

CARIES IN DECIDUOUS TEETH IN RELATION TO MATERNAL INGESTION OF FLUORIDE

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THE prophylactic effect of fluoride in the prevention of dental caries is well established, and this effect is known to be greatest when teeth are exposed during the period of calcification. Since much of the enamel of deciduous teeth calcifies prior to birth, the possible benefit from maternal ingestion of fluoride during pregnancy is a subject of both practical and theoretical interest.

A recent report (1) states that 25 ppm of fluoride (as NaF) in water given rats during gestation had no effect on caries incidence in the offspring. Evidence regarding transplacental passage of fluoride is conflicting. The existence of a placental barrier which mediates and perhaps impedes the transfer of the ion has been suggested (2, 3). However, in man, a considerably higher cord-blood fluoride concentration has been demonstrated with mothers exposed to fluoridated water throughout pregnancy (4). Although these investigations are of interest, they do not answer the fundamental question as to the effects of maternal ingestion of fluoride during pregnancy on the occurrence of caries in the deciduous teeth of offspring.

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This report provides such information for 178 children who were in utero before and after the beginning of water fluoridation in Newburgh, N.Y.

Methods

Three cohorts of Newburgh children, each examined at 6 years of age, were studied. Cohort A consisted of 52 children born in February, March, or April, 1945, just before fluoridation of the water supply began on May 2, 1945. These children served as a control group. Cohorts B and C, consisting of 52 and 74 children born in the same months 1 and 2 years later, presumably were exposed to water containing 1-1.2 ppm sodium fluoride from birth, as were their mothers throughout gestation. Only children born in Newburgh were included, with the exception of nine in cohort A who were born in nearby towns, none of which had fluoridated water supplies. Data on caries prevalence in their deciduous teeth were gathered for the three cohorts in 1951-53 during an intensive study of the effects of water fluoridation (5). All examinations were made by the same person. The cohorts did not differ significantly with respect to sex, race, or the proportion of children from various school districts.

Findings

The average number of decayed or filled teeth and tooth surfaces at age 6 was very similar in all three cohorts (table 1). A slightly higher percentage of children in cohort C were entirely free from caries than in either cohort A or B.

However, the difference was well within chance limits ($P > 0.50$).

Incisors and first molars begin intrauterine calcification earliest (6). It might therefore be expected that these teeth, because of their longer exposure, would evidence greater benefit from any prophylactic effect of prenatal fluoride than cuspids or second molars. Table 2 shows the percentage of children in each cohort who were free from caries in each of these types of teeth. No significant association between maternal ingestion of fluoride and freedom from decay was demonstrated in any tooth group.

Discussion

A comparison of the percentages of children free from decay, as made here, is not an entirely satisfactory indicator of possible differences between groups. Some sensitivity is lost since a person with one decayed first molar, for example, is given equal weight with one who has caries in all four of these teeth. However, the more usual comparisons of the average number of decayed teeth or tooth surfaces per person can be misleading, because of stronger correlations between the condition of teeth within individual mouths than between different individuals. The consequent lack of independence between observations of this type makes statements about the statistical significance of any observed differences hazardous. For this reason, tests of significance of the differences between the average number of decayed teeth per child in the three cohorts were not used. However, the consistency of the data supports the conclusion that exposure of the pregnant woman to fluoridated water had no observable effect on the caries experience of the deciduous teeth of the children in this study.

Table 2. Percentage of 6-year-old children having no caries in specific types of teeth, by cohort

Types of teeth	Cohort ¹			P ²
	A (N=52)	B (N=52)	C (N=74)	
Incisors.....	86.5	82.6	90.5	>0.40
First molars....	61.5	61.5	66.2	>0.50
Cuspids.....	94.2	96.1	93.2	>0.50
Second molars..	57.6	50.0	47.2	>0.40

¹ Mothers of cohort A were not exposed to fluoride during pregnancy; those of cohorts B and C were exposed.

² By the chi-square test.

Whether these findings indicate placental interference with the supply of fluoride to the teeth in utero is debatable. Although not possible in this study, a determination of the fluoride content of teeth at birth in relation to maternal ingestion of fluoride would help clarify this. Even if no such barrier exists, there may be qualitative and quantitative differences in the effects of fluoride during the prenatal as opposed to the postnatal period of tooth calcification. It is also possible that the effect of fluoride which may reach the fetal teeth is masked by postnatal fluoride ingestion. These points merit further investigation.

Summary

A study of three cohorts of children demonstrated no significant association between the occurrence of dental caries in their deciduous teeth and the ingestion of fluoridated water by their mothers during pregnancy.

Comparisons made between 6-year-old children born during the 3 months preceding fluoridation of the water supply in Newburgh, N.Y.,

Table 1. Prevalence of caries in deciduous teeth of 6-year-old children, by cohort

Cohort ¹	Number of children	Mean age (months)	Teeth per child	df teeth per child	df surfaces per child	df teeth per 100 teeth	Percent children caries-free
A.....	52	75.3	17.3	2.2	3.8	12.9	40.8
B.....	52	73.8	17.5	2.4	3.8	13.4	36.8
C.....	74	73.6	18.0	2.3	3.7	12.7	45.9

¹ Mothers of cohort A were not exposed to fluoride during pregnancy; those of cohorts B and C were exposed.
NOTE: df—decayed or filled.

and those born during the same months 1 and 2 years later, showed little difference in the average number of decayed or filled teeth or tooth surfaces, in the percentage of children entirely free from caries, or in those free from caries in specific types of teeth.

REFERENCES

- (1) Stookey, G. K., Osborne, J., and Muhler, J. C.: Effects of pre- and postnatal fluorides on caries. *Dental Progress* 2: 137 (1962).
- (2) Gardner, D. E., Smith, F. A., Hodge, H. C.: The fluoride content of placental tissue as related to the fluoride content of drinking water. *Science* 115: 208 (1952).
- (3) Buttner, G., and Muhler, J. C.: Fluoride placental transfer in the rat. *J. Dent. Res.* 37: 326 (1958).
- (4) Feltman, R., and Kosel, G.: Prenatal ingestion of fluorides and their transfer to the fetus. *Science* 122: 560 (1955).
- (5) Ast, D. B., Smith, D. J., Wachs, B., and Cantwell, K. T.: Newburgh-Kingston caries-fluorine study. XIV. Combined clinical and roentgenographic dental findings after ten years of fluoride experience. *J. Am. Dent. A.* 52: 314 (1956).
- (6) Kraus, B. S.: Calcification of the human dentition. *J. Am. Dent. A.* 59: 1128 (1959).

The Medical Center in the Nation's Future

I believe that the university-based medical center is the key to the future of the nation's health. Meeting the challenges before us will require genuine breakthroughs in all of the three basic elements which comprise the world of medicine—teaching, research, and service. Too frequently the medical school, the nursing school, the teaching hospital, the research program, and community health services have been thought of as separate and distinct entities functioning independently of one another. It is my firm conviction that they are, in fact, inseparable, and that our failure to recognize and build upon their interrelationships has cost us dearly in duplication of effort and dispersal of resources.

The "medical center" concept, which has been given practical realization in recent years, offers high promise for this kind of coordination. Typically, such a center has as its nucleus a medical school for undergraduate training. The scientists needed to direct such a program can be retained, and can be most effective, if they have facilities for research. An environment which encourages the pursuit of new knowledge lends vigor to the teaching program.

These same faculty members, and others attracted to the center, help to train graduate specialists in various fields of the parent university—from which future medical educators and researchers will be

recruited. They also play a part in the training of paramedical personnel.

At the same time, the medical center strengthens the teaching of clinical specialties, conducted in close relation to patient care by a corps of clinical teachers. The teaching hospital, therefore—whether it is directly operated by the medical school or affiliated with it—is an indispensable component of the medical center. The clinical faculty, in turn, has growing responsibilities in the graduate training of interns, residents, and fellows.

Medical centers so conceived can and should provide leadership in coordinating medical services within their areas, and in providing postgraduate and specialized training opportunities for practicing physicians, nurses, and others in the health professions.

Such a program—which combines basic and clinical research, teaching at many levels, and coordinated medical services to the community—represents a logical and constructive development of the concept of coordination on which, I believe, our medical future depends.—BOISFEUILLET JONES, *Special Assistant (Health and Medical Affairs) to the Secretary, Department of Health, Education, and Welfare, from commencement address, University of Mississippi Medical Center, Jackson, June 10, 1962.*