

Longitudinal evaluation of caries patterns from the primary to the mixed dentition

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Abstract

The purpose of this study was to develop a model describing the sites and patterns of dental caries in the mixed dentition for children with one of five caries experiences in the primary dentition. Dental records were used from 317 children followed an average of 7.8 years in private pediatric dental offices to assess specific caries experiences in children from early primary dentition to middle or late mixed dentition. Eighty-four per cent of the children who were caries-free in the primary dentition remained so in the mixed dentition. Children with the pit and fissure caries pattern in the primary dentition were more likely to develop smooth surface caries of primary teeth in the mixed dentition (32%) than caries-free children (14%, $X^2 = 5.6$; $P < 0.05$). For children with molar-approximal lesions in the primary dentition, 57% developed lesions on additional molar-approximal surfaces in the primary teeth in the mixed dentition. Children with the faciolingual pattern (baby bottle tooth decay) were at the highest risk of any group for developing additional carious lesions. The model could serve as a basis for a prospective study.

Introduction

The study of caries as a disease of the individual as well as an average disease for individuals within a population has several implications. The most direct is an added perspective in the study of disease occurrence and progression. The potential then exists to determine the prevalence of specific experiences based on etiology (e.g. Baby Bottle Tooth Decay — BBTD). From a practical standpoint, the potential exists to predict caries experiences; subsequently, clinic protocols or public programs might be targeted accordingly.

Epidemiological studies have been conducted to evaluate the relationship between caries levels in the primary and mixed dentitions (Hill et al. 1967; Adler 1968; Klein et al. 1981; Varpio 1981; Heidmann and Poulsen 1986). Several studies have shown that children who are caries free in the primary dentition tend to remain caries free in the permanent dentition. Attempts

have been limited in describing specific caries experiences; few attempts have been made to track children with specific caries experiences through normal dental development. The purpose of this study was to continue exploring a caries model (Johnsen et al. 1987) and specifically, to observe how caries experiences in the primary dentition associate with specific caries experiences for primary and permanent teeth in the mixed dentition. This preliminary work — done retrospectively — may then be useful in designing a prospective study.

Materials and Methods

Dental records for 317 children, 158 boys and 159 girls from 1.5 years to 15.5 years of age, were selected from three private pediatric dental practices in Northeast Ohio for this study. The practices were all located in middle-class areas. The average age at initial examination was 3.2 years and the average follow up time was 7.8 years. The beginning of the mixed dentition was noted with the eruption into occlusion of the permanent first molars, while the end was marked by eruption into occlusion of the permanent second molars.

The practitioners were selected because of good detail in record keeping and reported consistency in examination format. All three pediatric dentists determined pit and fissure decay by noting resistance to withdrawal of a #23 explorer used with moderate probing force. The practitioners were not formally calibrated before the time records were taken. The subjects were selected from consecutive children observed for at least two years during the primary dentition stage and at least two years after eruption of the first permanent molars into occlusion. This permitted identification of caries patterns during both the primary and the mixed dentitions. Subjects were maintained on a regular recall routine over the test period. While recall intervals were individualized for each subject, there were no subjects

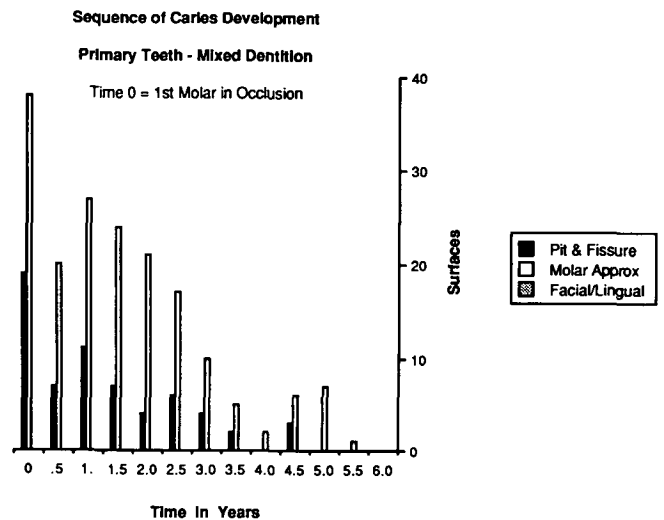
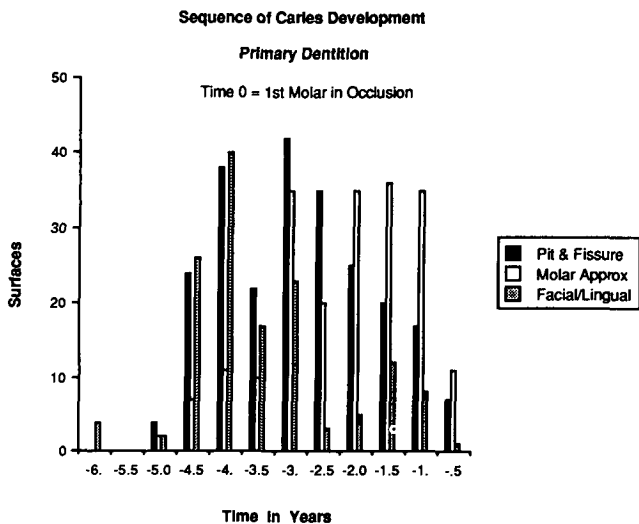
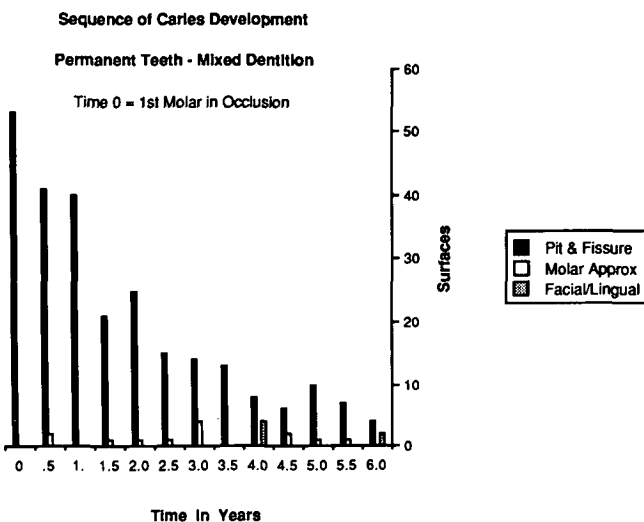


Fig 1. Chronological sequence of caries development on the basis of affected surfaces. 1a. Caries development by caries experience for children in the primary dentition.

1b. Development of caries experiences of primary teeth for children in mixed dentition.



1c. Development of caries experiences of permanent teeth for children in mixed dentition.

were caries free in the primary dentition.

In the primary dentition, the first caries experience to present is the faciolingual experience noted at time -6 years (approximately 1 year old, Fig 1). The first observation of this form of caries increased until the -4 years point (approximately 3 years old) and then decreased to time 0.

The pit and fissure pattern was first sighted at the -5 years (approximately 2 years old) and increased to the -3 year (approximately 4 years old, Fig 1). From this level, the highest of any form of decay in the primary dentition, the first observation of pit and fissure lesions declined until time 0 (7 years old).

The molar-approximal pattern also was noted at the same time as the first pit and fissure pattern, at -5 years (2 years old). The relative size of the group increased steadily to peak at the same time as the pit and fissure caries group at time -3 years (4 years old, Fig 1). The first time observation of the molar-approximal caries experience remained constant until the -0.5 year point (6.5 years old), immediately before time 0 (7 years old), however. Following the first observation for the pit and fissure caries experience in the permanent teeth in mixed dentition, there was a relatively high level of decay followed by a steady decline.

Sealants

Of the total population of 317 children, 88 received pit and fissure sealants. Among these subjects with sealants, 84% of the sealed surfaces remained caries free for the length of the study. Of the children with sealants on their permanent molars, those with caries in the primary dentition were more likely to subsequently have caries recorded on fissure surfaces of one or more permanent molars (27 of 48) than caries-free children in the primary dentition (11 of 33, $X^2 = 3.3$; n.s.).

cally significant ($X^2 = 3.0$; n.s.).

Chronological Survey

A chronological depiction of the appearance of carious lesions observed in the first 158 children from this study is seen in Fig 1. Time 0 is the eruption into occlusion of all four of the permanent first molars. From time 0, the tables are broken down into one-year recall intervals to illustrate the number and type of carious lesions experienced at each examination time. The average age at time 0 was 7 years and 1 month. The average age of the children at the time of the initial examination was 3 years and 3 months; there appears to be a higher incidence of decay between the 2.5 and 3.5 year age groups. Within this group of 158 children, 69

with more than one year between recall visits. Data were collected by reviewing patient charts and radiographs.

A lesion was considered carious if it was noted in the chart or observed radiographically; any radiolucency into the enamel or dentin on any tooth surface was considered carious. All surfaces considered carious by the dentists were restored. Subjects with congenital or traumatic enamel or dentin defects, or congenitally missing teeth were excluded from the study. The subjects were children with normally developing dentitions. Each carious lesion was counted at the first sighting by the clinician and was not recounted subsequently during the course of the study. Only new carious surfaces were counted; recurrent decay was not counted as a new lesion because of the possibility of practitioner error. Missing surfaces were not counted because of aberrant results caused by normal exfoliation.

Data were collected and analyzed separately for the primary dentition and for the primary and permanent teeth in the mixed dentition. Each patient was initially classified as caries free, or placed into one of five identifiable caries experiences previously described by Johnsen et al. (1987) for the primary dentition.

1. Caries free — no detectable carious lesions.

2. Pit and fissure caries experience — one or more carious lesions in a pit or fissure or an occlusal surface of a molar as well as the lingual groove of a maxillary molar, the buccal groove or pit of a mandibular molar or the lingual pit of a maxillary permanent central or lateral incisor.

3. Molar-approximal caries experience — one or more carious lesions on an approximal surface of a molar or the distal surface of a canine. The lesions were noted from chartings or from viewing of radiographs.

4. Faciolingual caries experience — one or more carious lesions on a facial or lingual smooth surface of any tooth, or on an approximal surface of an incisor or the mesial surface of a canine. Children in this group are assumed to have BBTD.

5. Faciolingual with molar-approximal caries experience — one or more carious lesions on both a facial and/or lingual surface and a molar-approximal surface.

The results presented reflect numbers of children with specific caries experiences and not numbers of carious surfaces.

Results

Caries experiences in the primary dentition and for primary and permanent teeth in the mixed dentition are presented in Table 1. Children who were caries free in the primary dentition were most likely to remain caries free in the mixed dentition than any of the groups. Children with pit and fissure caries in the primary dentition were more likely to develop caries in mixed dentition than were caries-free children; they were more likely to develop caries on approximal surfaces of primary molars ($X^2 = 5.6; P < 0.05$) and on pit and fissure surfaces of permanent molars ($X^2 = 6.1; P < 0.01$). Children in the molar-approximal group in the primary dentition also were more likely to develop new smooth surface lesions in the mixed dentition than were children in the pit and fissure group ($X^2 = 39.2; P < 0.01$).

Children in the faciolingual caries classification in the primary dentition (BBTD) had similar outcomes to children in the pit and fissure classification. Children in the faciolingual/molar-approximal classification in the primary dentition had similar outcomes to children in the molar-approximal category and differed from children in the faciolingual category. Children in the faciolingual/molar-approximal category in the primary dentition were more likely to develop caries of approximal surfaces of primary molars in the mixed dentition than children in the faciolingual category, but the difference was not statisti-

TABLE 1. Caries Patterns in the Primary Dentition and for Primary and Permanent Teeth in the Mixed Dentition

Primary Dentition			Mixed Dentition				
			CF	PF	MP	FL	FM
CF	121	PRIMX	102 (84%)	2 (2%)	17 (14%)	0 (0%)	0 (0%)
		PERMX	91 (75%)	29 (24%)	0 (0%)	1 (1%)	0 (0%)
PF	44	PRIMX	19 (43%)	11 (25%)	14 (32%)	0 (0%)	0 (0%)
		PERMX	21 (48%)	20 (45%)	2 (5%)	1 (2%)	0 (0%)
MP	79	PRIMX	27 (34%)	7 (9%)	45 (57%)	0 (0%)	0 (0%)
		PERMX	32 (41%)	39 (49%)	7 (9%)	0 (0%)	1 (1%)
FL	16	PRIMX	10 (63%)	1 (6%)	5 (31%)	0 (0%)	0 (0%)
		PERMX	7 (44%)	6 (38%)	1 (6%)	1 (6%)	1 (6%)
FM	57	PRIMX	19 (33%)	4 (7%)	34 (60%)	0 (0%)	0 (0%)
		PERMX	15 (26%)	32 (56%)	8 (14%)	2 (4%)	0 (0%)

CF—Caries free; PF—Pit & fissure; MP—Molar approximal; FL—Faciolingual.

FM—Faciolingual plus molar approximal.

PRIMX—Primary teeth in the mixed dentition.

PERMX—Permanent teeth in the mixed dentition.

Discussion

An evolving model on the development of specific caries experiences may contribute to our understanding of caries as a disease of the child as well as a disease of the tooth. Previous work has focused on descriptions of specific caries experiences in the primary dentition, followed by study of the timing for earliest occurrences for each experience in selected populations (Johnsen et al. 1987). Retrospective studies may be helpful in offering caries models that can be tested later using prospective studies. Extrapolation of the findings to other populations may not be advisable. In private offices where regular recalls and topical fluorides were used, caries levels are assumed to be no greater than and probably less than those in children not receiving regular care. The relatively small sample size further limits conclusions to a model in this population.

Caries Experiences

Children who were caries free in the primary dentition tended to remain caries free in the mixed dentition. This finding is in agreement with previous studies (Hill et al. 1967; Klein et al. 1981; Varpio 1981; Heidmann and Poulsen 1986). Twenty-five per cent of the children were caries free for the entire course of the study.

In the past, the pits and fissures of posterior teeth were considered a developmental defect. When analyzing the pit and fissure group, however, a high degree of susceptibility to caries tended to persist into the mixed dentition for both the primary and permanent teeth. This is in contrast to the caries-free group, which retained a high degree of resistance to pit and fissure decay in the primary and permanent teeth in the mixed dentition. This suggests that pit and fissure decay is a carious invasion requiring a susceptible host, as much as it is a developmental defect. A microbial threshold for colonization of artificial fissures was suggested by Svanberg and Loesche (1977).

A previous study has demonstrated that children with BBTD were at higher risk of developing additional lesions on the posterior teeth (Johnsen et al. 1986). This tendency was confirmed in the present study with three-and-one-half times more children advancing into additional molar-approximal decay after experiencing faciolingual decay. The faciolingual/molar-approximal group had the lowest percentage of caries-free subjects in mixed dentition. This decay pattern signals a significant potential for future caries development.

Chronological Survey

The faciolingual caries pattern was noted first in the chronological scheme and seemed to exhibit a different presentation from other types of decay. The sudden and rapid increase could be due to the nursing bottle habit, which produces rapid caries development. Pit and

fissure and molar-approximal decay were nearly equal in time of occurrence in the primary dentition. Children in both groups peaked at approximately the same time regarding caries experience. Previous studies have demonstrated that approximal caries in the posterior teeth in the primary dentition peaks at about 7 years of age (Walsh and Smart 1948; Parfitt 1955). In the present study the first observation of approximal carious lesions rose steadily from the first occurrence and peaked at time -3 years (approximately 4 years of age).

The permanent teeth examined at the first recall period experienced the highest frequency of carious surfaces. No other recall interval recorded a similar level and the decay was exclusive of the pit and fissure type. Similarly, in the primary dentition, caries experiences for children in the pit and fissure decay group peaked soon after the molars came into occlusion; the decay rate then declined into the mixed dentition until the teeth were exfoliated. Exposure time in the mouth was inversely related to the first observation of pit and fissure decay.

Clinical Relevance

There are several points of potential clinical significance from this study that are of interest in planning prospective studies. Children with pit and fissure decay are at increased risk of developing subsequent smooth surface caries. This may mean that these children warrant closer monitoring (more frequent exams and radiographs, perhaps even supplemental fluorides) than do caries-free children.

There appear to be levels of caries susceptibility for children that can be represented for this discussion by children with caries free, pit and fissure, and molar-approximal caries patterns, respectively. The notion of different microbial thresholds for fissure and smooth surface caries is reinforced by results of this study.

Progression of caries in children with BBTD is of interest in studying caries susceptibility for this group. The lower susceptibility to mixed dentition caries for the faciolingual group compared to the faciolingual/molar-approximal group may indicate that if BBTD does not progress to involve other teeth or surfaces in the late primary dentition, it is not likely to do so in the mixed dentition. Thus, the importance of stopping the progression of BBTD as soon as it is observed is reinforced.

Previous studies have shown that sealant placement will aid in preventing pit and fissure caries (Buonocore 1971; Going et al. 1977; Williams and Winter 1981). This was supported in the present study — 84% of the sealed teeth remaining caries free during the full course of the study. Early appearance of pit and fissure decay soon after permanent molar eruption reinforces the need for early decisions on sealants. Susceptibility of caries-active children to caries after sealant loss may be an

indication for more frequent initial monitoring in such children after sealant placement. This point is presented in an introductory way since it was not the intent of the study to follow children with sealants, and since the sample size of this subgroup is small.

Conclusions

1. Children who were caries free in the primary dentition tended to remain caries free in the mixed dentition.

2. Pit and fissure caries was the most frequent caries experience for children in the primary dentition presenting at private pediatric dentists' practices in the study. Molar-approximal caries was the second most frequent caries experience.

3. If the child experienced any form of decay in the primary dentition, the primary teeth in the mixed dentition tended to exhibit predominantly molar-approximal decay.

4. Caries experience in the primary dentition was associated with predominantly pit and fissure decay in the permanent teeth.

5. Early caries, from age 1-3, was the faciolingual type (BBTD).

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Gum disease affects young people

The first stage of periodontal disease is "nearly a universal finding in children and adolescents," according to a research paper recently published by the American Academy of Periodontology.

The incidence of gum disease in children and adolescents is much higher than most dentists or parents suspect. Symptoms include redness of the gums, swelling, and a tendency to bleed easily, especially during toothbrushing.

The AAP report said between 5 and 9% of 5 to 11 year olds experience loss of periodontal attachment and supporting bone in one or more locations. Twelve to 15 year olds have a rate of periodontal disease ranging from a low of 5% to a high of 46%, depending on the populations surveyed and the methods of diagnosis.

Localized juvenile periodontitis (LJP) leads to a rapid loss of alveolar bone that supports the permanent teeth. It is seen in first molars and incisors. Estimates of the incidence of LJP range from 0.1 to 15 percent of the adolescent population. Diagnosed early, this disease responds well to local treatment and antibiotics that eradicate the disease-causing bacteria.

Generalized juvenile periodontitis (GJP) is found more frequently in young adults than in children, often beginning with the onset of puberty. Like LJP, this form is characterized by a rapid loss of alveolar bone around the permanent teeth. Accumulations of heavy dental plaque and observable inflammation are present. Again, successful treatment depends on early diagnosis and professional treatment.