentage of caries reduction is juxtaposed with the average number of scheduled fluoride mouthrinses in which the children could have participated prior to being examined. [For instance, of the children examined in 1982, first graders had 31 scheduled rinse sessions, second graders had 62, and third graders had 92. Thus, the average number of fluoride contacts for these children was  $(31 + 62 + 92) \div 3 = 62$ .] The four hatched columns indicate years when the examined children had participated in the maximum possible number of rinses.

**TABLE 1.** Mean Caries Surface Prevalence Scores for the Deciduous Teeth of Kindergarten Children Before Entry into the Fluoride Mouthrinsing Program

	Year of Examination*							
	1975	1976	1977	1978	1979	1980	1981	1982
Children examined	125	111	128	126	118	126	130	138
$\bar{X}$ dfs/child	3.94	1.87	1.67	2.70	1.67	1.71	1.78	1.40
$\pm$ Standard deviation	7.89	3.80	3.21	6.22	5.01	4.54	5.36	3.48

\* Examinations conducted in the fall, at the beginning of an academic year.

**TABLE 2.** Mean Carious Surface Prevalence Scores for the Deciduous Teeth of First, Second, and Third Grade Children at Baseline and After Participation in the Fluoride Mouthrinsing Program

Examination*	Grade One		Grade Two		Grade Three		Grade One to Three	
	$\bar{X}$ dfs/child	Per cent Difference	$\bar{X}$ dfs/child	Per cent Difference	$\bar{X}$ dfs/child	Per cent Difference	$\bar{X}$ dfs/child	Per cent Difference
Baseline (1975)	3.29	—	4.37	—	5.60	—	4.42	—
First year (1976)	3.55	+ 7.9	4.25	- 2.8	4.75	-15.2	4.18	- 5.4
Second year (1977)	2.68	-18.5	3.64	-16.7	4.27	-23.8	3.53	-20.1
Third year (1978)	2.68	-18.5	3.32	-24.0	4.27	-23.8	3.42	-22.6
Fourth year (1979)	2.63	-20.1	2.80	-35.9	3.51	-37.3	2.98	-32.6
Fifth year (1980)	2.64	-19.8	2.82	-35.5	2.89	-48.4	2.78	-37.1
Sixth year (1981)	1.87	-43.2	2.93	-33.0	2.99	-46.6	2.60	-41.2
Seventh year (1982)	1.70	-48.3	3.23	-26.1	2.70	-51.8	2.54	-42.5

\* Examinations conducted in the fall, at the beginning of an academic year.

**TABLE 3.** Mean Caries Prevalence Scores of Site-Specific Deciduous Tooth Surfaces for First, Second, and Third Grade Children at Baseline and After Participation in the Fluoride Mouthrinsing Program

Examination*	Proximal Surfaces		Buccolingual Surfaces		Occlusal Surfaces	
	$\bar{X}$ dfs/child	Per cent Difference	$\bar{X}$ dfs/child	Per cent Difference	$\bar{X}$ dfs/child	Per cent Difference
Baseline (1975)	1.60	—	0.75	—	2.08	—
First year (1976)	1.49	- 6.9	0.73	- 2.7	1.96	- 5.8
Second year (1977)	1.16	-27.5	0.60	-20.0	1.76	-15.4
Third year (1978)	1.07	-33.1	0.70	- 6.7	1.64	-21.2
Fourth year (1979)	1.07	-33.1	0.49	-34.7	1.42	-31.7
Fifth year (1980)	0.95	-40.6	0.52	-30.7	1.32	-36.5
Sixth year (1981)	0.86	-46.3	0.43	-42.7	1.32	-36.5
Seventh year (1982)	0.81	-49.4	0.52	-30.7	1.20	-42.3

\* Examinations conducted in the fall, at the beginning of an academic year.

### Comparison of Caries Reductions in the Deciduous and Permanent Tooth Surfaces

Caries reduction in the deciduous and permanent teeth of the same children is compared in Figure 3. Third grade children were selected for this comparison because, of first to third graders, they participated longest in the mouthrinse program and because they had the greatest number of erupted permanent teeth. As shown in the figure, the caries reduction in both the deciduous and permanent dentitions increased steadily as the number of rinsing contacts increased. Once the number of rinsing contacts stabilized, the caries reduction for each set of teeth showed a more gradual change.

### Discussion

These seven-year findings continue to demonstrate that participation in a school-based fluoride mouthrinsing program will result in caries reductions to the deciduous teeth. For almost every year of the rinsing program, there was a gradual decline in caries prevalence scores in the deciduous teeth of participating children. After seven years, the caries prevalence reduction from baseline was 42.5%. The greatest reduction occurred on proximal surfaces which is consistent with the known effect of topical fluoride.

About 30 rinse sessions were scheduled during each academic year. For first, second, and third graders to have participated maximally in the program, they

PERCENT CARIOUS/FILLED SURFACE REDUCTION  
IN THE PERMANENT AND PRIMARY TEETH  
OF THIRD GRADE FLUORIDE MOUTHRINSE PARTICIPANTS

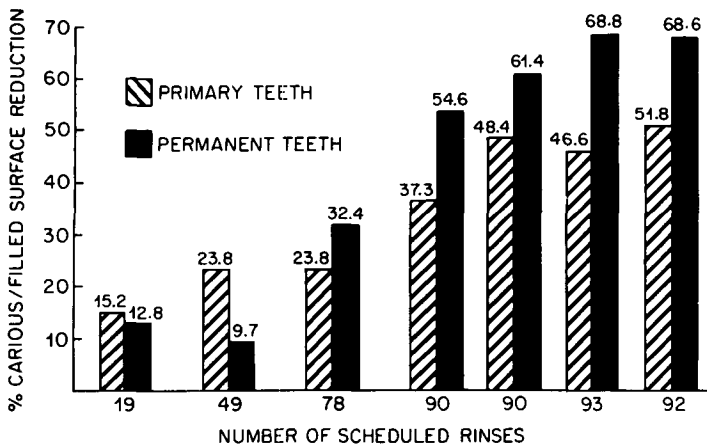


FIGURE 3. Comparison of caries reductions in the deciduous and permanent teeth of third grade children shows a similar leveling off of benefits of fluoride mouthrinsing after the maximum number of fluoride contacts had been reached.

would have been scheduled for 30, 60, and 90 rinse sessions, respectively. During the first year of the program, however, only 19 rinses were conducted. Thus, it was not until the 1979-80 academic year that all children examined had participated to the maximum level possible. From the initiation of the program until the 1979 examination, a 32.6% caries reduction occurred. Since all subsequent examinations were conducted on children who had participated in the rinse program for approximately the same number of rinses (Figures 1 & 2), a stabilization in the benefits associated with fluoride rinsing would have been expected. This did not occur. Over the next three years an additional 10% reduction in the caries prevalence of the deciduous teeth was detected. However, while a stabilization of the caries protective benefit was not seen, there was a considerable slowing of the rate of caries decline. For the first four years of the program, the annual reduction in caries prevalence averaged 8% per year. For the next three years, the reduction was 3.3% per year. Evaluation of caries reduction in the permanent teeth of third graders (Figure 3) shows a similar slowing in the rate of caries decline in the permanent dentition. These findings suggest that the major factor producing the caries reduction was the children's participation in the fluoride mouthrinsing program. Nevertheless, other background factors also appear to have a small but measurable influence on the children's increasing caries resistance.

An examination of the caries status of newly enrolled kindergarten children provides additional insight regarding whether background factors influence the caries status of this population. Kindergarten

children have had no contact with the fluoride program prior to examination; therefore, the caries prevalence of these children should be stable. Table 1 presents the mean dfs/child scores of the kindergarten children. The most frequently observed baseline scores are between 1.67 and 1.87. There are two higher scores and one lower score. The mean dfs score of 3.94 recorded for the 1975 examination is significantly higher than the average score for the other years, while the 1978 score is not. Inspection of the standard deviation for the 1975 caries findings suggests a number of children with high caries scores. A review of the original examination forms revealed an unusually high number of children with dfs scores of 12 or more. These children were not representative of the population entering the rinsing program at that time. Thus, it can be concluded that baseline caries scores of children entering the mouthrinsing program have not changed appreciably since the program began in 1975. This finding also supports the conclusion that background factors are playing a minor role in the change detected in the caries prevalence of the deciduous dentition of these children.

## Conclusions

First to third grade children who fully participated in a weekly school-based fluoride mouthrinsing program experienced a caries prevalence reduction of 32.6-42.5% in their deciduous teeth. The maximum percentage reduction accrued to proximal surfaces. The decreased caries activity was attributed primarily to the children's participation in the fluoride mouthrinsing program. This conclusion was based on the relatively stable caries prevalence scores of newly enrolled kindergarten children and the decreased rate of caries reduction once the maximum rinsing participation level had been achieved.

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### Quotable quote: sealants

The National Preventive Dentistry Demonstration Program is but the latest of many studies that have demonstrated the effectiveness of sealants in preventing caries. Sealants are a plastic-like material applied to the chewing surfaces of the back teeth, where fluorides are less effective in reducing decay. Sealants still are not used widely, because practicing dentists: (1) lack current information on sealants' effectiveness; (2) have difficulty in motivating patients and parents to accept the service; and (3) believe they can place amalgam restorations in the same amount of time for the same fee, and with better and longer lasting results.

Sealants have improved markedly since they were introduced a number of years ago. Early sealants did not always adhere well to the teeth; this problem has been resolved.

A growing professional consensus holds that small carious lesions do not need to be restored before sealants are applied. In the National Preventive Dentistry Demonstration Program, however, sealants were not applied over unfilled cavities.

The National Institute of Dental Research sponsored a consensus development conference on sealants in December, 1983, in order to raise awareness about sealants' role as an important and effective component of preventive dental programs.

From: Preventing tooth decay: results of a four-year national study. The Robert Wood Johnson Foundation, Special Report No. 2, 1983, p 5.

### Quotable quote: muscle sounds

In an awake human being the muscles of the body continually are contracting and relaxing. Strange as it may seem, as they do so they generate sound. Since this sound is not heard under ordinary conditions, you may be skeptical. If you are, put both thumbs gently in your ears and make a fist. You will hear a low rumble. The tighter you make the fist, the louder the sound will be. What you are hearing is the sound made by the forearm muscles as they contract.

Muscle sounds are normally inaudible because the human ear is insensitive to low-frequency sound. The main frequency of muscle sounds is 25 hertz (cycles per second), which is near the lower limit of hearing. Although the existence of such sounds has been known for centuries, physiologists and physicians have for the most part considered them a nuisance. Recent developments in computer science and medical instrumentation, however, have made it possible to investigate muscle sounds in detail. The results are most interesting. Work I have been doing with the new methods suggests the sound is generated by the muscle fibers as the muscle contracts. It could well be that such effects will yield a better understanding of muscle physiology, muscle pathologies (including those of the heart), and even certain kinds of animal communication.

From: Oster, G., Muscle sounds. *Scientific American* 250:109-14, March, 1984.