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Baby Bottle Tooth Decay in Native American Children in Head Start Centers

ERIC BRODERICK, DDS, MPH
JEFFREY MABRY, DDS, MS
DONALD ROBERTSON, DDS, MPH, MS
JEFFREY THOMPSON, DDS

Dr. Broderick is Chief, Area Dental Services Branch, Oklahoma City Area Indian Health Service. Dr. Mabry is Area Pediatric Dentistry Consultant, Oklahoma City Area Indian Health Service, Claremore Indian Hospital, Claremore, OK. Dr. Robertson is Endodontic Consultant and Area Dental Prevention Coordinator, Navajo Area Indian Health Service, Window Rock, AZ. Dr. Thompson is Area Dental Prevention Coordinator, Navajo Area Indian Health Service, Window Rock, AZ. Tearsheet requests to Dr. Broderick, at 215 Dean A. McGee St., NW, Room 409, Oklahoma City, OK 73102-3477.

Synopsis

Baby bottle tooth decay is a unique pattern of dental caries (tooth decay) affecting the dentition of young children. It is associated with the practice of putting the child to sleep with a nursing bottle filled with liquid that contains sugar. Practitioners who treat Native American children have noted that this population suffers from a high prevalence of the condition.

In order to establish specific program priorities and treatment needs for this segment of the Native American population, additional information is required on both prevalence and severity of baby bottle tooth decay. In this survey, an overall prevalence of 70 percent was observed when Navajo and Cherokee Head Start students ages 4-5 years were examined. Of the children affected by baby bottle tooth decay, 87 percent displayed the most severe manifestation of the disease.

The prevalence of this disease in these Native American children appears to be substantially higher than in other populations. Further study is needed to identify the factors contributing to this difference in prevalence and to identify effective measures for reducing the occurrence of baby bottle tooth decay among Native Americans.

MANY TERMS HAVE BEEN applied to a specific pattern of dental caries (tooth decay) observed in young children: nursing caries, nursing bottle caries, nursing bottle syndrome, nursing bottle mouth, baby bottle caries, and bottle mouth. Most recently, the term baby bottle tooth decay (BBTD) has been adopted by the Healthy Mothers/Healthy Babies Coalition, a consortium representing organizations interested in the health of children. The term was selected to emphasize the frequent association of this form of dental caries with improper feeding practices.

Dental caries is a complex, multifactorial disease. Causative bacteria adhere to tooth surfaces in dental plaque and ferment carbohydrate to produce acid, which then demineralizes adjacent tooth enamel. At the earliest stages, this process can be interrupted. Remineralization depends on many factors, including the availability and concentration of fluoride. For clinical dental caries to develop, four factors are essential: acid-producing bacteria; a suitable substrate, particularly refined carbohydrate; enamel that is susceptible to demineralization; and time for repeated and undisturbed interaction of the first three factors.

While the process that produces BBTD is identical to the one just described, the resulting pattern of dental caries is unique to very young children. McDonald and Avery (*1*) explain that the pattern involves primary maxillary incisors, followed sequentially by the maxillary and mandibular primary first molars and the mandibular primary cuspids.

The mandibular incisors usually are protected from caries formation by the tongue and nipple.

Practitioners who provide dental care to Native American children note that this population experiences a higher prevalence of BBTD than other population groups. Anecdotal reports from these practitioners have been confirmed by dental surveys of Native American children. (*2,3*)

Literature Review

Severe carious lesions of the primary dentition, particularly affecting the maxillary incisors, have been observed in many groups for almost a century. In 1911 Harries (*4*) observed in English children that labial caries of the maxillary incisors appeared to be associated with the sucking of pacifiers. Pitts (*5*) realized in 1927 that the sweetened coating placed on the surface of the comforter probably was the main etiologic agent of the disease. Similar associations between carious incisors and sweetened comforters have been observed in the United States by Stein (1947) (*6*); in Sweden by Syrrist and Selander (1953) (*7*); and in England by James and coworkers (1951) (*8*).

Most theories on the etiology of BBTD involve a common factor—the child has been put to bed with a bottle containing milk, fruit juice, or some sweetened liquid. When the child stops nursing, the liquid pools around the primary maxillary incisors, thus serving as an excellent substrate for cariogenic microorganisms. An average 2-year-old sleeps approximately 10–14 hours per day. The presence of carbohydrates, microorganisms, decreased salivary flow, and stagnation of oral contents during sleep favor the formation of dental caries (*9*).

During the 1960s and 1970s British researchers found a prevalence of BBTD between 5.2 and 12 percent (*10–11*). Derksen and Ponti (*12*) examined 596 children ages 9 months to 6 years in Vancouver, BC; 3.2 percent of these children exhibited BBTD. In 1977, Currier and Glinka (*13*) studied 246 children in Richmond, VA, noting a BBTD prevalence of 5 percent.

Some studies have established a profile of behaviors characteristic of children affected by BBTD and their families (*14–15*). Johnsen described a profile for children with carious lesions on at least three primary maxillary incisors (*14*). Parents of 95 percent of these children reported that the child used the bottle overnight or when going to sleep. None of the caries-free children slept overnight with the bottle, although 45 percent occasionally went to bed with a bottle. Parents of affected children were less likely to have attended college and to report that the child used a pacifier or sucked a finger or thumb. These parents also reported more difficulty saying "no" to the child. Children with carious maxillary incisors were more likely to have experienced a serious medical condition such as asthma, a heart condition, or hydrocephalus. No significant differences were found regarding gender or activity level of the child, age of the parents, marital status, or water fluoridation status.

Dilly and coworkers (*15*) described a sample of children under 5 years of age exhibiting BBTD. Children with carious maxillary incisors were likely to be from lower socioeconomic families. Their parents were unaware of the age when weaning should occur or when oral hygiene should be initiated.

In 1980, Wolford and Miller conducted a survey to determine the prevalence of BBTD in the Indian Health Service treatment population (unpublished data, IHS, 1980, E. W. Wolford). Data were gathered on a sample of 1,334 children ages 1–5 years. The diagnosis of BBTD was made if all primary maxillary incisors were decayed, extracted for caries, or filled (def), or any combination thereof. In this survey, 37 percent of those examined met these diagnostic criteria. A mean def score (reflecting caries experience) of 6.0 was calculated for the entire sample, while a mean def score of 9.4 was observed among those with BBTD.

In 1983, the IHS conducted a survey to assess the oral health of Native Americans (*2*). The survey measured a wide range of oral conditions, through the full age spectrum of the dental patient population. Selected dental practitioners from all IHS Areas examined a convenience sample of 16,197 persons from the service population (1.76 percent of the total population) at selected Indian Health Service dental clinics. A mean def for the 0–4 year age group of 5.7 was observed, and 52 percent of the 1,321 subjects in this age cohort had maxillary central incisors in the decayed, extracted for caries, or filled category.

In 1985, Kelly and Bruerd (*3*) surveyed 514 Native American students (ages 3–5) enrolled in Head Start programs within the Alaska and Oklahoma Areas. To determine the prevalence of BBTD, children were classified solely by visual examination; those with three of the four maxillary incisors affected by caries were classified as having BBTD. (Because this survey was designed as a screening mechanism, a total def was not measured.) While an overall BBTD prevalence rate of

Table 1. Prevalence of baby bottle tooth decay among selected Native American children enrolled in Head Start Programs, 1985

Tribe	Total number surveyed	BBTD present	
		Number	Percent
Navajo	1,463	1,054	72
Cherokee	144	80	55
Total	1,607	1,134	70

Table 2. Level of severity of baby bottle tooth decay among selected Native American children enrolled in Head Start Programs, by tribe, 1985

Level of severity	Navajo		Cherokee	
	Number	Percent	Number	Percent
I. Minimal	32	3	6	7
II. Mild	69	6	8	10
III. Moderate	29	3	0	0
IV. Severe	924	88	66	83
Total	1,054	100	80	100

53 percent was found in the total sample, the prevalence rates for individual sites ranged from 17 to 85 percent.

Each of the cited IHS surveys used a different set of criteria for BBTD, yet all indicated high prevalence of the condition. These surveys demonstrate a need for more precise measures of the prevalence and severity of BBTD within the Native American population. This paper describes a survey of Native American children that assesses these parameters.

Methods

The purpose of this survey was to confirm the extent of BBTD in the Native American population, in order to define treatment needs and to establish specific program priorities for this segment of the population. There appears to be a disparity between the prevalence of BBTD reported in the literature in various populations and the limited prevalence data specific to Native American populations. IHS studies describe high prevalence rates but provide little information on the severity of the condition. No adequate measures of severity were evident in the literature. The investigators, therefore, established criteria to categorize those children with BBTD into four levels of severity. Levels and criteria were developed corresponding to the apparent natural progression of dental caries and specifically BBTD (*1,16,17*). A detailed description of these levels is as follows.

Type I. Minimal—Two maxillary anterior tooth surfaces with caries; no carious lesions in posterior teeth.
Type II. Mild—More than two maxillary anterior tooth surfaces with caries; no carious involvement of posterior teeth.
Type III. Moderate—Two or more maxillary anterior tooth surfaces with caries; one or more posterior teeth with caries.
Type IV. Severe—Two or more maxillary anterior tooth surfaces with caries, one or more teeth with pulpal involvement and/or mandibular anterior decay.

A sample of 1,607 Native American Head Start children was examined to measure both prevalence and severity of BBTD. The children examined were members of the Navajo tribe from Arizona and the Cherokee tribe from Oklahoma. This convenience sample was drawn from 105 different Head Start Centers, and consisted of all children attending school on the day of the oral examinations. The number examined represents approximately one-half of Head Start enrollees at these sites; children eligible for Head Start comprise 50 percent of the Navajo and 12 percent of the Cherokee children, ages 3-5.

Three examiners, one in Arizona and two in Oklahoma, conducted the survey. Examinations were performed using a mouth mirror, light, and explorer, without the benefit of radiographs. The following factors were accepted as evidence of prior pulpal involvement: presence of a sinus tract, absence of primary teeth, and pulp chambers that could be probed by an explorer. Although no attempt was made to calibrate examiners, caries was diagnosed on the basis of visual and tactile measures, using color and softness as primary indicators. To enhance consistency, surfaces that were not frankly carious were considered sound.

Findings

Survey results verify past reports of prevalence and provide an indication of the severity of BBTD within the survey population. Tables 1 and 2 present findings by tribal group and by severity. Great variation in prevalence among sites was noted (table 3). Of the 105 Head Start Centers, 10 sites had 100 percent of students classified as having BBTD. In one center, all students were free of BBTD.

Seventy-two percent of the Navajo sample and 55 percent of the Cherokee sample exhibited some level of BBTD. In comparison to the 3.2 to 12 percent prevalence reported in the literature

(*10–13*), these Native American children appear to exhibit much higher prevalence of BBTD than other population groups. In addition, 88 percent of Navajo children and 83 percent of Cherokee children with BBTD were categorized as being in the most severe category of BBTD. This finding would suggest that, if a Native American child has the condition, the most severe manifestations of the disease are likely to be present.

Discussion

This survey corroborates findings from other IHS surveys which have suggested high prevalence of BBTD within Native American populations. Identification of BBTD as a public health problem for this population requires that preventive measures be identified that specifically target the condition.

Results also indicate a need for further studies to identify behavioral, cultural, and social traits that place Native American children at increased risk for BBTD, and to examine the level of caries-associated bacteria among mothers. These investigations also could provide replication of this study in other Native American groups, to determine levels of BBTD in different Native American cultures. Ideally, the extent of inter- and intra-examiner variability should be calculated for such studies.

The full impact of BBTD on the health of the Native American population is unknown at this time. Nonetheless, if 70 percent of Native Americans experience BBTD as children, their oral health or their attitudes about oral health may be affected adversely during later life. This aspect also will require further study.

Treating children with this level of disease diminishes the ability of IHS providers to meet the dental needs of other eligible patients. Treatment of BBTD is both costly and time consuming. Because children often are given priority for dental care over other age groups in the IHS, treatment of BBTD limits availability of resources for others needing dental care, thus restricting access to the IHS oral health care system. In addition, extensive treatment for BBTD can be a traumatic experience for the child, the parents, and the dentist.

Native American children, as a group, should be targeted for prevention strategies specifically addressing BBTD. Parents and other caregivers should be informed about the causes of this significant—but preventable—condition. Efforts should focus on practices associated with BBTD. These educational programs should be evaluated, and characteristics associated with "successes" and "failures" carefully examined.

Table 3. Prevalence of baby bottle tooth decay among selected Native American children, by Head Start Center, 1985

Prevalence of BBTD among children	Navajo centers		Cherokee centers	
	Number	Percent	Number	Percent
Zero	0	0	1	12.5
1–49 percent	7	7.2	1	12.5
50–75 percent	39	40.2	6	75.0
76–99 percent	41	42.3	0	0
100 percent	10	10.3	0	0
Total	97	100.0	8	100.0

Conclusions

Seventy-two percent of Navajo and 55 percent of Cherokee Head Start children examined exhibited BBTD. Of those with BBTD, 87 percent displayed severe manifestation of the disease. Prevalence of BBTD varied widely among Head Start Centers; in the Navajo centers, from 29 to 100 percent and in the Cherokee centers, from 0 to 73 percent. Among Navajo children examined, BBTD prevalence was somewhat higher than among the Cherokee children examined.

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The Presence-Absence Coliform Test for Monitoring Drinking Water Quality

EUGENE W. RICE, MS
EDWIN E. GELDREICH, MS
ELEANOR J. READ, MS

Mr. Rice and Mr. Geldreich are with the Environmental Protection Agency (EPA). Mr. Rice is a Microbiologist in the Microbiological Treatment Branch, and Mr. Geldreich is EPA Senior Microbiologist. Ms. Read is a Senior Statistician with the Computer Sciences Corp., Cincinnati, OH. Tearsheet requests to Mr. Rice at the Microbiological Treatment Branch, Drinking Water Research Division, Water Engineering Research Laboratory, EPA, Cincinnati, OH 45268.

Synopsis

The concern for improved monitoring of the sanitary quality of drinking water has prompted interest in alternative methods for the detection of total coliform bacteria. A simplified qualitative presence-absence test has been proposed as an alternate procedure for detecting coliform bacteria in potable water.

In this paper data from four comparative studies were analyzed to compare the recovery of total coliform bacteria from drinking water using the presence-absence test, the multiple fermentation tube procedure, and the membrane filter technique. The four studies were of water samples taken from four different geographic areas of the United States: Hawaii, New England (Vermont and New Hampshire), Oregon, and Pennsylvania. Analysis of the results of these studies were compared, based upon the number of positive samples detected by each method.

Combined recoveries showed the presence-absence test detected significantly higher numbers of samples with coliforms than either the fermentation tube or membrane filter methods, $P < 0.01$. *The fermentation tube procedure detected significantly more positive samples than the membrane filter technique,* $P < 0.01$. *Based upon the analysis of the combined data base, it is clear that the presence-absence test is as sensitive as the current coliform methods for the examination of potable water. The presence-absence test offers a viable alternative to water utility companies that elect to use the frequency-of-occurrence approach for compliance monitoring.*

IN THE UNITED STATES, the total coliform group of bacteria serve as the principal microbiological parameter for determining the sanitary quality of drinking water. The National Interim Primary Drinking Water Regulations require that all public water supplies be monitored for coliform bacteria with the use of either the multiple fermentation tube (FT) procedure or the membrane filter (MF) technique (*1*).

Proposed changes to existing regulations call for amending the recommended maximum contaminant level for coliform bacteria to 0 organisms per 100 ml and adopting a frequency-of-occurrence concept for compliance monitoring (*2*). This type of moni-