Retrospective survey of dental anomalies and pathology detected on maxillary occlusal radiographs in children between 3 and 5 years of age

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Abstract

Purpose: *Radiographs play an important role in the diagnosis of anomalies and pathology of the oral structures of young children as well as in the interception and management of developmental problems in the dentition. The occlusal film, commonly indicated in the young child, is a helpful tool in establishing a baseline and in revealing certain region-specific dental concerns in a timely fashion. The purpose of this retrospective study was to perform a comprehensive examination of maxillary occlusal radiographs in a clinical pediatric population and to determine the prevalence of dental anomalies and pathology in the premaxilla in children between 3 and 5 years of age.*

Methods: *Radiographs of healthy preschool children (236 males and 264 females), who received their initial examination at the University of Texas-Houston Pediatric Dentistry Graduate Clinic during 1997 and 1998, were reviewed independently by two pediatric dentists, using a 2X magnifying lens and a standard dental light box. Interexaminer discrepancies were resolved by consultation and mutual agreement.*

Results: *Ninety-two (18%) showed no evidence of dental caries, restorations, current pathological conditions, or other anomalies. Frequencies of anomalies such as congenitally missing and supernumerary teeth were consistent with other reports.*

Conclusions: *These observations emphasize the importance of obtaining intraoral radiographs on preschool children who are in apparent good dental health. (Pediatr Dent 23:347-350, 2001)*

Among the main goals of dentistry for children are the prevention and/or treatment of aberrations in the developing dentition. Radiographs play an important role in this, as they are valuable aids in the diagnosis and treatment planning of the pediatric dental patient.

Information evident in the radiograph assists in diagnosis and may support clinical findings such as:

- Size and shape, position, and angulation of the unerupted teeth.
- Presence or absence of teeth, including anomalies in morphology, number, delayed eruption, impaction, or ectopic position.
- Carious lesions, particularly interproximal carious lesions.
- The degree and variation of root development and resorption of the primary teeth as well as the root development of the permanent tooth and sequence of eruption.
- The presence of periapical pathology and bone lesions.

The guidelines of the American Academy of Pediatric Dentistry for prescribing dental radiographs,[1] are based on patient selection criteria, which are descriptions of clinical conditions derived from patient signs, symptoms, and history that identify patients who are likely to benefit from a particular radiographic examination. The recommendations were developed by an expert dental panel comprised of representatives from the Academy of General Dentistry, American Academy of Dental Radiology, American Academy of Oral Medicine, American Academy of Pediatric Dentistry, and the American Dental Association under the sponsorship of the Food and Drug Administration. The guidelines were reproduced and distributed to the dental community by Eastman Kodak Company.[1]

Although no recommendation is made for obtaining routine occlusal radiographs for a child in the primary dentition, it is possible that their inclusion could provide valuable information in the immediate as well as long-term dental management of the child. However, the number and type of radiographs that should be taken in these patients is somewhat controversial due to professional concerns relative to radiation exposure in children such as carcinogenesis and mutagenesis.[2-9]

Although several reports and surveys of specific conditions such as congenitally missing teeth[10] and dens invaginatus[11] have been published, a comprehensive survey of all pathological/developmental conditions in children between 3 and 5 years of age has not been accomplished. Therefore, the purpose of this retrospective study was to determine, from records available in the graduate pediatric dental clinic of The University of Texas, Houston, Dental Branch, the prevalence of all observable dental anomalies and pathology in the premaxilla in children between 3 and 5 years of age, utilizing single maxillary occlusal radiographs.

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Table 1. Age and Gender Distribution of the Sample

Age	Male	Female
	N (%)	*N (%)*
3 years	74 (31)	87 (33)
4 years	130 (55)	140 (53)
5 years	32 (14)	37 (14)
Total	236 (100)	264 (100)

Methods

The maxillary occlusal radiographs of the first 500 healthy preschool children between 3 and 5 years of age, who had been examined at the University of Texas-Houston Pediatric Dentistry Graduate Clinic between the years 1997 and 1998, were reviewed. The radiographs were taken by trained dental assistants using a short cone, 0.2 sec. exposure at 60 KVP and 7mA with a size 2 E-speed "occlusal film" standardized to a 70° angulation exposure. The radiographs were displayed on a fluorescent light view box in a darkened room and evaluated independently by two pediatric dentists with the aid of a magnifying Viewscope (JS Dental Manufacturing, Inc., Ridgefield, CT). The Viewscope effectively blocks out surrounding light and provides 2x magnification. Standardization was accomplished by independent examination, followed by joint comparison of the first 100 films.

During the study, films were reviewed at the examiners' discretion over a period of six to eight weeks. A printed data sheet was used to record pathology and anomalies. Poor quality radiographs were excluded on the basis of faulty angulation, cone-cuts, inadequate exposure, and "fuzzy" image. The first 500 children with acceptable quality radiographs were included in the study. Interexaminer discrepancies were resolved by consultation and mutual agreement. The investigators limited their observations to the primary central and lateral incisors and the germs of their permanent successors.

In the primary dentition, conditions of interest included: anomalies in number, metamorphic calcification, fusion and gemination, caries, internal and external resorption, periodontal ligament enlargement, dilaceration, crown and root fracture, and periapical infection. Conditions of interest in the permanent dentition included: mesiodens, congenitally missing teeth, supernumerary teeth, ectopic position, macrodontia, peg laterals, dens invaginatus, and cyst. After tabulation of the various conditions was completed, frequencies were calculated and expressed as population percentages (per child) as well as tooth percentages.

Results

The sample consisted of 236 males and 264 females with an almost identical age distribution (Table 1). In Tables 2, 3 and 4, the various conditions are presented as raw numbers and as percentages of the study population. Frequencies per child for the primary dentition included: caries (20%), internal resorption (3.6%), periapical infection (12%), periodontal ligament enlargement (22%), restored teeth (11%), impaction (0.2%), metamorphic calcification (12%), external resorption (29%), crown fracture (14%), root fracture (3%), supernumerary (0.2%), fusion (0.4%), dilaceration (20%), and missing teeth with no permanent successor present (1%). Missing teeth were also observed in 19 other children (4%) who had permanent successors present.

Frequencies based on the total number of 1963 primary teeth present include: caries (11%), internal resorption (2%), periapical infection (4%), periodontal ligament enlargement (10%), restored teeth (6%), impaction (0.1%), metamorphic calcification (5%), external resorption (13%), crown fracture (6%), root fracture (1%), supernumerary (0.1%), missing teeth with no permanent successor present (0.4%), total missing teeth (2%), fusion (0.1%), and dilaceration (9%). These tooth frequencies are based on a total of 1963 primary teeth, rather than the actual 2000 teeth that would have been present if none had been scored missing.

Results for the permanent dentition are given in Table 4. Frequencies per child include the following: mesiodens (2%), congenitally missing teeth (2%), ectopic position (24%), macrodontia (1%), and peg laterals (1%). When expressed per tooth, the frequencies were as follows: mesiodens (0.7%), congenitally missing teeth (0.7%), ectopic position (10%), macrodontia (0.7%), and peg laterals (0.5%). Tooth frequencies in Table 4 are based on a total of 2000 permanent teeth.

An additional observation, crowded dentition/lack of space, not shown in the tables, was found in 1% of the patients due to either macrodontia or ectopic position of permanent teeth.

Discussion

Table 2. Frequency of Conditions Observed in 500 Children (Primary Dentition)

	Per child	Per tooth
	N (%)	*N (%)*
	Conditions	
Supernumerary	1 (0.2)	1 (0.1)
Missing *	24 (5)	37 (2)
Fusion	2 (0.4)	2 (0.1)
Dilaceration	104 (21)	170 (9)
	Traumatic conditions	
Metamorphic calcification	62 (12)	89 (5)
Ext. resorption	147 (29)	249 (13)
Crown fracture	68 (14)	109 (6)
Root fracture	14 (3)	16 (1)
	Other conditions	
Caries	101 (20)	220 (11)
Int. resorption	18 (4)	34 (2)
Periapical bone loss	58 (12)	85 (4)
PDL enlargement	111 (22)	194 (10)
Restored	53 (11)	122 (6)
Impaction	1 (0.2)	1 (0.1)
Large Pulp	1 (0.2)	2 (0.1)

* With and without permanent successor present.
Note: All primary tooth frequencies are based on 1963 total teeth present.

Table 3. Frequency of Missing Primary Teeth with and without Permanent Successor

	Per child	Per tooth
	N (%)	*N (%)*
With Successor	19 (3.8)	30 (1.5)
Without Successor	5 (1.0)	7 (0.4)
Total	24 (4.8)	37 (1.9)

Note: The per tooth frequencies are based on 2000 primary teeth.

Many of the conditions surveyed in this report, such as dilaceration, internal resorption, and crown/root fracture have not been the subject of previous reports in the epidemiological literature for this age group. An excellent discussion of traumatic injuries to the anterior maxillary dentition and their sequella is presented by Andreasen and Andreasen.[12] In their *Textbook and Color Atlas of Traumatic Injuries to the Teeth*, they note that root fractures in the primary dentition are "uncommon before completion of root development and are most frequent at the age of 3-4 years where physiologic root resorption has begun, thereby weakening the root." Relative to the primary as well as permanent dentitions, they note that tooth luxations are rather common, primarily involve the maxillary incisor region, and are seldom seen in the mandible.

For the conditions such as mesiodens, congenitally missing teeth, caries, trauma, fusion and other dental anomalies, our results are consistent with other investigators.[3,8] It is interesting to note that Howard[13] reported that supernumerary teeth and congenitally missing permanent teeth are two of the most common dental anomalies seen in children. He suggested that these anomalies can be detected with 2 anterior occlusal radiographs and 2 bitewing radiographs.

Diagnosis of tooth agenesis in the primary dentition from radiographs alone is complicated by the possibility of tooth loss from other causes such as trauma and extraction. In our study, primary teeth were considered to be congenitally missing only when the corresponding permanent tooth was also missing. Grahnen and Granath[10] observed that it is very unlikely that a primary tooth is congenitally missing when the succedaneous permanent tooth is present.

In view of the high overall prevalence of anomalies, pathology, and abnormalities detected in this study, together with the minimal radiation exposure associated with taking a single occlusal radiograph with E-speed film,[14] the risk:benefit ratio would seem to be favorable. Indeed, early intervention concerning the management of diseased, impacted, and supernumerary teeth as well as the recognition of entities such as root and bone fractures in the premaxilla (a highly accident-prone area) could be quite beneficial to the health and future harmonious occlusal development of the child. In a review of 14 published papers on traumatic injuries to the primary dentition,[12] 12-69% of the involved permanent teeth were observed to have developmental disturbances in the followup period. Radiography is essential to this process. With the recent development of film even faster than E-Speed, the radiation risk can be further minimized.

Conclusions

1. For the conditions observed in this survey, only 92 patients (18%) showed no evidence of caries history, current pathological conditions, or other anomalies; 86% had one or more of the conditions studied.
2. When the occlusal radiograph is part of the examination/diagnostic procedure, considerable additional information is obtained that is helpful in the future dental management of the child.
3. These results emphasize the importance of obtaining intraoral radiographs on preschool children who are in apparent good dental health. While many of the conditions detected by this method can be considered routine, others required more urgent attention.
4. A single occlusal radiograph taken in 3- to 5-year-old children with E-speed film is associated with relatively low risk, but provides a wealth of information that can be of great potential value in the immediate- as well as long-term dental management of the child.

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Table 4. Frequency of Anomalies/Pathology Observed in 500 Children (Permanent Dentition)

Condition	Per child	Per tooth
	N (%)	*N (%)*
Mesiodens	12 (2)	14 (0.7)
Congen. missing	10 (2)	14 (0.7)
Ectopic position*	120 (24)	192 (10)
Macrodontia	5 (1)	14 (0.7)
Peg laterals	7 (1)	10 (0.5)

*Lateral incisors apparently erupting ahead of centrals.
Note: Tooth frequencies based on 2000 total teeth.

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Abstract of the Scientific Literature

Biocompatibility of a resin-modified glass ionomer cement

The purpose of this *in vivo* study was to evaluate the biocompatibility of a light-cured resin modified glass ionomer (Vitrebond) and a calcium hydroxide (Dycal) used for direct pulp capping of human dental pulps. Class V cavities were prepared in sound human premolars under rubber dam isolation, the pulps were exposed, and capping materials were applied directly to the sites of exposure. The authors found that teeth capped with Vitrebond presented moderate to intense inflammatory pulp responses and large necrotic zones. Congested microvessels, neutrophilic infiltration, and lack of dentin bridging were common findings in dental pulps exposed to Vitrebond. In contrast, pulps exposed to calcium hydroxide presented an initial inflammatory response that was followed by repair and dentin bridge formation.

Comments: This study demonstrates that Vitrebond is not indicated for direct pulp capping, since this material did not allow for pulp repair or dentin bridge formation. **JN**

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Abstract of the Scientific Literature

Effect of sealant viscosity on the penetration of resin into etched human enamel

This *in vitro* study was designed to investigate the effect of sealant viscosity on its ability to penetrate etched enamel and to prevent microleakage. Sixty unerupted lower first human premolars were etched with 35% phosphoric acid and sealed. Two high-viscosity sealants (Prisma-Shield and Concise White Sealant) and one low-viscosity sealant (Teethmate A) were used. The pattern of acid etch was evaluated by scanning electron microscopy (SEM), and photographs of secondary electron image (SEI) were done to evaluate the resin tags. Silver nitrate was used to evaluate microleakage in a SEM with backscatter electron detector. The data demonstrated that the lower viscosity sealant was more effective in penetrating etched enamel than the two high viscosity sealants used in this study. Furthermore, microleakage was significantly reduced in specimens sealed with the low-viscosity sealant.

Comments: This study suggests that high-viscosity sealants may not penetrate far enough into etched enamel to fill completely the porosity created during the acid etching step. This might affect their ability to maintain good marginal seal and to prevent microleakage. **JN**

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