PEDIATRIC DENTISTRY/Copyright © 1990 by
The American Academy of Pediatric Dentistry
Volume 12, Number 4

Radiographic recommendations for the transitional dentition: comparison of general dentists and pediatric dentists

David R. Myers, DDS, MS Carole McKnight-Hanes, DMD
Jennifer C. Dushku, BA William O. Thompson, PhD Laura C. Durham, DDS

Abstract

A survey which included brief case histories and intraoral photos of four transitional dentitions, including examples of ectopic and delayed eruption, as well as carious lesions, was mailed to a random sample of 2000 general dentists and 1000 pediatric dentists. Radiographic options were listed, from which each dentist was to indicate all films needed for each child's examination. Surveys were returned by 1273 (43%) dentists, including 713 (36%) general dentists and 560 (56%) pediatric dentists.

The pediatric dentists took significantly more diagnostic radiographs than did the general dentists for each of the four transitional dentition cases. Pediatric dentists were more likely than the general dentists to take panoramic films and combinations which included panoramic films, bite-wing radiographs and periapical films. The most frequently ordered combinations were bite-wing radiographs plus panoramic films and bite-wing radiographs plus anterior periapical films. General dentists recommended bite-wing radiographs films only more frequently than did pediatric dentists. In view of the results of this study and the USDHHS guidelines for radiographic examinations, (1987) education must be provided for both general dentists and pediatric dentists regarding appropriate radiographic examinations for transitional dentition patients.

Introduction

The timely diagnosis and treatment of dental anomalies during the transitional dentition requires an appropriate radiographic examination (Murray and Majid 1978). Detection of developmental conditions such as missing teeth, supernumerary teeth, ectopic eruption, delayed root resorption of primary teeth, and deflected eruptive paths of permanent teeth is very important for the optimal development of the child's dentition (Turner and Hill 1986; Pilo et al. 1987). In spite of the benefits a child receives from a dental examination, there is concern about the possibility of long-term adverse effects from exposure to low-dose ionizing radiation (Committee on Biological Effects of Ionizing Radiation 1980 National Research Council 1980; Goepp 1981; Preston-Martin et al. 1988). Rapidly growing tissues and longer life expectancy may mean that children face greater risk than adults from exposure to low-dose ionizing radiation (Modan et al. 1974; UN Scientific Committee 1976). Patient exposure to ionizing radiation has been reduced significantly by improvements in dental radiographic equipment (Council on Dental Materials and Devices 1984). Guidelines were developed by the American Academy of Pediatric Dentistry concerning dental radiographic examination for children (Nowak et al. 1981). More recently, guidelines for prescribing dental radiographs have been issued by the US Department of Health and Human Services (1987). The intent of these guidelines is to maximize the value of a dental radiographic examination, yet minimize the patient's exposure to ionizing radiation.

General dentists and pediatric dentists treat transitional dentition-age children and regularly expose diagnostic radiographs. During the transitional dentition, a child may require dental radiographic examination for orthodontic diagnosis. Differences have been described for radiographs prescribed by various dentists for orthodontic evaluation of the transitional dentition patient (McNicol and Stirrups 1985; Osman et al. 1985; Atchison and Luke 1989). Necessary radiographs may include various combinations of intraoral films along with panoramic and cephalometric films. However, minimal information is available regarding radiographic examination practices for a transitional dentition-age child's examination when no orthodontic evaluation is anticipated. Because of their extensive training in growth and development and pediatric oral pathology, pediatric dentists may be expected to approach radiographic examination of the transitional dentition patient differently from the general dentist.

The purpose of this project was to investigate the

radiographic examination practices of general dentists and pediatric dentists for children in the transitional dentition stage of development, and to determine if there are differences between the radiographic prescriptions of the general dentists and pediatric dentists.

Method

A mail survey developed by the Medical College of Georgia Department of Pediatric Dentistry in conjunction with the Office of Research Computing and Statistics was designed to obtain information pertaining to radiographic examination practices for children. The survey included a series of eight simulated clinical cases with intraoral photographs. Four of the cases represented common clinical conditions encountered in the transitional dentition and are the subject of this paper (Fig 1). A cover letter indicated the following: 1) All patients were healthy and cooperative 2) No parents objected to the radiographs 3) Finances were not a factor 4) None of the patients had been examined by a dentist previously 5) All the patients lived in optimally fluoridated areas. Given these assumptions, along with the patient's age and the intraoral photos, the dentists were asked to indicate all radiographs they would prescribe for each case. Radiographic selections were provided, and dentists could select as many films as desired. Radiographic options included the following: 1) No radiographs 2) Bite-wing radiographs (BX) 3) Panoramic radiographs (PN) 4) Posterior periapical (Post PAs) 5) Maxillary occlusal films 6) Mandibular occlusal films scored as anterior periapical films (Ant PAs). The radiographic options included only those films considered part of a standard dental examination and did not include a cephalometric film or other specialized films for orthodontic evaluation. All survey responses were transferred to optical scan sheets for computer scoring.

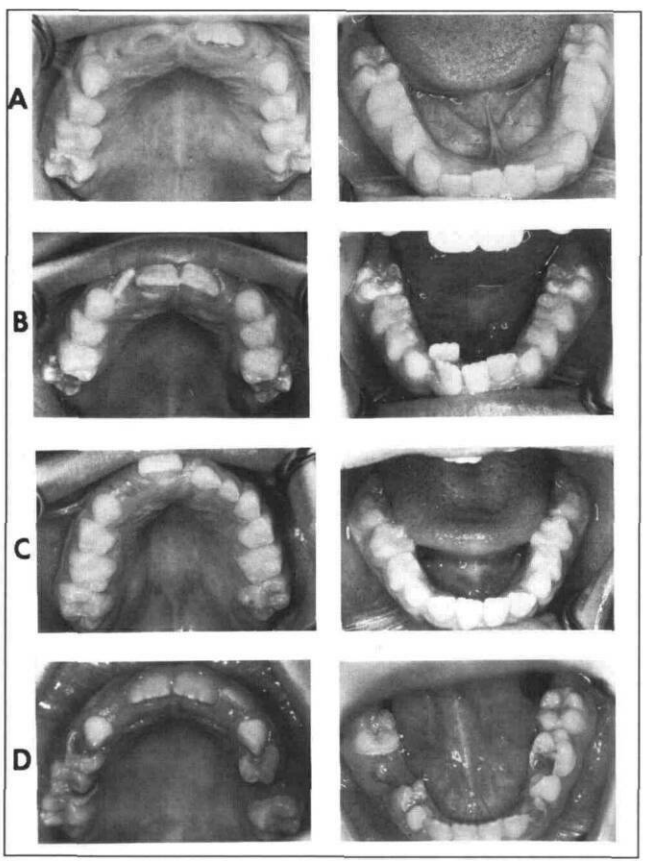

Fig 1. Series of intraoral photographs simulating four clinical cases in the primary dentition.

The survey was mailed to 2000 general dentists and 1000 pediatric dentists randomly selected from the American Dental Association national membership roster through the Association's Data Processing Service. No follow-up survey was conducted.

For each clinical case, comparisons were made between the radiographic recommendations of the general dentists and pediatric dentists for single radiographs and for combinations of radiographs selected for each case, based on probable diagnostic value. Eighty-six per cent to 95% of the responding dentists were included within the selected categories for each case. Chi-square statistical analysis was performed using the percentage of general dentists and pediatric dentists who prescribed the various radiographic selections to determine whether there were significant differences between the radiographic recommendations of the practitioners.

Results

Surveys were returned by 1273 (43%) of the dentists, including 713 (36%) general dentists and 560 (56%) pediatric dentists.

Case 1 was a 9-year-old child with a normal developing transitional dentition (Fig 1A). The radiographic recommendations are shown in Table 1. Thirty per cent of the general dentists recommended only bite-wing radiographs, while 6% of the pediatric dentists selected bite-wing radiographs as the only radiographs re-

TABLE 1. Percentages of Dentists Who Prescribed Various Radiographs for the Early Transitional Dentition Patient

Radiographs	*General Dentists (%)*	*Pediatric Dentists (%)*
None	3	1
BX	30	6
PN	5	3
Ant PAs	3	<1
BX + PN	27	38
BX + Ant PAs	24	25
BX + Ant and Post PAs	3	6
BX + Ant PAs + PN	5	20

ceived. Thirty-eight per cent of the pediatric dentists and 27% of the general dentists recommended bite-wing radiographs and a panoramic film. Twenty-five per cent of the pediatric dentists and 24% of the general dentists recommended bite-wing radiographs along with anterior periapical radiographs. Twenty per cent of the pediatric dentists, compared to 5% of the general dentists, recommended a combination of films which included bite-wing radiographs and a panoramic film supplemented with anterior periapical films. Only 6% of the dentists recommended radiographs other than the preselected films. Pediatric dentists recommended significantly more radiographs than did the general dentists ($X^2 = 181.36$, $P < .001$).

Case 2 was a 9-year-old child with crowding apparent in the transitional dentition (Fig 1B). The radiographic recommendations are shown in Table 2. Forty-two per cent of the general dentists and 45% of the pediatric dentists recommended bite-wing radiographs and a panoramic film. Nineteen per cent of the pediatric dentists recommended bite-wing radiographs and a panoramic film supplemented with anterior periapical films and selected posterior periapicals. Five per cent of the general dentists recommended this combination. Eleven per cent of the general dentists selected bite-wing radiographs as the only radiographs necessary, compared to less than 1% of the pediatric dentists. Fourteen per cent of the dentists recommended radiographs other than the preselected combinations. The pediatric dentists recommended significantly more films than did the general dentists ($X^2 = 146.96$, $P < .001$).

TABLE 2. Percentages of Dentists Who Prescribed Various Radiographs for the Transitional Dentition Patient with Crowding

Radiographs	*General Dentists (%)*	*Pediatric Dentists (%)*
BX	11	<1
PN	10	4
BX + PN	42	45
BX + Ant PAs	18	9
BX + PN + POST PAs	3	7
BX + Ant PAs + Post PAs	8	11
BX + Ant PAs + PN	<1	4
BX + Ant PAs + Post PAs + PN	5	19

Case 3 was a 9-year-old child with asymmetrical eruption of the maxillary central incisors and an overretained primary central incisor (Fig 1C). The radiographic recommendations are shown in Table 3. Thirty-two per cent of the general dentists and 28% of the pediatric dentists recommended bite-wing radiographs and a panoramic radiograph. Thirty-two per cent of the general dentists and 24% of the pediatric dentists recommended bite-wing radiographs and anterior periapical films. Twelve per cent of the general dentists recommended only a bite-wing examination, compared to less than 1% of the pediatric dentists. Thirty-nine per cent of the pediatric dentists recommended a combination which included bite-wing radiographs, an anterior periapical film, and a panoramic film. Nine per cent of the general dentists selected this combination. Seven per cent of the dentists recommended radiographs other than the preselected combinations. Again, the pediatric dentists recommended significantly more radiographs than did the general dentists ($X^2 = 199.42$, $P < .001$).

TABLE 3. Percentages of Dentists Who Prescribed Various Radiographs for the Transitional Dentition Patient with an Over-retained Primary Incisor

Radiographs	*General Dentists (%)*	*Pediatric Dentists (%)*
BX	12	<1
PN	6	2
Ant PAs	2	1
BX + PN	32	24
BX + PN + Post PAs	1	<1
BX + Ant PAs + PN	9	39

Case 4 was a 9-year-old child with severe caries and loss of a second primary molar (Fig 1D). The radiographic recommendations are shown in Table 4. The radiographic examination recommended by 24% of the general dentists and 35% of the pediatric dentists consisted of bite-wing radiographs and a panoramic film. Fourteen per cent of the general dentists and 15% of the pediatric dentists recommended bite-wing radiographs, a panoramic film, and selected posterior periapical films. Seventeen per cent of the pediatric dentists and 16% of the general dentists recommended bite-wing radiographs, supplemented with anterior periapical films and selected posterior periapical films. These

TABLE 4. Percentages of Dentists Who Prescribed Various Radiographs for the Transitional Dentition Patient with Caries

Radiographs	*General Dentists (%)*	*Pediatric Dentists (%)*
BX	5	<1
PN	4	4
Post PAs	5	1
BX + PN	24	35
BX + Post PAs	20	4
PN + Post PAs	5	4
BX + Ant PAs	4	3
BX + PN + Post PAs	14	15
BX + Ant PAs + Post PAs	16	17
BX + Ant PAs + PN	3	17

combinations were followed by a variety of other recommendations. Only 5% of the dentists recommended radiographs other than the preselected combinations. The pediatric dentists recommended significantly more radiographs than did the general dentists ($X^2 = 165.89$, $P < .001$).

Discussion

The overall 43% response rate for a once-mailed survey suggests the nonresponder bias is not significant (Horland et al. 1980).

An appropriate radiographic examination for each of these children would consist of a panoramic film plus bite-wing radiographs supplemented by intraoral periapical exposures on an individual basis, or a full mouth intraoral survey plus bite-wing radiographs (UHDHHS 1987). The results demonstrate that there were differences in the radiographic examinations prescribed by general dentists and pediatric dentists for these children in the transitional dentition. The pediatric dentists recommended significantly more radiographs than did the general practitioners for each of the four cases. The recommendations for panoramic and bite-wing radiographs, or for bite-wing radiographs supplemented with anterior and posterior periapical films, are within the guidelines and appear appropriate for these patients. For each case, more pediatric dentists than general dentists recommended the appropriate combinations. However, in no case did more than 45% of the pediatric dentists or 42% of the general practitioners make appropriate recommendations. The recommendations were diverse, suggesting that many dentists are unfamiliar with the guidelines or lack understanding of the dental anomalies and pathology seen in children.

On a case-by-case basis, important differences between the recommendations of the general dentists and pediatric dentists were apparent. In three of the four cases, from 10 to 30% of the general dentists recommended only a bite-wing radiographic examination. Compared to the USDHHS, this recommendation is inadequate and essentially precludes detection of important developmental anomalies at a time when treatment decisions are required.

The pediatric dentists recommended more panoramic films for each of the four cases than did the general dentists. The panoramic film is a valuable diagnostic film for detecting dental pathology and developmental anomalies, but its value for detecting interproximal caries or pulp pathology is limited. Pediatric dentists supplemented the panoramic and bite-wing radiographs with anterior periapical films and selected posterior periapical films more frequently than did the general dentists. The practice of routinely supplementing the panoramic plus bite-wing radiographs combination with anterior and posterior periapical films must be questioned. Supplemental periapical films may be required to visualize adequately the furcation and periapical areas when pulp pathology is a consideration, or to assist in interpretation of a developmental finding. Panoramic radiographs may not display clearly the anterior area of the jaws, making supplemental intraoral radiographs necessary to detect or rule out developmental anomalies. However, in order to minimize the child's exposure to ionizing radiation, these supplemental films should be taken only after it is determined that the combination of bite-wing radiographs and panoramic radiographs does not provide adequate diagnostic information.

General dentists frequently prescribed only bite-wing radiographs and pediatric dentists recommended more panoramic films and frequently prescribed supplemental intraoral films. This pattern appears to indicate that pediatric dentists are more inclined to look for dental developmental problems than are general dentists. By virtue of their training in dental growth and development, pediatric dentists apparently are more likely to look for dental developmental anomalies than are general dentists. However, it cannot be determined from this data whether pediatric dentists recognize more developmental disorders than do general dentists or that the care delivered by the two groups of practitioners is different. Further studies are needed to determine whether there are differences in the treatment recommendations of general dentists and pediatric dentists for transitional dentition-age children.

Conclusion

The results of this study reflect differences between the prescriptions of general dentists and pediatric dentists for radiographic examination of the transitional dentition-age child. Pediatric dentists recommended significantly more radiographs than did general dentists for these cases and frequently prescribed multiple intraoral exposures to supplemental panoramic film. General dentists frequently failed to prescribe adequate radiographs for a comprehensive examination. Although this study was conducted prior to the release of the US Department of Health and Human Service Guidelines for Dental Radiograph Examinations, the results suggest there is a need for education of practitioners relative to appropriate radiographic examination practices for transitional dentition age children.

This project was supported by a grant from the American Fund for Dental Health.

Dr. Myers is dean, Merritt professor of pediatric dentistry; Dr. McKnight-Hanes is associate professor, department of pediatric dentistry; and Dr. Durham is assistant professor, department of pediatric dentistry; all are at the School of Dentistry, Medical College of Georgia, Augusta, GA. Ms. Dushku is programmer analyst II; and Dr. Thompson is director; both are in the office of research computing and statistics at the college.

Atchison KA:· Radiographic examinations of orthodontic educators and practitioners. J Dent Educ 50:651-55, 1986.

Atchison KA, Luke LS: Orthodontic radiographic usage by pediatric dentists. ASDC J Dent Child 56:26-29, 1989.

Committee on the Biological Effects of Ionizing Radiations: The effect on populations of exposure to low levels of ionizing radiation (BEIR II). Washington, DC: National Academy of Sciences, 1980.

Council on Dental Materials and Devices: Recommendations on radiographic practices. J Am Dent Assoc 109: 764-65, 1984.

Gibbs SJ: Council On Dental Materials, Instruments, and Equipment: Biological effects of radiation effects from dental radiography. J Am Dent Assoc 105:275-81, 1982.

Goepp RA: Risk/benefit considerations in pedodontic radiology. Pediatr Dent 3 (Special issue no. 2):437-40, 1981.

Houland EJ, Romberg E, Morland HW: Nonresponse bias to mail survey questions within the professional population. J Dent Educ 44:270-74, 1980.

McNicol A, Stirrups DR: Radiation dose during the dental radiographic techniques most frequently used during orthodontic treatment. Eur J Orthod 7:163-71, 1985.

Modan B, Mart H, Baidatz D, Steinit R, Levin SG: Radiation-induced head and neck tumors. Lancet 1:277, 1974.

Murray JJ, Majid ZA: The prevalence and progression of approximal caries in the deciduous dentition in British children. Br Dent J 145:161-64, 1978.

National Research Council Committee on the Biological Effects of Ionizing Radiations: The effects on population of exposure to low levels of ionizing radiation. Washington National Academy Press, 1980.

Nowak AJ, Creedon RL, Musselman RJ, Troutman KC: Summary of the conference on radiation exposure in pediatric dentistry. J Am Dent Assoc 103:426-28, 1981.

Osman F, Davies RM, Stephens CD, Dowell TB: Radiographs taken for orthodontic purposes in general practice. Br J Orthod 12:82-86, 1985.

Pilo R, Kaffe I, Amie E, Sarnat H: Diagnosis of developmental anomalies using panoramic radiographs. ASDC J Dent Child 54:267-72, 1987.

Preston-Martin S, Thomas DC, White SC, Cohen D: Prior exposure to medical and dental X-rays related to tumors of the parotid gland. J Natl Cancer Inst 80:943-49, 1988.

Turner C, Hill CJ: Supernumerary mandibular premolar: the importance of radiographic interpretation. J Dent Child 53:375-77, 1986.

United Nations Scientific Committee on the Effects on Atomic Radiation: Sources and effects of ionizing radiation. New York United Nations: 1977.

United States Department of Health and Human Services Public Health Service, Food and Drug Administration: The Selection of Patients for X-ray Examinations: Dental Radiographic Examinations. HHS Publication FDA 88-8273, Rockville, MD, 1987.

Causes of death: 1987

Estimated number of deaths in the United States for 15 leading causes of death:

Heart disease	762,820
Cancer	477,190
Cerebrovascular	149,220
Accidents	94,840
Pneumonia, flu	70,120
Diabetes	37,900
Suicide	30,980
Liver (Chronic)	26,050
Atherosclerosis	23,200
Kidney Disease	23,040
Homicide	20,580
Blood Poisoning	19,810
Infant Deaths	18,460
Birth Defects	12,130

The death rate of 8.7 per 1,000 persons remained unchanged from 1986. The Center for Health Statistics, which has been listing AIDS in the category of "other infectious and parasitic diseases," estimated that between 12,450 and 13,820 persons died of AIDS in the United States during 1987. If listed separately, the disease would have been the 14th leading cause of death.