

Dental Caries Prevalence and Treatment among Navajo Preschool Children

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Abstract

Objectives: The purpose of this study was to assess the dental health of Navajo preschool children, a population about whom little dental information is published.

Methods: Caries data were collected and analyzed for 2,003 Navajo children aged 3–5 years in the Head Start program, and for a convenience sample of 115 children younger than three years old from the Women, Infants and Children (WIC) program. **Results:** Each age group had an extremely high mean dmfs; however, as much as 70 percent of this index comprised treated surfaces. Maxillary anterior caries was observed in the WIC children under two years of age and posterior proximal caries was observed as early as two years of age. The prevalence of maxillary anterior caries reached a maximum of 68 percent in the three-year-old Head Start children, and may be associated with the high level of posterior caries in this population. **Conclusions:** Most children in this

population may be considered at risk for developing caries. This Navajo preschool population has perhaps the earliest caries onset, among the highest caries prevalence, and among the highest level of treatment of any reported population.

Key Words: Navajo, preschool children, dental caries, primary dentition, dental treatment.

There is little information in the literature about the dental health and treatment needs of Native American preschool populations. The relatively few references to these children almost exclusively pertain to the prevalence of nursing caries, which is reportedly as high as 85 percent (1–4). One of the few papers that examined the overall dental health of Native American three- to five-year-old children reported the mean number of decayed, missing, and filled primary teeth to be 9.3, with 89 percent of the affected teeth being decayed (1). Another paper reported a mean dmft and dmfs of 4.9 and 11.0, respectively, for 381 Native Alaskan children of the same age, with nearly 11 percent having a dmfs greater than or equal to 25 (5).

Previous studies have been based on the traditional dmfs index, a broadly encompassing measure that looks

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at entire populations without focusing on individuals or caries patterns. A recently developed system for analyzing caries has been used to describe the prevalence, severity, and distribution of caries patterns in populations with little dental treatment (6). This system, called the Caries Analysis System, focuses on caries-positive children and distinct patterns of dental disease that may have different etiologies and methods of prevention. A slight modification of this system to include extracted and restored surfaces allows for the comprehensive assessment of both dental needs and treatment.

The purpose of this study was to analyze the specific patterns of dental caries experience in a previously unreported sample of more than 2,000 Navajo children to determine the caries prevalence in this population and preventive approaches that might be useful.

Methods

Data collected between November 1990 and April 1991 were analyzed for 2,003 Navajo children ranging in age from three to five years, inclusive. All children were participants in Head Start programs from more than 100 centers located in Arizona and New Mexico. Head Start is a federally funded program for three- to five-year-old children of families whose incomes generally fall below federal poverty guidelines. Clinical examinations were conducted on site, without the aid of radiographs, by two standardized dentists using WHO criteria. Each tooth surface was examined visually in ambient light (without the use of an explorer or dental chair) and designated as sound, carious, restored with stainless steel crown, restored with amalgam or composite, or missing due to caries.

Data from a convenience sample of 115 children younger than three years of age also were analyzed. These children were enrolled in the WIC (Women, Infants and Children) program, a supplemental food program for low-income pregnant or nursing mothers and children at nutritional risk. One dentist performed these examinations using WHO criteria, and was calibrated by comparing results of replicate examinations on a subset of the sampled children. While these children's caries and restoration data were not necessarily representative of the approximately 2,000 children enrolled in these Navajo WIC programs, these data provided an opportunity to assess caries levels and treatment in an age group that traditionally has been difficult to study because of lack of accessibility.

Caries data were analyzed using the dmfs surface and tooth index, and the Caries Analysis System, in which caries was categorized into three disease patterns with different possible etiologies related to distinct stages of dental development. The "maxillary anterior" pattern included all maxillary incisor surfaces and the mesial surfaces of the maxillary canines, and describes the caries pattern attributed to an infant sleeping with the feeding

bottle (7,8), or occasionally to an infant being breast fed "at will" (4,9,10). The "fissure" pattern included all occlusal fissures, buccal pits, and lingual grooves of the molars, representing those surfaces susceptible to caries due to their anatomy. The "posterior proximal" pattern included all contacting posterior smooth surfaces, those surfaces that are protected from routine mechanical disturbances.

Prevalence—i.e., the percent of the population experiencing a particular caries pattern—and severity—i.e., the percent of available surfaces affected in a specific caries pattern among children positive for that pattern—were calculated. Children could be classified into more than one caries pattern.

Results

The mean dmft in the Navajo Head Start children ranged from 4.5 in three-year-olds to 6.6 in five-year-old children, while the corresponding mean dmfs ranged from 10.7 to 18.9 (Table 1). In the five-year-olds, 78 percent of the affected surfaces were either filled or missing. Among the WIC children younger than two years, mean dmft and dmfs scores were 0.2 and 0.5, respectively. In the two-year-old WIC children, mean dmft and dmfs scores were 1.7 and 3.9, respectively. The cumulative frequency of dmft scores among Head Start children revealed that 20 percent of three-, four-, and five-year-olds with the highest dmft scores had 46.5 percent, 41.4 percent, and 38.8 percent, respectively, of all caries within each age group.

The maxillary anterior pattern was the only disease pattern present in WIC children younger than two years of age, with 11 percent affected (Figure 1). This pattern was the most prevalent in three-year-olds, of whom 68 percent were affected. Fissure caries and posterior proximal caries were first evident in two-year-old WIC children and were more prevalent in successive Head Start groups. The prevalence of fissure caries was consistently

Table 1
Dental Caries Experience for Navajo Children by Age and Program Type

	WIC		Head Start		
	<2-year-olds (n=76)	2-year-olds (n=39)	3-year-olds (n=320)	4-year-olds (n=1,385)	5-year-olds (n=298)
% caries free	89.5	56.4	18.8	12.3	10.4
Mean dmfs	0.45	3.92	10.73	15.29	18.94
Mean dmft	0.24	1.69	4.54	5.95	6.62
Mean ds	0.45	2.77	4.00	4.12	4.26

FIGURE 1
Prevalence of Caries Patterns in Navajo Children

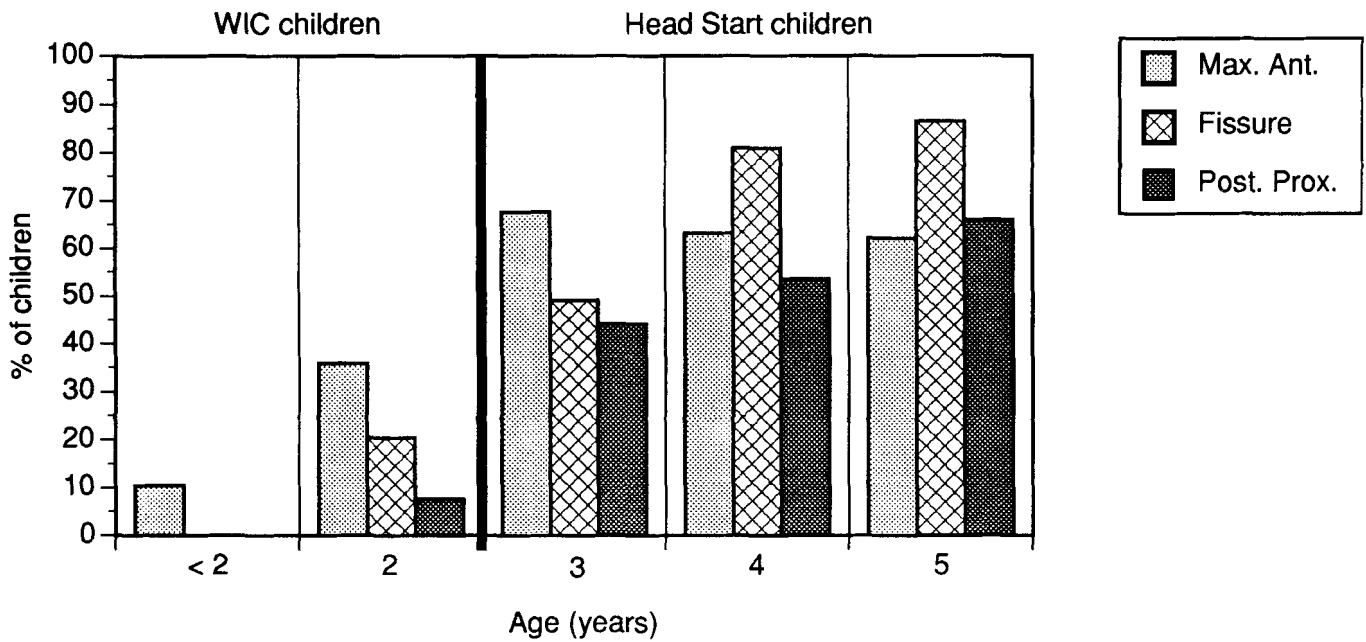
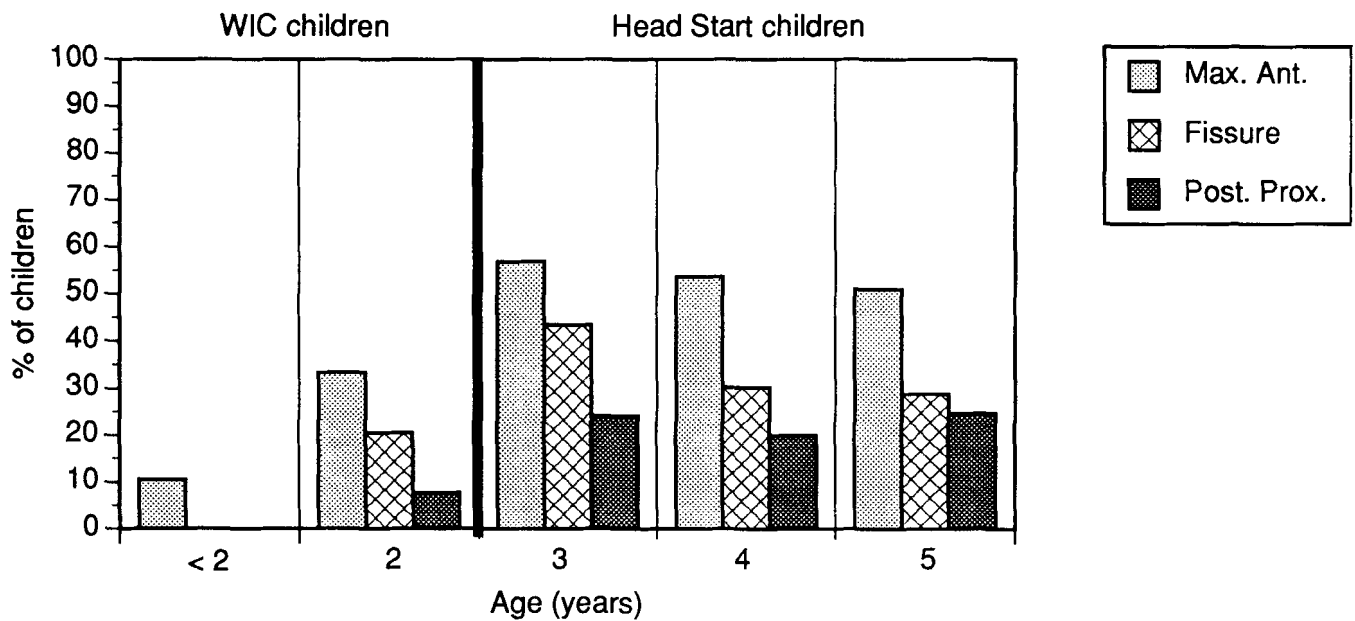


FIGURE 2
Prevalence of Untreated Lesions by Caries Pattern in Navajo Children



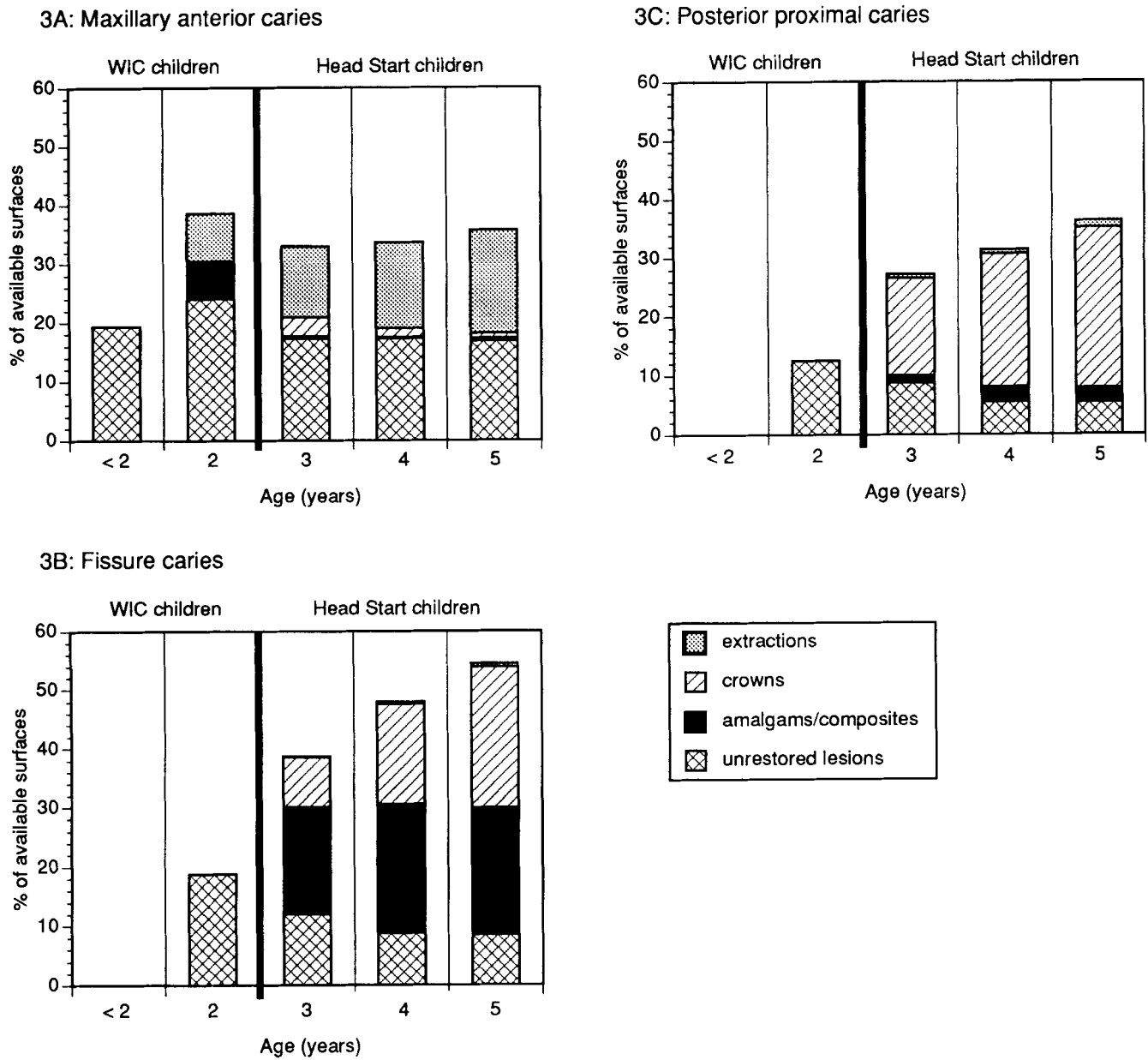
greater than that of posterior proximal caries, reaching a maximum of 87 percent in the five-year-olds.

The prevalence of untreated lesions in the maxillary anterior pattern in children younger than two years was identical to the total prevalence of this pattern; i.e., none of these children had received treatment (Figure 2). The prevalence of untreated maxillary anterior caries among the Head Start children was less in successive age groups. The total and untreated prevalence of fissure and posterior proximal caries was identical among the WIC children. In the Head Start group the untreated prevalence

of the fissure and posterior proximal patterns was greatest in three-year-olds, with 44 percent and 24 percent of the children affected, respectively. Unlike the total prevalence of these patterns, the untreated prevalence was less in the older age groups.

The severity of maxillary anterior caries was 19 percent in the WIC children younger than two years of age and 39 percent in two-year-olds. Among the Head Start children the severity ranged between 33 percent and 36 percent. Treatment was first seen in two-year-olds, with extractions comprising the majority of treated surfaces in

FIGURE 3
Severity of Caries Patterns in Caries-positive Navajo Children



all age groups (Figure 3A). The severity of fissure caries was greater in successive age groups, with 55 percent of available surfaces being affected in five-year-old children positive for fissure caries. The majority of the increase in severity was attributable to restored surfaces with an even distribution of crowns and amalgams or composites in the five-year-olds. The severity of untreated lesions was less in successive age groups (Figure 3B). The severity of posterior proximal caries also was greater in successive age groups. Like fissure caries, the majority of the increase in severity was attributable to restored surfaces, but with stainless steel crowns accounting for the majority of the treatment (Figure 3C).

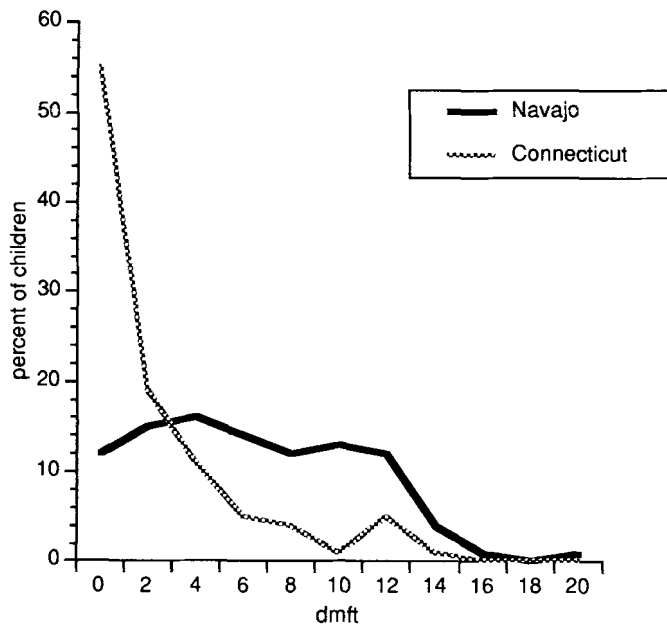
The distribution of dmft scores in four-year-old Navajo

children was contrasted with another four-year-old population from Connecticut Head Start programs, made up mainly of African Americans and Hispanics (6). The dmft frequency distribution was markedly different, with caries in the Navajos more evenly distributed and that of the Connecticut cohort polarized toward the caries-free individuals (Figure 4).

Discussion

The current study found a mean dmfs of 18.9 in five-year-olds, a dmfs score that is markedly greater than that of previous studies examining Native American preschool children (5,11) and among the highest contemporary dmfs means reported in the world for this age group

FIGURE 4
Frequency Distribution of dmft Scores in Four-year-old
Head Start Children



(12). What distinguishes the children in the present study from the subjects in other reports is the high level of treatment. Approximately 70 percent of the dmfs in this Head Start population comprises treated surfaces. Comparisons with other populations of similar age are difficult because few other populations have received the same high level of dental care. However, the dmft index, in contrast to the dmfs index, may be used to negate treatment effects, since number of surfaces affected by the treatment does not alter the dmft number. The extremely high dmft in this Head Start population (mean=6.2 in five-year-olds) indicates that even considering the exceptional level of treatment among these children, the level of caries is still remarkable, and consistent with dmft scores in other studies of Native American children (5,13). Since no radiographs were taken, actual dmfs levels may be greater in this Head Start population than the results demonstrate.

The dmft frequency distribution for these Navajo Head Start children is in sharp contrast to recent reports suggesting that a small proportion of children have the majority of caries. One study states that 20 percent of the US child population has 60 percent of its caries (14), and a more recent report states that 25 percent of US children have 75 percent of caries (15). Although both of these studies are based on caries in permanent teeth, the figures nonetheless suggest that caries is declining and is not distributed evenly in the general US population. However, results from the current study show that caries among Navajo Head Start children is at higher levels and more evenly distributed, so classifying children as high

or low risk is not appropriate. The greater uniformity of caries among this group of Navajo children suggests that unlike most other groups of children, nearly all of these Navajo children may be considered at risk.

The prevalence of the maxillary anterior pattern in this study is consistent with that found in other Native American studies (2,4), but is greater than that reported for other populations (7). Unlike the other caries patterns investigated, the prevalence of maxillary anterior caries was not successively greater in three-, four-, and five-year-olds. It is likely that most of these older children have either discontinued bottle usage by these ages, or are not predisposed to this disease pattern. The high level of maxillary anterior caries found in the present study also may be attributable to linear enamel hypoplasia, a defect noted in other Native American populations (16). Children with linear enamel hypoplasia have significantly greater caries experience in the posterior dentition than children without the defect (17). Additionally, recent studies have indicated that children with the maxillary anterior pattern are at markedly greater risk for developing the fissure and posterior proximal patterns (18). Among the Head Start children in this study, 70 percent to 75 percent of those with the posterior proximal pattern in each age group have the maxillary anterior pattern. These findings suggest that preventing or arresting the development of maxillary anterior caries may significantly reduce the level of caries in the posterior primary dentition.

Although the prevalence of maxillary anterior caries in Navajo children is high, the severity is relatively low. Three-year-old Chinese children, who have a high prevalence of maxillary anterior caries, have 44 percent of the available maxillary anterior surfaces involved, compared with only 32 percent in the Navajo children. Similarly, Caucasian three-year-old Head Start children have a maxillary anterior severity of 38 percent (6). This inverse relationship of prevalence and severity is in contrast to the traditional belief that the greater the prevalence of caries in general, the greater the severity (19).

The goal of the Indian Health Service is complete treatment for the Head Start children; however, at the time this survey was conducted approximately 85 percent to 90 percent of the children were midway through treatment. Few of these Head Start children receive complete care for their maxillary anterior teeth. The priority for treatment of this pattern may be low because of the frequently nonrestorable nature of these teeth and the reduced importance of maxillary anterior teeth in dental arch development as compared with posterior teeth.

The finding that the severity of the fissure and posterior proximal patterns is greater in successive age groups while the severity of untreated lesions is less may be attributed to the high level of dental care the Navajo Head Start children are receiving and the treatment priority these caries patterns are given. The specific type of

care is dependent upon the caries pattern. The fissure pattern has the highest proportion of amalgam restorations. In contrast, the overwhelming use of stainless steel crowns seen in the treatment of the posterior proximal pattern among these Navajo children is supported by their greater cost effectiveness and superior longevity compared with multisurface amalgam restorations (20, 21). Additionally, stainless steel crowns provide protection from further cariogenic attack, especially in high caries-risk children, and therefore may have been an influence in preventing an even greater prevalence and severity of untreated lesions in older age groups.

The high prevalence and severity of caries among children in the youngest WIC group is surprising, but emphasizes the need to examine potentially high-risk children at an early age. The finding that nearly 10 percent of the two-year-old WIC children already have posterior proximal caries represents perhaps the earliest manifestation of this pattern, which is among the latest to develop because it usually requires contacts to be closed for at least one year (22).

The high prevalence and severity of all caries patterns studied among Navajo preschool children represents a significant dental public health problem. However, results from this study demonstrate that Navajo children in Head Start programs have received some of the most extensive dental treatment reported. Preventive programs targeting the underlying causes of dental caries specific for this population would be of great benefit. The current study highlights the early initiation of the carious process in this Navajo population, and the need to focus preventive programs at a very young age for high caries risk populations.

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