Failure of intense preventive efforts to arrest early childhood and rampant caries: three case reports

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Abstract

This report presents the first three children who developed dental caries despite being enrolled in a randomized, control trial to test methods to prevent early childhood caries. The children's caretakers received education on decreasing frequent and prolonged feeding with a nursing bottle and other sugar containing foods, as well as brushing the children's teeth daily with 0.4% SnF_2 gel. One of the child's caretaker additionally received training sessions to improve confidence in eliminating the child's nursing bottle habit and in performing daily tooth brushing. The two other children received monthly topical fluoride treatments with 2% NaF. Despite these intensive preventive efforts, these three children developed dental caries. Two of the children had mutans streptococci colonization at the time of initial visit, (12 and 14 months of age, respectively). All had high mutans streptococci levels at the time that caries was detected. Incorrigible, high-frequency sugar consumption from a bottle or from solid foods was suggested in all three cases. In one case, dental caries was associated with defects of the tooth enamel. Conceivably, the cariogenic challenge and harmful behaviors in certain children may be so extreme that they can overwhelm even extraordinary preventive efforts.(Pediatr Dent 21:160-163, 1999)

Early childhood caries (ECC), also known as nursing caries and baby bottle tooth decay, has been defined as one or more carious lesions involving maxillary anterior teeth in a child three years of age or younger. The etiology is ascribed to prolonged or frequent contact with sugar containing foods, oral infection with mutans streptococci (MS), and, in some cases, enamel hypoplasia that makes the primary teeth more susceptible to demineralization.[1] The caries pattern is most often characterized as first affecting the primary maxillary anterior teeth, followed by the first primary molars.[2] The etiology and pattern of caries in young children that does not involve the maxillary anterior teeth are not as well characterized.

Efforts to prevent caries in children under three years of age have involved informing and counseling parents about cariogenicity of prolonged and night-time feeding practices; however, such approaches have had only limited success. One study showed that among parents of children with ECC, 68% did not substitute water for cariogenic drinks in the nursing bottle as recommended.[3] Another study reported little influence of parental counseling in weaning their children from the night-time bottle and brushing fluoride gel on their children's teeth.[4] A report on an intensive educational program in Native American communities to reduce harmful feeding habits also reported limited success. The program included training of parent volunteers, health professionals, and tribal employees to counsel caretakers of young children regarding proper feeding practices. The prevalence of caries in these communities declined from 57% before the program to 43% at the end of the intensive program.[5]

Combining education with behavioral modification techniques may enhance caretakers' home health care behaviors, while reducing their childrens' harmful feeding habits. Although education is necessary to modify a change of behavior, individuals must be motivated to make the changes. One report has shown that subjects who received training to evoke confidence to change their behavior (self-efficacy enhancement) regarding oral hygiene practices had improved oral health three months later; however, the improvements were not evident at nine months.[6]

Besides behavioral techniques, preventive interventions that do not rely on patient compliance have also been investigated. Professional fluoride treatments have been well documented to reduce caries;[7] however, there are few contemporary clinical trials to determine the benefits of frequent topical fluoride treatments for the general child population, or specifically for toddlers at high caries risk. Antimicrobial approaches also have been examined to prevent transmission or reduce colonization of MS and consequently diminish dental caries incidence. In one study, children of mothers given chlorhexidine mouth rinse were noted to have lower levels of MS and lower caries prevalence than control children[8]. Another study of high caries risk children given a topical application of 10% povidone iodine solution every two months found that none of 15 children treated with the antimicrobial agent developed caries, as compared with 5 of 16 control subjects.[9]

This report documents three children who developed dental caries despite being enrolled between 12-14 months of age

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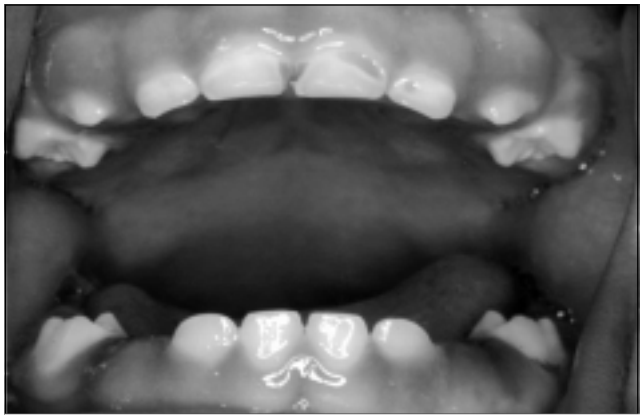

Fig 1. Child's dentition at 22 months of age. Numerous carious lesions on the maxillary incisors are evident.

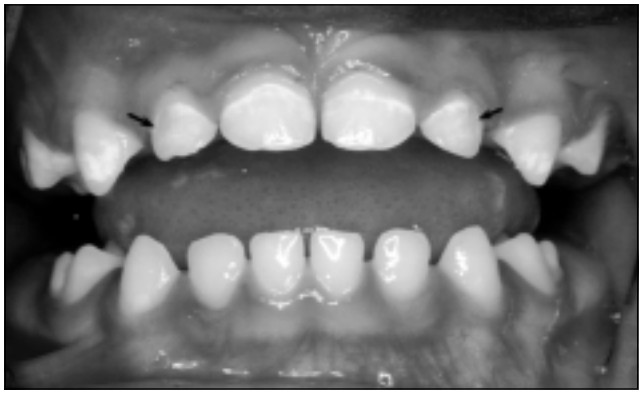

Fig 2. Child's dentition at 24 months of age. Enamel defects on the maxillary incisors, maxillary canines, and mandibular canines are evident. Two carious lesions on the labial surface of the maxillary lateral incisors have been restored with a polyacid-modified resin restoration (arrows).

in a clinical trial that examined the effect of education, self-efficacy enhancement, and frequent professional fluoride treatments on caries incidence. The longitudinal nature of these cases gives insight regarding the etiology and progression of caries in this age group, and despite intensive efforts, the difficulty in preventing it in some individuals.

Case Reports

The first three children who developed caries in a two-year longitudinal study concerning caries interventions in inner-city toddlers are the subjects of this report. Parents and their children in Hartford's Women, Infants, and Children (WIC) program were eligible to participate if, at the beginning of the trial, the child was between 8 and 15 months of age; still using a nursing bottle, and had a least four teeth with no visually identified dental caries or enamel defects. This study started with 245 child/parent pairs.

Eligible and consenting child/parent pairs were assigned randomly to a control, self-efficacy, or high frequency fluoride group. All parents, irrespective of their group, received annual education regarding the potential harm of frequent and prolonged feeding with a nursing bottle, as well as instructions on the use of daily bushing their child's teeth with a "pea sized" amount of 0.4% SnF_2 gel. Parents in the self-efficacy group received six additional training sessions in the first year and four in the second to improve their confidence in eliminating the nursing bottle habit and to perform daily tooth brushing with fluoride gel. Children in the high frequency fluoride group received monthly supervised professional topical fluoride treatment of approximately 0.1 gram of 2% NaF topical foam that was "brushed-on" for one minute.

Baseline and subsequent dental examinations were conducted by two dentists blind to the experimental conditions. Clinical detection of caries was determined by visual and tactile examinations[10] using #23 explorers, front surface mirrors, and dental light. MS screening tests were performed at least yearly, or more frequently if the child was in the self-efficacy group. The test involved sampling the saliva from each child by placing a sterile wooden tongue depressor on the child's tongue until it was visibly moistened. The tongue depressor was then pressed onto plates containing MS selective medium.[11] After the plates were incubated for three days, bacterial colonies that morphologically resembled MS were recorded semiquantitatively as low (0 colony forming units [CFU]), moderate (1-50 CFU), or high (>50 CFU).

Case 1 is a child who entered the study at 14 months of age and was assigned to the self-efficacy group. At baseline the child reportedly was put to bed with a bottle containing juice, sweetened milk, or plain milk, had six incisors present without defects, and moderate MS levels. During the course of the study, the parent received an initial education program and five self-efficacy training sessions. Despite these training sessions, questionnaire data showed that the parent had not been able to accomplish the desired changes. At 22 months of age, eight months after entry into the study, the child still was given juice in the bottle at night. At this time, the MS levels were recorded as high. Carious lesions and enamel opacities were evident on 52, 51, 61, 62 (using F.D.I./ International tooth designation sysytem) (Fig.1), and consequently the subject was dropped from the study and referred for dental care.

Case 2 is a child who entered the study at 12 months of age and was assigned to the monthly professional fluoride group. Baseline data revealed that the child was put to bed with a bottle containing formula, juice, or water, had six incisors without visual defects, and had moderate MS levels. Despite the initial education, the child persisted in using a baby bottle with juice or water during the day and night over the 12 month study period. During this year the child received only 7 of the 12 planned fluoride treatments. Five were "no show" appointments, and contacting the caretaker to reschedule appointments was difficult. At 24 months of age the child was found to have carious lesions on buccal surfaces of 52 and 62, and was referred for restorative care. Although the initial examination did not find any visual defects on his partially erupted incisors, the examination at 24 months revealed what appeared to be enamel defects on the cervical thirds of the maxillary incisors, the middle to incisal thirds of the maxillary canines and the cervical thirds of the mandibular incisors (Fig 2). The MS level at 24 months was high.

Case 3 involves a child who entered the study at 12 months of age and was also assigned to the monthly professional fluoride group. The child at baseline reportedly used a bottle once a week, had five incisors present without any visual defects, and had no detectable MS levels. During the 24 months in the study, 20 fluoride treatments were administered. The child reportedly was weaned from a bottle shortly after admission to

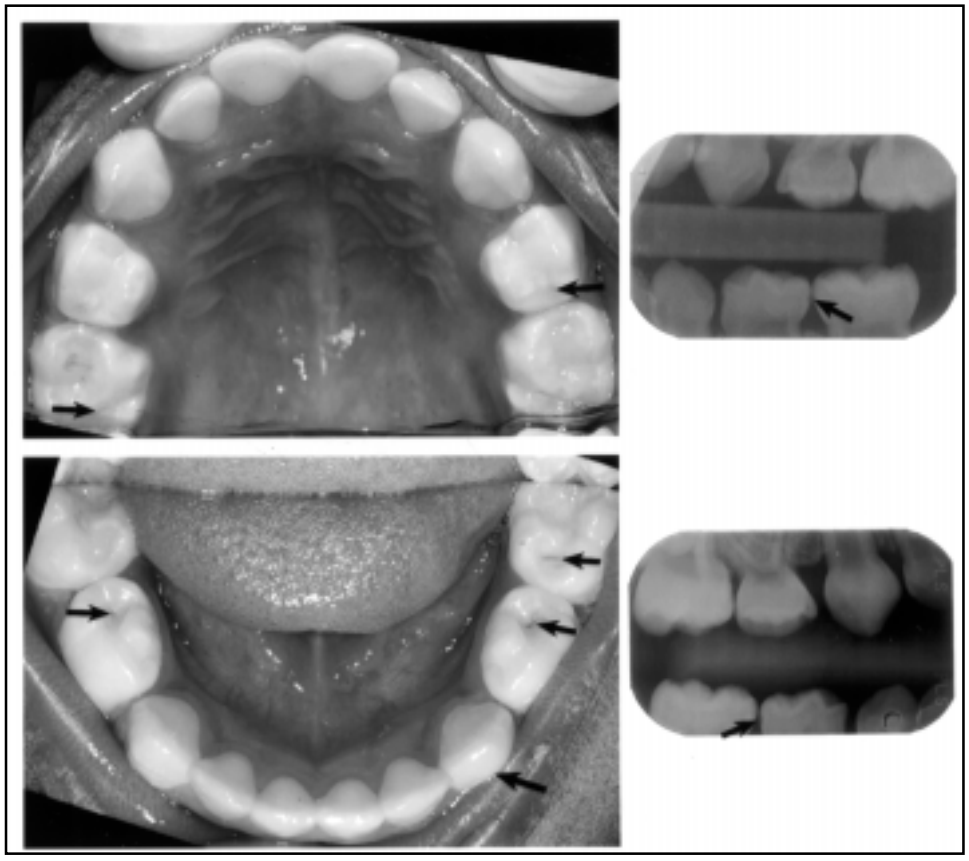

Fig 3. Child's dentition at 35 months of age. Arrows show occlusal and proximal carious lesions on the molars, and a buccal lesion on a mandibular canine.

the study; however, there were frequent notations in the patient's record that the child came to the study visits eating candy. Additionally, on one diet questionnaire the caretaker reported that the family does not eat regular meals. High MS levels were recorded at 23 and at 35 months of age. At the age of 35 months, eight carious lesions were detected on the occlusal surfaces (55, 64, 74, 75, 84) and posterior proximal surfaces (74, 84). Furthermore, enamel opacities were evident of 54, 51, 61, 83. (Fig. 3).

Discussion

These three cases examine factors related to the dental caries in toddlers. However, the observations should be interpreted recognizing the limitations of data collected from case reports. The cases presented are the first children noted to have caries from a randomized controlled trial of intensive approaches to reduce the carious process in children between one to three years of age. The longitudinal study of all the children in the intervention trial proved to be inconclusive because of the large number of subjects that did not complete the two year study.

These case reports, nevertheless, shed some insights on both the etiology and prevention of caries in children between one and three years of age. It is generally believed that ECC is attributed to early infections with MS, high frequency sugar consumption, and, in some cases, enamel hypoplasia of the primary teeth. It should be noted that Case 1 and Case 2, that fit the criteria for ECC, had moderate colonization with MS at the time of initial visit (12 and 14 months of age, respectively). Previous studies have suggested variation of the time of initial colonization from at or before the first birthday[12-14] to as late as between 19 and 31 months.[15] Although the early colonization of MS in two of these cases may not be representative, it does suggest that early colonization may occur in children at high risk for caries. The age that MS colonization can occur is important for understanding the disease process, timing preventive interventions, and determining a child's caries risk.

Dental caries in two children also appears to be associated with enamel opacities (alteration of translucency) and enamel hypoplasia (reduced thickness).[16] The locations of the defects on the incisors and canines are compatible with enamel mineralization occurring just before, or just after birth.[17] Defects on primary teeth are frequently reported in children born in developing countries, in disadvantaged communities of industrialized countries, and in children born with low birth weight.[18] Altered enamel of primary teeth from such environmental insults may be predisposed to caries due to surface roughness or pitting that may favor the colonization of cariogenic microorganisms.[19] Indeed, in Case 2, the two cavitated lesions on the maxillary lateral incisors are associated with what appeared to be enamel opacities or hypoplasia. It also should be noted that the enamel defects observed at the two-year examination in this case were not evident at the baseline examination because these teeth either were not erupted, or only partially erupted at 12 months of age. Dental caries was also detected in Case 3 on the middle third of a mandibular canine, an area also frequently reported to have developmental defects.[20] Primary prevention in children at risk for enamel defects and subsequent ECC perhaps should include both pre- and post-natal dietary counseling.

The association of high frequency sugar consumption from a bottle and from solid foods is suggested in all three cases. Case 1 and Case 2 appear to have had persistent bottle habits and characteristic carious lesions of the maxillary anterior teeth. Case 3 reportedly was weaned from the bottle shortly after entry into the study; however, this child frequently consumed sugar containing foods and did not eat regular meals. The presence of carious lesions on the occlusal and proximal surfaces of the molars in this child under three years of age suggests that the carious process at these sites was occurring concurrently, rather than sequentially. Previous descriptions suggest that proximal carious lesions are initiated after fissure lesions and they may not be evident until the age of four.[21]

These three cases also challenge the commonly accepted belief that "dental caries is a preventable disease."[22] Modifica-

tion of dental health behaviors may not be attainable by all families. Consequently, education and counseling to reduce adverse feeding behaviors and to institute oral hygiene behaviors may not always be effective. Another report that counseled parents to change bottle habits and establish tooth brushing also was not successful in arresting dental caries progression on maxillary anterior teeth.[4] Furthermore, preventive approaches that relying on professional therapy instead of patient compliance have variable success. The present study indicates that dental caries can develop in children despite intensive professional fluoride treatments. However, topical application of oral antimicrobial agents to either reduce the transmission or the microbial burden of cariogenic microorganisms has shown promise in reducing caries in young children. Antimicrobial approaches need more investigations to both confirm the findings and optimize the regimens.

This report describing children under age three who developed frank carious lesions despite intensive preventive regimens gives some insight into the etiology and prevention of the early carious process. Although the MS levels in these children may not be representative for all populations, it suggests that colonization can occur near or before the first birthday. The reported high frequency sugar consumption from a bottle or from solid foods in all three cases confirms other reports that such feeding behaviors are associated with high dental caries incidence. Additionally, the two children with enamel defects suggest that deficiencies of enamel may further predispose teeth to early caries. These etiologic factors in some children may impart such a large cariogenic challenge that even the most intensive preventive procedures can be overwhelmed. Additional investigations with more representative and larger populations are needed to verify and further explore the finding suggested by these three cases.

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