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Effect on the primary dentition of mouthrinsing with a 0.2 percent neutral NaF solution: results from a demonstration program after four school years

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Abstract

Results to the primary dentition of a school-based fluoride mouthrinsing program using a 0.2 percent neutral sodium fluoride solution are presented after up to four years of weekly rinsing (109 rinses) for children in grades one through four. Compared to baseline caries scores of children in the same schools who were examined before the rinsing program started, there was a reduction in caries prevalence of 25.5 percent (dfs/child) or 27.6 percent (dfs/100 s). The greatest reduction after four years, 28.6 percent, was found for proximal surfaces. Caries reductions in the permanent dentition of the same children were greater than in the primary dentition. It was concluded that the earlier that children begin to participate in a weekly fluoride rinsing program and the longer the program continues, the greater should be the benefits.

Introduction

School-based fluoride mouthrinsing programs are usually conducted in elementary schools, and generally have kindergarten children as their youngest participants.[1] Therefore, some children with a full primary dentition and many children with a mixed dentition will rinse for several years. Despite the enrollment of young schoolage children in rinsing programs, most of the reports on fluoride rinsing have been concerned with the permanent dentition, while the effects to the primary dentition have been largely ignored.

This is unfortunate since at the lower grade levels the primary teeth constitute a significant tooth population at risk to caries. Any benefits that may accrue to these teeth as a result of fluoride rinsing should be recognized when the results of school-based mouthrinsing programs are tabulated or when the costs relative to the benefits of a rinsing program are analyzed.[2]

In 1975, a weekly fluoride rinsing program using a 0.2 percent neutral NaF solution was initiated in the Three Village Central School District, Long Island, New York ($F \leq 0.1$ ppm). The results of this program on the primary dentition after one, two, and three years of rinsing have been previously published.[3,4] The purpose of this report is to evaluate the effects of fluoride mouthrinsing on the primary dentition four years after the rinsing program began. The effect of rinsing on caries prevalence of the permanent teeth in the same children is also presented for comparison.

Methods and Materials

The Rinsing Progrom

The rinsing program has been described in detail in previous publications[5-7] and will be only briefly reviewed.

A 0.2 percent neutral NaF solution is freshly prepared each week and delivered to approximately 200 classrooms in five elementary schools housing the kindergarten through sixth grades. (Initially six schools participated, but one school closed due to a decline in the number of school children in the district.) Children rinse once a week under supervision of homeroom teachers. Kindergarten children rinse with 5 ml (one teaspoonful), all other with 10 ml. Rinsing is performed for 60 seconds and then the solution is expectorated. During four years, 109 rinses have been scheduled.

Only children whose parents signed consent forms participate. At the time covered by this report, approximately 3,900 children were enrolled in the rinsing program, representing 81 percent of the total elementary school population.

Caries Examinations

Visual-tactile examinations were conducted in the Fall of 1975, before rinsing began, in order to establish baseline caries prevalence scores, and in the Fall of each succeeding year. All examinations were conducted by the same examiner using front surface #4 mirrors and Starlite MG #23 explorers. The examinations were accomplished using a portable dental chair, light, and air compressor. The examination criteria were those recommended at the American Dental As-

sociation Conference on the Clinical Testing of Cariostatic Agents.[8] Examinations were recorded by a trained assistant on standardized optical-scan forms and processed by the Biometry Section of the National Institute of Dental Research.

Subjects

Approximately 125 children were randomly selected from each grade level for each examination. Children in the first through fourth grades were considered to have sufficient numbers of primary teeth for meaningful analysis. Since the dental examinations are conducted at the beginning of each academic year, kindergarten children have only begun to participate in the program and, because they have only rinsed a few times, they are excluded from this report. The other children, who were examined at the latest examination (Fall, 1979), had participated in the program commensurate with their grade level; i.e., first graders had rinsed for one year, second graders for two years, etc. (Figure 1).

Caries Analysis

To provide the benefits of fluoride rinsing to as many children as possible, there is no concurrent nontreatment control group in the design of this study. Instead, the caries prevalence scores from the examination conducted before rinsing began (Fall, 1975) serve as the baseline scores. The results of all succeeding examinations of rinse-participant children are compared to the 1975 baseline scores in order to determine the effects of the mouthrinsing program. The design of this study and the special considerations when analyzing caries activity in primary teeth have been previously discussed in another publication.[4]

It has been observed that a potential problem with the use of a retrospective baseline design is that factors unrelated to the rinsing program could influence the caries activity in a community. If these factors remain undetected, the observed changes in caries prevalence could falsely be attributed to the preventive procedure being studied. The population in this report, however, has a high socioeconomic level and enjoys a good level of dental health. It is unlikely that factors that could effect the caries status to the extent herein reported and in such a short time could go undetected. Additionally, observation of the baseline scores of kindergarten children entering the study each year are generally similar.

Results

Baseline Versus up to Four Years of Rinsing

Caries prevalence scores are presented per child in Table 1 and (in order to minimize an effect that may be caused by primary teeth exfoliating[9]) per 100 surfaces on Table 2. The reductions in caries prevalence are 25.5 percent (dfs/child) and 27.6 percent (dfs/100 s). It should be noted that all of the children examined started rinsing as kindergarteners but, depending upon their grade at the last examination, had participated in the rinsing program for from one to four years. With the exception of grade four, the percentage difference in the caries prevalence between baseline and the last examination increased with increased participation in the rinsing program.

Caries Prevalence of Individual Surfaces

Table 3 presents the dfs prevalence scores per child, for the different types of tooth surfaces. The greatest difference between the baseline caries score and the score after up to four years of rinsing, 28.6 percent, was found for proximal surfaces, although the differ-

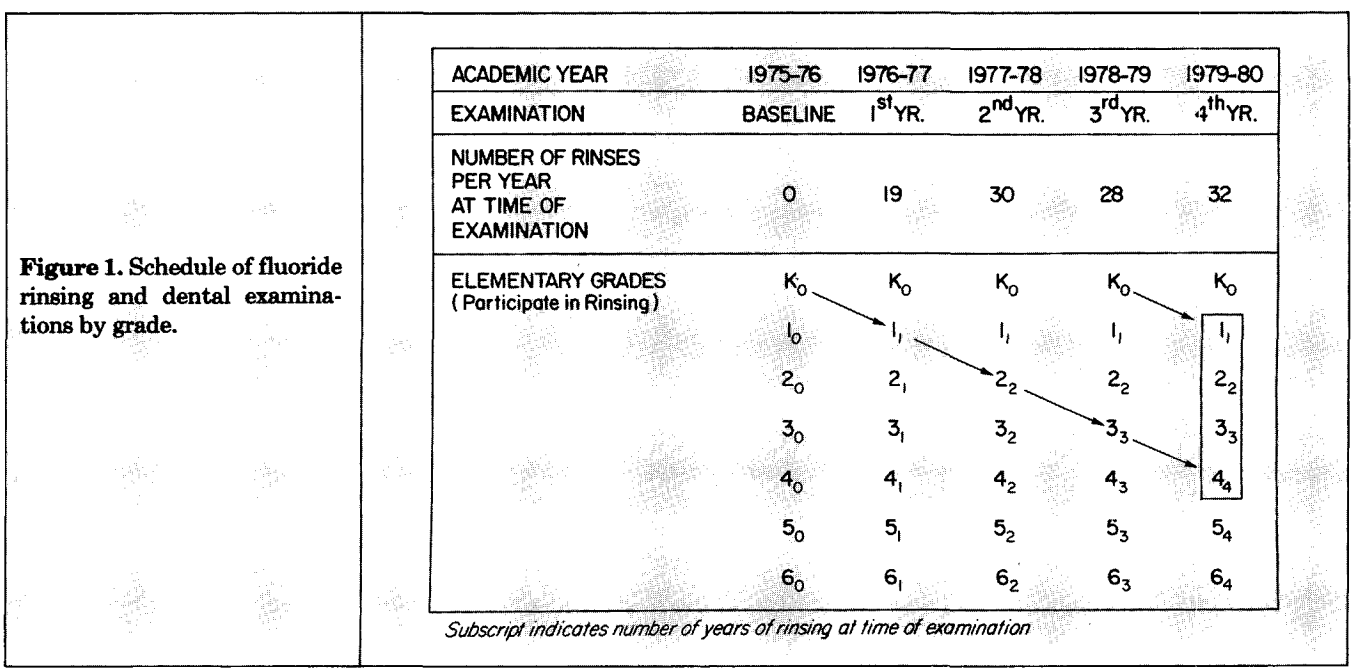

Figure 1. Schedule of fluoride rinsing and dental examinations by grade.

Table 1. Mean carious surface prevalence (dfs/child) at baseline and after up to four years of rinsing.

Grade	Years of Rinsing	X dfs/child Baseline	X dfs/child 4th Yr Exam	Percent Difference
1	1	3.29	2.63	- 20.0
2	2	4.37	2.80	- 35.9
3	3	5.60	3.51	- 37.3
4	4	4.28	4.13	- 3.5
All Grades	1-4	4.39	3.27	- 25.5

Table 2. Mean carious surface prevalence (dfs/100 s) at baseline and after up to four years of rinsing.

Grade	Years of Rinsing	X dfs/100 s Baseline	X dfs/100 s 4th Yr Exam	Percent Difference
1	1	4.14	3.34	- 19.3
2	2	6.69	4.12	- 38.4
3	3	10.39	6.20	- 40.3
4	4	9.05	8.23	- 9.1
All Grades	1-4	7.56	5.47	- 27.6

ence for both buccolingual and occlusal surfaces were only slightly lower.

Effect of Duration of Rinsing

By reviewing the results of the fourth year examination and previous yearly examinations, it was possible to analyze the relationship, for each grade, between increased duration of participation in the rinsing program and the reduction in caries prevalence. Figure 2 demonstrates that for all grades, except grade four, the caries reduction increased the more the children participated in the rinse program.

Comparison of the Effects of Fluoride Rinsing Between the Primary and Permanent Teeth

Figure 3 compares the percentage caries reductions for primary and permanent teeth and surfaces of the children in grades one through four who rinsed for from one to four years respectively. A greater reduction is observed for both teeth and surfaces of the permanent dentition compared to the primary.

Discussion

After a fluoride mouthrinsing program was in operation for four years, there was a 25.5 percent reduction in the caries prevalence of the primary dentition (dfs/child) for participating children in grades one through four. All children started in the rinse program as kindergarteners and, therefore, rinsed for from one to four years, concommitant with their grade level at the time of the last examination. The highest caries reduction, 28.6 percent, was found for proximal surfaces, although the reductions for buccolingual and occlusal surfaces were only slightly lower. Previous results from this program have shown that fluoride rinsing is most beneficial to proximal surfaces compared to other surfaces of primary teeth,[3,4] and similar findings have been reported by ourselves and others for the permanent dentition.[7,10-12]

While fluoride rinsing reduces the prevalence of caries in the primary dentition, the effects are not as great as in the permanent dentition (Figure 3). A principal reason for the disparate findings between the two dentitions may be the degree of post-eruptive

Table 3. Mean caries prevalence scores by type of primary tooth surface for children in grades one through four at baseline and after up to four years of rinsing.*

Surface	X dfs/child Baseline	X dfs/child 4th Yr Exam	Percent Difference
Proximal	1.61	1.15	- 28.6
Buccolingual	0.73	0.55	- 24.7
Occlusal	2.05	1.57	- 23.4

* First grade rinsed for one year; second grade for two years, etc.

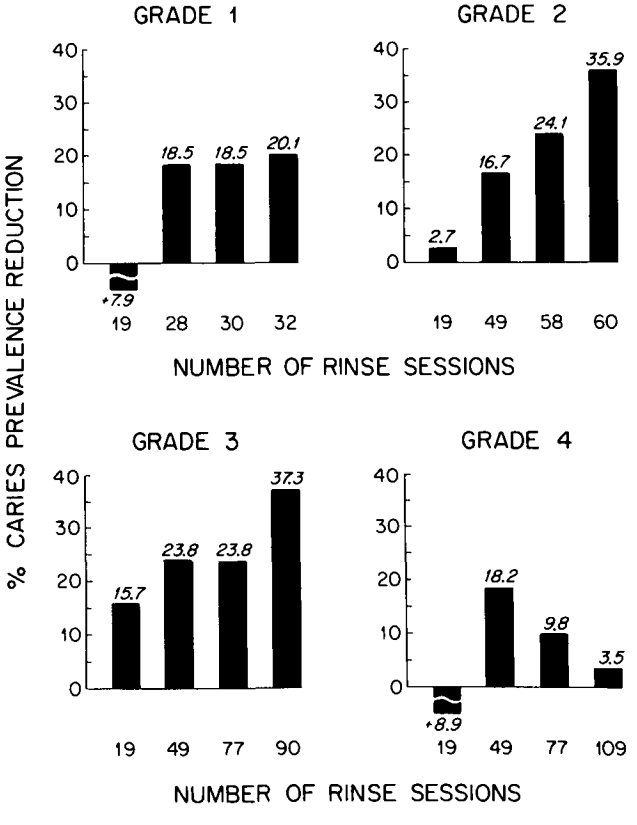

Figure 2. Percent caries prevalence reduction for primary teeth relative to the number of rinse sessions.

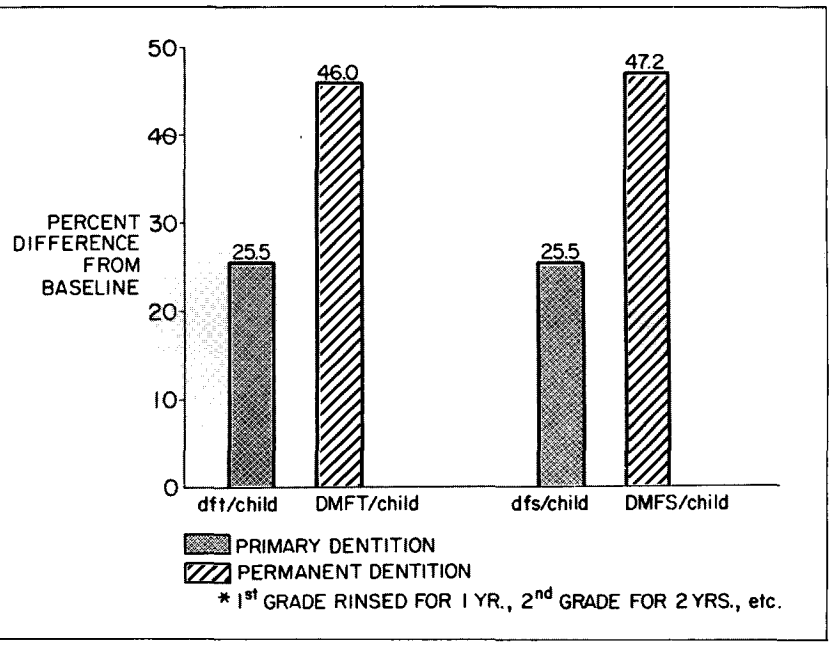

Figure 3. Difference in caries prevalence between the primary and permanent dentitions for children in grades one through four for up to four years of rinsing.*

maturation of the primary and permanent teeth at the time of first contact with the fluoride rinse. All of the primary teeth were *erupted* for three or more years before the children started in the rinsing program; conversely almost all of the permanent teeth were *erupting* while the rinsing program was in progress. Newly erupting teeth usually show greater benefits from topical fluoride therapy than teeth that have been erupted for several years; hence, the reason for greater benefits accruing to the permanent dentition in this program. Since the youngest children in a school-based rinsing program will be five or six years old, the effect of fluoride rinsing on the primary dentition would always be expected to be less than that observed for the permanent teeth in the same children. Nevertheless, as seen in Figure 2, continued rinsing participation enhances the benefits to the primary dentition, just as has been reported for the permanent dentition.[13] Therefore, for maximum benefits to both dentitions, school-age children should be enrolled in rinsing programs at the lowest grade level possible, preferably kindergarten.

The effectiveness of this mouthrinse program was evaluated by comparing the caries prevalence of a random sample of children who rinsed for up to four years to the caries prevalence of randomly chosen children who were enrolled in the same schools in 1975 before the rinsing program was initiated. There are problems with this type of a retrospective baseline and random sampling design. Specifically, the same children cannot be followed longitudinally, and the assumption must be made that observed caries differences are the result of the preventive program under investigation.

An additional assumption is that the baseline data are representative of the caries status of the population under investigation. This, however, is not always the case. As seen in Table 1, the baseline caries scores for fourth grade children do not show the same sequential rise, as do the baseline caries scores for grades one through three. In fact, baseline scores for grade four children are even lower than those recorded for grades two and three. While natural exfoliation may partially influence this observation, it is not a principal factor since a caries analysis using dfs/100 s (Table 2) also shows lower than expected baseline scores for fourth graders. By including the fourth grade baseline caries scores in the analyses in this article, the percent caries difference averaged for all grades, which are listed in Tables 1 and 2, are lowered. In addition, the percent caries reductions for each grade, which were found to increase directly with increased participation in the rinsing program (Figure 2), show an inverse trend for grade four. Although the baseline scores for fourth graders are obviously aberrant, scientific honesty requires that they not be excluded from the analysis, nevertheless, the discrepancy and its influence on the results must be recognized.

Summary and Conclusions

The results to the primary dentition of weekly rinsing with a 0.2 percent neutral NaF solution in a fluoride-deficient ($F \leq 0.1$ ppm) school district on Long Island, New York, were evaluated after four years. One hundred twenty-five children each from grades one through four were randomly chosen for dental examinations. Their caries prevalence scores were compared to baseline scores of children in the same grades who were examined before the rinsing program began. Because participating children entered the program as kindergarteners, at the time of the last examination

grade one had rinsed for one year, grade two for two years, etc.

After four years (up to 109 rinses), there was a caries prevalence reduction in the primary dentition of 25.5 percent (dfs/child) and 27.6 percent (dfs/100 s). It was felt, however, that abberant baseline scores for fourth grade children lowered the overall percentage reductions. Caries reductions for proximal, buccolingual, and occlusal surfaces were 28.6 percent, 24.7 percent, and 23.4 percent respectively. Caries reductions in the permanent dentition of the same children were provided for comparison. Reductions in the permanent dentition were greater than those recorded for the primary dentition and probably reflect the fact that the permanent teeth are in a less mature posteruptive status than the primary teeth when they are first exposed to rinsing.

It was felt that the earlier the children entered a fluoride mouthrinsing program and the longer they participated in it, the greater should be the benefits.

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Quotable Quote

Normal development of a child's immune system requires a properly functioning thymus gland. Hormones from the gland may also be required to maintain the immune system throughout life. Two substances recently discovered in calf thymus glands are likely to play a role in such development and maintenance. Karl Folkers and colleagues at The University of Texas in Austin have isolated small amounts of two thymic polypeptide molecules, which they suspect to be hormones. One, which they have named thymone A, has about 70 amino acids; the other, thymone B, has at least 13. Several thymic hormones have already been characterized as helping bone marrow stem cells mature into immune system T cells and increase T cell effectiveness. Folkers also has isolated from thymus the coenzyme glutathione, which is suspected of playing a role in the transport of amino acids across membranes.

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