ASDC AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN

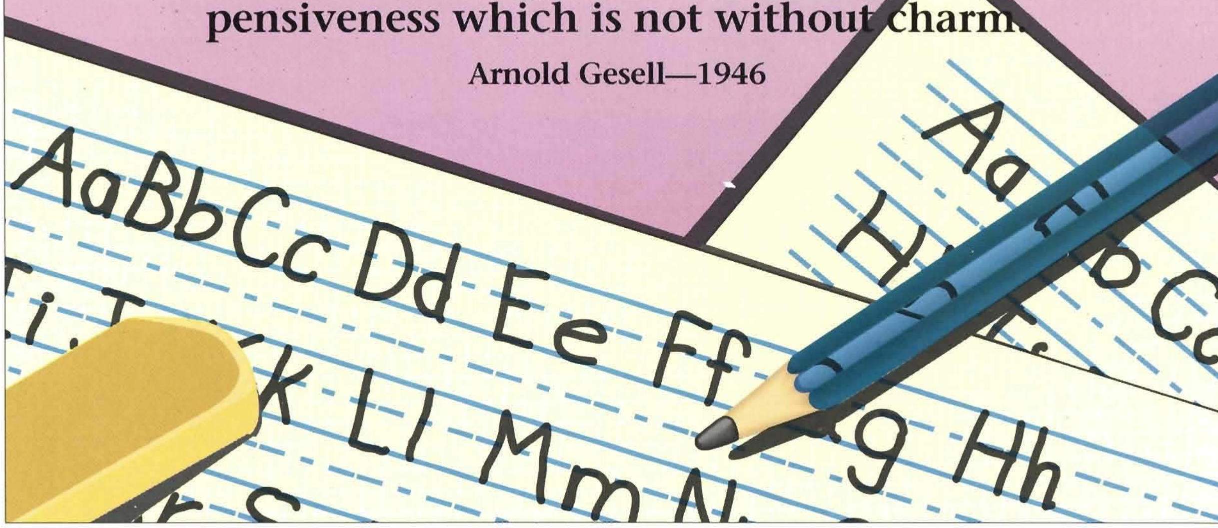
MARCH–APRIL 1990

JOURNAL OF DENTISTRY FOR CHILDREN

There is a kind of quieting down at seven. Six-year-oldness tended to produce brash reactions and bursts of activity. The seven-year-old goes into lengthening periods of calmness and of self-absorption, during which he works his impressions over and over, oblivious to the outer world. It is an assimilative age, a time for salting down accumulated experience and for relating new experiences to the old.

This inner life is the hidden subtle aspect that demands some deference from us. We cannot do justice to the psychology of the seven-year-old unless we recognize the importance of his private mental activities. They account for his occasional brooding, his heedlessness, the minor strains of sadness and complainingness, his sulks, his mutterings, his shynesses, and a certain pensiveness which is not without charm.

Arnold Gesell—1946



BLESSED IS THE ONE WHO CAN DISCOVER THE POETRY OF A CHILD'S WORLD.
—*Anonymous*

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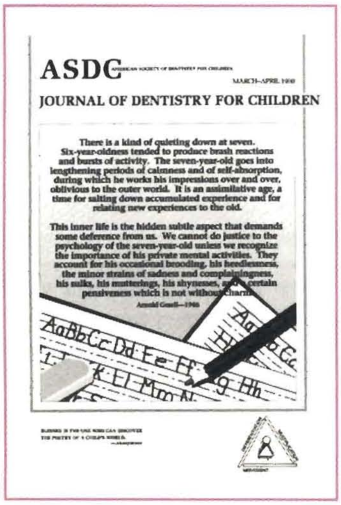

Seven could be called the eraser age. Inclined to self-disparagement, he strives, nonetheless, to self-improvement. Art by Sharlene Nowak-Stellmach.

FLUORIDE

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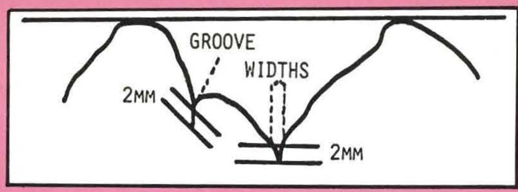

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CLINIC

CASE REPORTS

For the busy reader

In vivo fluoride uptake in enamel and dentin from fluoride-containing materials—page 97

The ability of fluoride-containing materials to deposit fluoride into the cavity walls could be a measure of their anticariogenic properties. Great penetration depths of fluoride were found in all groups in this study, with deeper penetration in dentin compared to enamel.

Requests for reprints should be directed to Dr. Liv Skartveit, Department of Dental Research, University of Bergen, Aarstadveien 17, N-5009 Bergen, Norway.

Effects of systemic fluoride on the morphology of occlusal grooves of primary and permanent molars—page 101

Molars developed in the presence of systemic fluoride have been judged to have shallow grooves and short cusps. In this replication study, however, both water fluoridation and fluoride supplementation had no significant effect on the groove-widths or depths.

Requests for reprints should be directed to Dr. Frank J. Foreman, Chief, Pediatric Dentistry, 2426 Singa, North Pole, AK 99705.

A radiographic investigation of third-molar development—page 106

In view of limited investigations it was considered worthwhile to determine the impact of race, age, and gender on the development and calcification of third molars. Results showed that calcification of third molars could be estimated by observing one quadrant. The crown calcification process begins and is completed earlier in blacks. There were no significant gender differences.

Requests for reprints should be directed to Dr. Nosrat Gorgani, UNMC College of Dentistry, Department of Pediatric Dentistry, 40th & Holdrege, Lincoln, NE 68583-0740.

Pediatric dentists: evolving demography—page 111

The changing gender, racial and ethnic distribution of enrollees in advanced dental education programs is noted for the period 1983-1988. The evolving demography of pediatric dentistry provides positive role-models and represents an opportunity for better services to American youth.

Requests for reprints see Waldman below.

We need to know more about the economics of pediatric dental practice—page 114

Reports by the ADA, U.S. Dept. of Commerce, and the HCFA all confirm the improving economics of dental practice, a reflection of increasing use of dental services by children of all ages. Unfortunately, the continued activity of questionable proprietary economic surveys results in a jaded group of practitioners continuously asked to respond. It is inexcusable that we just don't know very much about the income of the profession.

Requests for reprints should be directed to Dr. H. Barry Waldman, Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11749-8715.

Accuracy of clinical diagnosis for the detection of dentoalveolar anomalies with panoramic radiography as validating criterion—page 119

It is noteworthy that little attention has been paid to the balance between economy, discomfort, and risk to the patient (costs) and the clinical significance (benefit) of panoramic radiography as a routine screening procedure. This study used orthopantomographs to validate clinical detection of dentoalveolar anomalies in young children. It appears that 439 children (67 percent) were exposed without benefit from the radiography.

Requests for reprints should be directed to Dr. Hanne Hintze, Depart. of Radiology, Royal Dental College, Vennelyst Blvd., DK-8000 Aarhus C, Denmark.

Eruption cysts: a retrograde study—page 124

The eruption cyst is a specific type of cyst reportedly associated with erupting primary or permanent teeth. This retrograde study was set up to determine the frequency of occurrence of these lesions and to document the sites, age, sex, and race of affected individuals. Of the fifty-four subjects, thirty-five were male (64.8 percent) and forty-one subjects were Caucasian (76 percent), with eleven black (20.3 percent). Most cysts occurred on the right side of the maxilla, and appear most often in the six-to-eleven-year age-group.

Requests for reprints should be directed to Dr. Ruth A. Anderson, 1225 4th Street, S.W., Washington, D.C. 20024.

Premature eruption of the premolars—page 128

This paper presents a variety of cases in which very early loss of abscessed primary molars caused early eruption of the permanent successors. Clinical sequelae including ectopic eruption, alteration of eruption sequence, arch-length inadequacy and tooth impaction are illustrated by five case reports.

Requests for reprints should be directed to Major (Dr.) Jeffrey H. Camm, 13th AFMC/SGD, Clark AB, APO San Francisco, CA 96274-5300.

Utah dentists sealant usage survey—page 134

After a statewide survey of dentists to determine how many were using sealants, the Utah Department of Health, Dental Health Bureau developed and began implementing a sealant-education program in 1982. The extent of reported usage increased from 48 percent in 1982 to 98 percent in 1987. Routine use increased from 10 percent to 48 percent.

Requests for reprints should be directed to Ms. Peggy A. Bowman, Utah Department of Health, Dental Health Bureau, 288 North 1460 West, P.O. Box 16650, Salt Lake City, UT 84116-0650.

Anodontia of the permanent dentition: fourteen years after initial diagnosis—page 139

The congenital absence of teeth, total anodontia, may involve both the primary and permanent dentitions. This paper updates the dental history of a twenty-eight-year-old Greek-American woman first reported in 1977 by Herman and Moss, when she was fourteen. Five complete sets of dentures had been made for her in thirteen years. Treatment was more complex due to an underdeveloped maxilla and a prognathic mandible.

Requests for reprints should be directed to Dr. Warren Scherer, New York University, College of Dentistry, 345 East 24th Street, New York, NY 10010.

Precocious puberty in a monozygous twin: report of case—page 142

This report describes some effects of premature production of sex hormones observed in a boy with precocious puberty. The data presented are compared with corresponding skeletal and oral factors in an unaffected monozygous twin brother.

Requests for reprints should be directed to Dr. Per Rasmussen, Dept. of Pedodontics, Dental Faculty, University of Bergen, Aarstadveien 17, 5009 Bergen, Norway.

Talon cusp: a review and two case reports on supernumerary primary and permanent teeth—page 147

Resembling an eagle's talon in shape, the term *talon cusp* is applied to a morphologically well-delineated cusp that projects from the lingual surface of the primary or permanent anterior tooth and extends at least half the distance from the cementoenamel junction to the incisal edge.

Requests for reprints should be directed to Dr. Fouad S. Salama, Medical College of Georgia, School of Dentistry, 1459 Laney Walker Blvd., Augusta, GA 30912-0200.

In vivo fluoride uptake in enamel and dentin from fluoride-containing materials

Fluoride

Liv Skartveit, DDS
Anne Bjørg Tveit, Dr odont
Bård Tøtdal, Dr. ing.
Rosane Øvrebø, DDS
Magne Raadal, Dr odont

Secondary caries is reported to be the reason for more than fifty percent of the replacements of amalgam fillings.[1,2] In contrast, secondary caries is seldom found adjacent to glass ionomer fillings, probably due to the high content of fluoride in this material.[3,4] In order to achieve a similar benefit for amalgam, small amounts of fluoride were added to the material, and subsequent studies demonstrated reduced solubility of the enamel adjacent to fluoride amalgam restorations and inhibition of the development of cavity wall lesions *in vitro*.[5-7] One study reported lower incidence of natural secondary caries adjacent to fluoride-containing amalgam fillings compared to fluoride-free amalgam.[8]

Caries may occur at the margin of occlusal fissures sealed with composites or in fissures where the sealant was partially or totally lost. Such lesions may be prevented by using a fluoride-releasing resin or a glass ionomer cement as sealant.[9]

The ability of fluoride-containing materials to deposit fluoride into the cavity walls could be a measure of their anticariogenic properties. *In vitro* fluoride uptake from fluoride-containing amalgam, resin sealants, and

Drs. Skartveit, Tveit, Øvrebø, and Raadal are with the School of Dentistry, University of Bergen, in the Departments of Dental Research, Cariology and Endodontics, and Pedodontics, respectively. Dr. Tøtdal is with the Department of Physics, University of Trondheim, Norway.

glass ionomer cement has been demonstrated, but uptake in human teeth under clinical conditions remains to be shown.[10-16] When six shed primary molars filled with fluoride-containing materials were available, the opportunity was taken, therefore, to register and compare the amounts of fluoride assimilated and retained in the cavity walls. Fluoride taken up in enamel from a glass ionomer cement sealant was also registered.

MATERIALS AND METHODS

As part of routine dental therapy, some children, eight to nine years of age, received fluoride-containing restorations. The actual filling materials were a fluoride-containing amalgam (FluorAlloy®), which contains 1 percent stannous fluoride in the alloy and a glass ionomer cement (Fuji II F®), which contains 11.3 percent fluoride in the powder.

Six teeth, two with fluoride-containing amalgam and four with glass ionomer fillings, were available when shed one to two years after restoration. Three primary molars restored with a conventional fluoride-free amalgam (New True Dentalloy®) were collected as controls.

Four premolars scheduled to be extracted for orthodontic reasons were sealed with a glass ionomer fissure sealant (3 Fuji III®), which contains 11.8 percent fluoride in the powder; while their contralaterals were sealed with a fluoride-free resin (Concise®). The teeth were extracted after two weeks, and stored in 100 percent humidity in glass vials containing wet cotton and crystals of thymol until they were prepared for electron microprobe analysis. By this method the fluoride concentration and the depth of penetration of fluoride in enamel and dentin were registered and compared.

For analysis, two 200 μm thick sections were prepared through each cavity or sealed fissure along the mesiodistal axis of the crown to include both enamel and dentin parts of the cavity walls. During sectioning all fillings and remnants of filling materials were removed. The enamel walls around fluoride amalgam fillings were destroyed during the preparation; consequently dentin walls only could be analyzed in these specimens.

The ground sections were dried at room temperature before they were mounted on methacrylate specimen holders with double-stick tape and coated with a thin layer of carbon.

Elemental analyses were performed with an Applied Research Laboratories electron microprobe, operating at 10 kV with a sample current on brass of approximately 60 nA. Line scans of the electron beam were made at right angles to the cavity and the fissure walls, and several analyses were performed in each specimen, as shown in the Table. Simultaneous analyses for F, Si and Ca were conducted. Analyses of Ca were included to determine the exact position of the edge of the fissure and cavity wall; and the Si analyses to see whether glass ionomer material persisted, attached to the tooth. The analyses for F used the K emission of this element, the concentration estimated by assuming a linear relationship between concentration and intensities in the specimens, when compared to those in a standard of fluorapatite (38.94 percent Ca, 17.77 percent P, 3.85 percent F). Measurements of the concentration of fluoride with fluorapatite as reference standard is regarded as quite reliable.[17,18] The techniques used have been fully described elsewhere.[13,18] The minimum detection limit for fluoride was about 0.15 percent by weight, under the given operating conditions.

RESULTS

The fluoride concentrations registered are presented below. In the glass ionomer filling group, the F concentration ranged from 1.2 to 3.8 percent in dentin and from 0.2 to 2.9 percent in enamel walls. For the fluoride amalgam values from 0.6 to 0.9 percent F were registered in dentin cavity walls. Three fissure analyses showed values below the detection limit. The other values in the sealant group (Fuji III) ranged from 0.2 to 1.9 percent F. Penetration depths varied greatly, in

Table ☐ F concentration in enamel and dentin cavity walls of 1-2-year-old, F-containing fillings and in enamel of fissures sealed with a F-containing sealant for two weeks.

Material/tooth tissue	Number of analyses	F concentration %						
		<0.15	0.15–0.49	0.50–0.84	0.85–1.19	1.20–1.54	1.55–1.90	>1.90
F-am/dentin	8		1	4	3			
Fuji II/dentin	18					13		5
Fuji II/enamel	16		8	2	2	2		2
Fuji III/enamel	34	3	17	8	4	1	1	

dentin walls around F amalgam from 110 μm to 550 μm; while in the glass ionomer group, 220-750 μm in dentin and 180-400 μm in enamel, respectively. The glass ionomer sealant deposited fluoride 40 μm to 260 μm in the occlusal enamel.

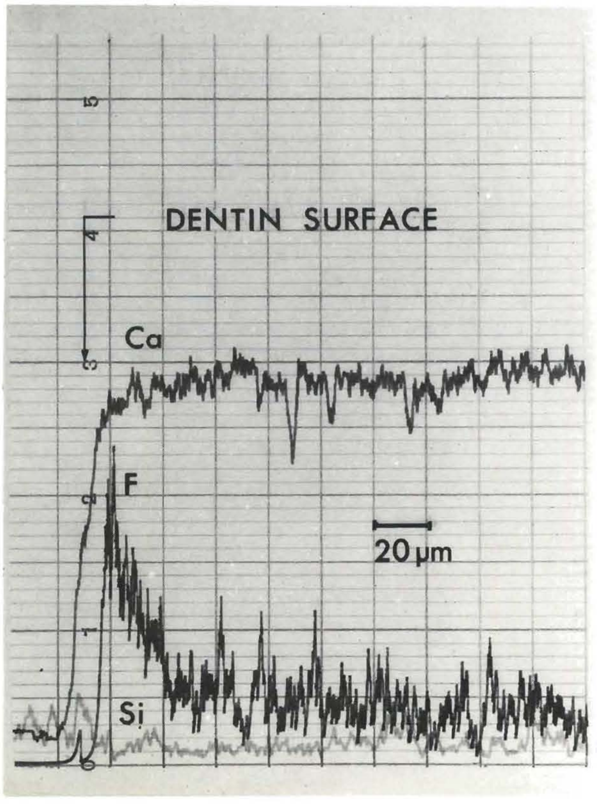
In the control cavity walls, none of the specimens showed fluoride concentrations exceeding the detection limit, while four out of twenty analyses of the control fissures contained 0.2 percent F in the outermost 20 μm. A typical fluoride distribution curve in dentin adjacent to fluoride amalgam is shown in the Figure.

DISCUSSION

This study showed that great amounts of fluoride are taken up by cavity walls from fluoride-containing amalgam and from glass ionomer, and by occlusal enamel from a glass ionomer sealer.

The greater fluoride content in cavity walls surrounding glass ionomer cement fillings compared to fluoride amalgam fillings was not surprising, when keeping in mind the more than ten-fold difference in fluoride content between these materials. Tveit and Gjerdet found that the fluoride release relative to the original fluoride content of the materials, was greatest for the fluoride-containing amalgam.[19] This seemed to be the case in this study as well.

Figure. Linear scans through dentin cavity wall surrounding a fluoride-containing amalgam filling. Concentration profile of calcium shows the exact edge of the cavity wall. The profile of silicon is included to register remnants of glass ionomer cement. The peak of F concentration near the surface shows 0.92 percent F. Elevated F concentration is registered 110 μm into the dentin wall.



Glass ionomers have low tensile strength, are brittle, and show low resistance to wear.

The most successful clinical applications of glass ionomer materials have been in restoring Class V erosion or abrasion lesions and conservative Class III lesions.[4,20-22] The use of glass ionomers for restoring Class II lesions in primary teeth has also been advocated.[20] Glass ionomer filling material requires minimal preparation, and the release of fluoride would be advantageous. *In vitro* studies have shown reduced solubility of enamel adjacent to glass ionomer cements and in a 4.5-year clinical study, there was no evidence of caries at the margins of the restorations of cervical erosions.[4,23,24] Although it has been demonstrated that glass ionomers indeed possess a cariostatic effect, the low tensile strength, brittleness, and low resistance to wear most often preclude the use of these materials for Class I and II restorations. Recently, sintered metal-glass compositions with markedly improved wear resistance have been produced. These metal-reinforced glass ionomers are, however, still in the developmental stage, and further studies are needed before they should be advocated for general use. In primary teeth, however, the clinician often meets situations where anticariogenic properties are a more important consideration than longevity of the filling material.

While laboratory studies showed that the addition of fluoride to amalgams is accompanied by a small reduction in compressive strength and a slight increased corrosion susceptibility this seems to have no clinical significance.[25-27] In a clinical study, a fluoride-containing amalgam showed at least as good clinical performance as a well-known fluoride-free amalgam.[28] Thus, the use of fluoride-containing amalgam is advocated in cases with high caries susceptibility.

The use of glass ionomer cement for fissure-sealing purposes is not very widespread compared to resin sealants. The reasons for this are probably its more complicated handling properties and poorer retention.[29] The observation that Fuji III, however, deposits fluoride into adjacent fissure enamel indicates an increased caries-resistance even in fissures from which the sealant subsequently was lost.

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Effects of systemic fluoride on the morphology of occlusal grooves of primary and permanent molars

Frank J. Foreman, DDS
Arthur E. Retzlaff, DDS

Molars that developed in the presence of systemic fluoride have been subjectively judged to have occlusal anatomy characterized by shallow grooves and short cusps.[1-6] It was assumed that such anatomy made the molar more resistant to occlusal caries.[7,8] Studies have been done to measure whether exposure to systemic fluoride produces a quantitative difference in occlusal anatomy. Three of these studies concluded that fluoride had a significant effect upon the anatomy of developing teeth, while three found that fluoride had little effect on occlusal anatomy.[9-14] In all of these studies, comparisons were made of measurements obtained at "equivalent points" along the grooves of fluoridated and control molars. The major problem with such comparisons is that groove and cusp anatomy within a molar is highly variable. It is highly unlikely, therefore, that one measurement, or a number of measurements, taken from a single cross section, or at a single point on the groove, would characterize the anatomy of the entire molar or be at all reproducible. In order to characterize a highly complex entity, such as the central groove of the molar, it would seem necessary to draw as many sample measurements as possible from different sites along the groove. If an adequate number of samples could be obtained, the mean of these measurements would then characterize the groove as a whole.

The purpose of the study is to determine whether reproducible measurements of groove anatomy, which characterize the entire occlusal groove of a molar, are possible. If such measurements are obtainable, they will then be utilized quantitatively to compare the occlusal anatomy of the molars of independent populations of children of varying fluoride histories.

MATERIALS AND METHODS

Replication study

Five replicate condensation silicone† impressions were obtained of the primary lower right second molar and the permanent lower right first molar of an eight-year, three-month-old male subject, and also of two extracted mandibular third molars. In all, twenty impressions (five replications of four teeth) were taken. To obtain the impressions, Citricon base was first molded over the teeth to form a tray. The teeth were then blown dry, the Citricon wash was painted into the

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†Citricon, Kerr Mfg. Co., Romulus, MI.

grooves of the teeth and into the tray, and the tray was replaced over the teeth. Methylmethacrylate resin‡ was painted into the impressions to obtain hard models of the teeth. The twenty models were coded and sectioned faciolingually, using a thin sectioning machine* with a 375-micron-thick, diamond-edged blade. Each model produced eight to twelve 225-micron-thick cross sections. The sections were then glued to microscopic slides, projected with a photographic enlarger** to ten times their actual size, and the projections traced onto paper.

On each tracing, construction lines were drawn connecting the cusp-tips and at levels 2 mm above the deepest portion of each groove parallel with the cusp slopes. A measurement of groove-depth for each tracing was obtained by measuring from the construction line connecting the cusp-tips to the bottom of the deepest groove (Figure 1a). In order to obtain a groove-depth measurement characteristic of the entire groove of the model, a mean groove-depth (GD) was then calculated for each model.

A deep-groove-width measurement was obtained for every groove on every tracing by measuring the length of the construction lines drawn 2 mm above the groove-floor at their intersections with the cuspal slopes (Figure 1b). The mean groove-width (GW) was calculated by first computing the provisional mean of the narrowest grooves from each section. Any additional grooves on the tracings that were found to be narrower than this provisional mean were then added in and a final mean groove-width was recalculated. In tracings where the only groove observed was found to be very wide, a maximum measurement of 5 mm was utilized in order to minimize the inclusion of superfluous data. All grooves wider than 5 mm were considered coalesced and equally resistant to caries.

The methods used in obtaining the mean groove-depth and groove-width measurements were designed to utilize the maximum amount of information that might be relevant to the caries-susceptibility of the groove from each section, while minimizing the inclusion of superfluous data.

The groove-depth and groove-width measurements were determined for each replicate model and the standard error of the means was calculated for each tooth. The percent error was then found to average 2.2 percent for the groove-depth measurement and 3.4 percent for the groove-width measurement. It was felt that this level of error in measurement would not exclude comparison of independent populations.

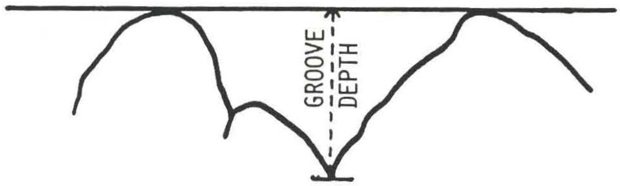

Figure 1a. The groove-depth of a given section was obtained by measuring from the construction line connecting the cusp tips to the bottom of the deepest groove.

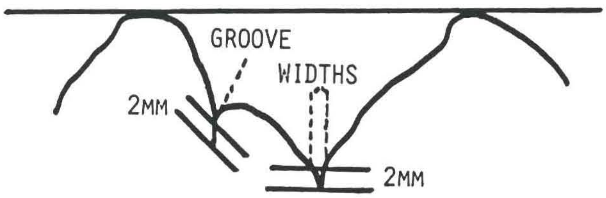

Figure 1b. Construction lines were fabricated 2 mm above the bottom of the grooves parallel to the cuspal slopes for each groove in each section. The groove-widths were obtained by measuring the lengths of these lines at their intersections with the cuspal slopes.

Fluoride study

A patient consent form and a history of the systemic fluoride ingestion of seventy-five children between the ages of six and nine in the Portland, Oregon area was obtained from each child's parent. On the basis of the history, the child was placed into one of three categories:

- ☐ The control-group included thirty-two children with no history of significant fluoride ingestion. To be placed in this group, the children must have continuously resided in a fluoride-free community and their consumption of fluoride supplements deemed to be inconsequential.
- ☐ The fluoridated-water-group included thirty children with histories of continuous exposure to optimally fluoridated water until at least the age of five.
- ☐ The fluoride-supplement-group included thirteen children who were reported by their parents to have taken a fluoride supplement continually from at least three months of age until at least five years of age.

The mean age of the seventy-five subjects was 7.9 years with a standard deviation of 1.0 year. There was no significant difference in the ages of the three groups (F = 2.2, df = 72.2).

Utilizing the techniques described above, impres-

‡Duralay Inlay Pattern Resin, Reliance Mfg., Co., Worth, IL.

*Gilling-Hamco Thin-Sectioning Machine, Bronwill Scientific Co., Rochester, NY).

**Beseler Photographic Enlarger, Beseler Co., East Orange, NJ.

sions were obtained of one primary lower second molar and one permanent lower first molar from each subject. Children were excluded from the study, if caries, restorations, or sealants were present on these teeth. In the control group, an impression of only the primary second molar was obtained from two children and of only the permanent first molar from two other children. In total, thirty sample impressions of each molar were obtained from the thirty-two children in the control group.

The models obtained from the impressions were randomly coded and catalogued before sectioning. This was done so that the tooth's fluoride history would be unknown, while the tracing, measuring, and computing of mean groove-depth and groove-width were accomplished as described above.

The permanent molars had deeper, but narrower grooves than the primary molars.

RESULTS

The Table shows the means and standard deviations of the groove-depths and groove-widths for each fluoride group and for the combined groups. All measurements are in millimeters. The range of the groove-depth was from 1.29 mm to 2.22 mm for the permanent molars and 0.94 mm to 1.93 mm for the primary molars. The range of the groove-width was from .12 mm to .46 mm for the permanent molars and from .18 mm to .49 mm for the primary molars.

The means for each group's groove-depth and groove-width were compared using a two by three analysis of variance. This analysis found that the difference in primary and permanent molar groove-depth and groove-width was significant to a level of .001. The permanent molars had deeper, but narrower grooves. The analysis showed, however, that there were no significant interactions between the variables of tooth-type and fluoride-exposure.

Since no significant differences were found between fluoride groups, the groups were combined and Pearson's correlation coefficients (r) were calculated between the groove-depth and groove-width of the subject's primary molar and the groove-depth and groove-width of the subject's permanent molar. The correlation between the primary molar's groove-depth and the permanent molar's groove-depth was significant at a .05 level (r = .31). This correlation for groove-width was significant at a .001 level (r = .48). If the children had primary molars with deep and narrow grooves, they tended, therefore, to have neighboring permanent molars with deep and narrow grooves.

The groove-depth of the individual tooth was then correlated with the groove-width of the same tooth. None of these correlations were found to be significant for the primary molars (r = .18). This correlation was significant, however, to a .01 level for the permanent molars (r = .36). Teeth with deep grooves tended, therefore, to be narrow in the permanent molars, but not in the primary molars.

Table □ Groove depth and groove width measurements for each fluoride group.

		Groove depth				Groove width			
		Primary		Permanent		Primary		Permanent	
	n	mean	SD	mean	SD	mean	SD	mean	SD
Control	30	1.28 ±	.13	1.74 ±	.15	.33 ±	.09	.28 ±	.08
Water fluoride	30	1.31 ±	.19	1.82 ±	.19	.37 ±	.08	.28 ±	.08
Fluoride supplement	13	1.34 ±	.22	1.76 ±	.13	.38 ±	.08	.31 ±	.08
Combined	73	1.30 ±	.18	1.78 ±	.17	.35 ±	.08	.29 ±	.08

DISCUSSION

As previously cited, many studies gave subjective opinions that water fluoridation itself modifies occlusal anatomy. Our data do not corroborate these findings. The results of the present study indicate that there is not significant modification of the occlusal anatomy as a result of exposure to water fluoridation during amelogenesis. Although the sample was small, fluoride supplements were likewise found to have no effect.

Although indicating that fluoride supplements have a greater effect on the fissure-anatomy, Aasenden and Peebles also reported significant effects due to water fluoridation. Their data were reported, however, as the

The bacterium that first colonizes a fissure is a variable in determining whether the fissure becomes carious.

percentage of patients with subjectively determined "atypically shallow pits and fissures." The control group had a much higher percentage of occlusal surfaces restored, which would eliminate them from this category. Although the anatomy of fissures may be considered a major variable in determining whether a fissure becomes carious, Loesche brings convincing evidence that another variable is the bacterium that first colonizes the fissure.[15] He also argues that the presence of fluoride selects against initial colonization by *Streptococcus mutans* and rapid caries-formation. This topical effect of fluoride may be a factor in the decrease in occlusal restorations noted by Aasenden and Peebles.

In the Glenn *et al* study of prenatal fluoride supplementation's effect upon groove anatomy, the differences were dramatic, but the technique was very subjective. By chance the mother of one of our subjects followed Glenn's formulation of drinking fluoridated water while taking fluoride supplements during her entire pregnancy. Her daughter had quite deep, narrow grooves (GW = .19 mm for the permanent molar), however, and she was given appointments for the placement of sealants. A sample of one is hardly adequate; it would be very interesting to learn, therefore, whether Glenn's subjective results could be duplicated with an objective measure in a double-blind study.

In previous studies attempting to measure fluoride's effect upon occlusal groove morphology, only Lovius and Goose reported their replication errors, which ranged from 4.5 to 8.0 percent.[12] In this study, the error of measurement was found to be 2.2 to 3.4 percent. The significance of any laboratory measurement is also dependent, however, upon its clinical significance. In this study, as in previous studies, the significance of the groove-depth and groove-width measurements are dependent upon their correlation with the susceptibility of the groove to caries. Since such measurements as groove-depth, groove-angle, or cusp-height would be affected by occlusal wear of the cusp-tips, it is doubtful that such measurements would be of clinical significance in the prediction of caries susceptibility. The fact that groove-depth and groove-width were significantly correlated in the permanent molars, but not in the primary molars, may reflect upon the insignificance of the groove-depth measurement. The primary molars suffered more occlusal wear than the permanent molars. Hence, the moderate correlation inherent in the groove-depth and groove-width measurements and reflected in the permanent molars is nullified by the independent variable of cuspal wear in the primary molars.

The fact that fissures have been shown to be impacted with plaque and debris might make it questionable whether the impression material accurately reflected their anatomy.[16] The highly significant difference found between the groove-width of the permanent and primary molars would indicate, however, that at the level of measurement utilized, true differences in this measurement are obtainable. This finding that the permanent molars have significantly narrower grooves than the primary molars would also be an indication that the groove-width measurement in the present study is a valid indicator of caries-susceptibility. The occlusal surfaces of the permanent lower first molar are more caries-prone than the occlusal surfaces of the primary lower second molar.[17,18] This difference in caries susceptibility is accurately reflected, therefore, by the difference in the groove-width measurement.

As following Fejerskov *et al*, in this discussion, the term "groove" was chosen to designate the visible macroscopic anatomy of the molar.[19] The term "fissure" has been reserved for the microscopic entity at the depth of the grooves. In several studies, a correlation between the anatomy of the microscopic fissures and the occurrence of caries has been substantiated.[19-21] In the study by Fejerskov *et al*, a high correlation was found between the microscopic fissure-depth and an occlusal angle measurement made at the depth of the groove in the orifice of the fissure.[19] Although the techniques of examination differ between the studies, the measure of groove-width at a level .2 mm above the observed groove-floor, in this study, should correlate closely with their measurement of occlusal angle. The sections less than .2 mm in width would tend to have deep fissures and to be susceptible to caries.

Finally the significant correlation found between the groove-widths and groove-depths of the individual's permanent and primary molars' might indicate that there is within individuals a genetic tendency toward forming molars with deep, narrow grooves and that this tendency carries over from the primary to the permanent dentition.

CONCLUSION

Within the limitations inherent in this study, it appears that:

- ☐ Exposure to fluoride during amelogenesis has no effect upon the groove-depths and groove-widths of the subject's permanent lower first molars and primary lower second molars.
- ☐ The permanent lower molars have significantly narrower grooves than the primary lower molars.
- ☐ The groove-width measurement may be a valid indicator of the caries-susceptibility of a molar, but the groove-depth measurement is of questionable value.
- ☐ There may be a genetic component in the amelogenesis of the primary and permanent molars that predisposes an individual to deep, narrow grooves.

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Development

A radiographic investigation of third-molar development

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The presence or absence of third molars and the age at which they develop is relevant to the overall dental evaluation of a patient.[1,2] Opinions vary, however, on the earliest age at which these teeth are radiographically apparent. For example, Adamson stated that third-molar crypts do not appear until nine or ten years of age.[3] Garn, Lewis and Vicinus reported that most third-molar crypts appear at the age of eight.[4]

Dachi and Howell examined a series of 3874 routine full-mouth radiographs.[5] They found that 29.9 percent of the maxillary third molars and 17.5 percent of the mandibular third molars were impacted. In patients in whom impaction of third molars is likely or a genetic tendency to develop an impacted third molar exists, the prophylactic removal of third molars can be beneficial.[6] If the third-molar crypt is detected before calcification starts, the surgical procedure will be less traumatic, because the follicle is not submerged in the bone and bone removal through surgical enucleation, therefore, will remain minimal.[7]

In view of limited investigations, it was considered worthwhile to determine the impact of race, age, and gender on the development and calcification of the third molars.

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METHODS AND MATERIALS

In this study 450 panoramic radiographs of 229 black and 221 white dental patients aged six to fourteen years, who attended the Pediatric Dentistry Clinic at the University of Nebraska Medical Center in Omaha, were examined. These radiographs were taken as part of routine dental treatment between 1970 and 1974. None was taken for purposes of the present investigation.

The radiographs were allocated to nine separate annual age-groups. Each group had fifty subjects: twenty-five females and twenty-five males. Stages of development of crown formation of third molars across arches were recorded for all radiographs. A score of zero was given where no signs of crypt formation or calcification were detectable. A score of 1 to 5 was given depending upon the degree of crown calcification as defined by Gravely:

Stage 1 This stage includes all cases in which there is clear evidence of crypt formation. Where there is also radiographic evidence of calcification of the crown that has not proceeded sufficiently to constitute a quarter of the crown, neither are the cusps joined.

Stage 2 At least a quarter of the crown has formed, cusps have united, but radiographic evidence of calcification has not proceeded sufficiently to constitute half the crown.

Stage 3 Half the crown has formed, but evidence of calcification has not progressed sufficiently to constitute three-quarters of the crown.

Stage 4 At least three-quarters of the crown has formed or in cases where the crown is fully formed, root formation has not commenced.

Stage 5 Crown formation is complete and root development progressing.[8] •

To establish rater reliability using the 0-5 scale, thirty-six randomly selected radiographs were reviewed by an oral radiologist and compared to the author's rating. A Spearman's correlation coefficient was used to calculate the rater reliability. The correlation coefficients were .97 for maxillary ratings and .98 and .99 for mandibular ratings. The result of this test showed a high degree of uniformity between observers in rating and established the reliability of the methodology.

For each subject, four scores were recorded: one each for right maxilla, right mandible, left maxilla, and left mandible. The percentages of each stage of crown development for all annual groups were separately tabulated for black males, black females, white males and white females. The data then were entered into the computer and subjected to statistical analysis.

A Spearman correlation coefficient was used to calculate the interquadrant correlations. The range of coefficients was from .77 to .96 for females and from .83 to .96 for males. This analysis showed that crown calcification among the four quadrants was highly correlated.

A Mann-Whitney U Test was used to examine the impact of race on the crown calcification of third molars. The significance levels of this test were $p < .05$. This indicated that there was not significant difference for gender in third-molar development.

RESULTS

Descriptive statistics for mean frequencies of stages of development were tabulated for each age-bracket (Tables 1 to 4). The findings are as follows:

- ☐ *For black males at age eight*, there was evidence of crypt formation and calcification in 70 percent of the individuals. By age ten, 90 percent of those third molars that eventually formed were visible on panoramic radiographs. During early stages of calcification (between ages six to eight years), mandibular third molars calcified faster, but by age ten the maxillary third-molar development caught up and calcification became more pronounced in the maxilla. At age thirteen, 90 percent of the crown-calcification was completed in the mandible. At age fourteen, the calcification of the crowns was completed in both arches, with those in the maxilla slightly more advanced than those in the mandible. Agenesis of third molars was 7 percent with bilateral agenesis occurring in 6 percent of the sample.
- ☐ *For black females at age eight*, there was evidence of crypt formation and calcification in 50 percent of the individuals. At age nine, 90 percent of those third molars that eventually formed were visible on panoramic radiographs. Before age nine, the development of the third molar was more advanced in the mandible. In the maxilla at age ten, the development accelerated and became equal to the mandible at age eleven. By age eleven, the crowns of the third molars were half to three quarters calcified in both arches. At age fourteen, the calcification of the crowns was completed in both arches with those in the maxilla being slightly more advanced than those in the mandible. Agenesis of third molars was 9 percent, with bilateral agenesis occurring in 7 percent of the sample.
- ☐ *For white males at age nine*, there was evidence of crypt formation and calcification in 70 percent of the individuals. By age eleven, 90 percent of

Table 1 □ Percentage of stage of development of third molars in black males (see footnotes).

Age	Right maxillary		Right mandibular		Left maxillary		Left mandibular		Maxilla R & L sides		Mandible R & L sides	
6	100	S0	93	S0	100	S0	93	S0	100	S0	93	S0
			7	S1			7	S1			7	S1
	93	S0	60	S0	93	S0	54	S0	93	S0	57	S0
7	7	S1	40	S1	7	S1	46	S1	7	S1	43	S1
	50	S0	20	S0	40	S0	20	S0	45	S0	43	S0
8	20	S1	40	S1	20	S1	40	S1	20	S1	40	S1
	30	S2	40	S2	40	S2	40	S2	35	S2	40	S2
	33	S0	20	S0	13	S0	13	S0	23	S0	16	S0
9	7	S1	47	S1	27	S1	53	S1	17	S1	50	S1
	40	S2	27	S2	40	S2	27	S2	40	S2	27	S2
	20	S3	6	S3	20	S3	7	S3	20	S3	7	S3
	8	S0	8	S0	8	S0	8	S0	8	S0	8	S0
	8	S1	8	S1	8	S1	8	S1	8	S1	8	S1
10	23	S2	62	S2	23	S2	62	S2	23	S2	62	S2
	38	S4	23	S3	38	S3	23	S3	38	S3	23	S3
	23	S4			23	S4			23	S4		
	8	S1	8	S1	8	S0	8	S1	8	S1	8	S1
11	76	S3	77	S2	85	S3	62	S2	80	S3	70	S2
	16	S4	15	S3	8	S4	30	S3	12	S4	22	S3
	27	S2	73	S2	18	S2	18	S1	23	S2	9	S1
12	37	S3	18	S3	45	S3	55	S2	41	S3	64	S2
	27	S4	9	S4	27	S4	18	S3	27	S4	18	S3
	9	S5			9	S5	9	S5	27	S4	9	S5
	29	S4	21	S3	219	S4	21	S3	25	S4	21	S3
13	71	S5	36	S4	79	S5	14	S4	75	S5	25	S4
			43	S5			65	S5			54	S5
	9	S0	9	S0	100	S5	9	S0	5	S0	9	S0
14	18	S4	9	S3			9	S4	9	S4	5	S3
	73	S5	80	S5			81	S5	86	S5	80	S5

S0 = No sign of crypt formation
S1 = Stage one of crown calcification
S2 = Stage two of crown calcification
S3 = Stage three of crown calcification
S4 = Stage four of crown calcification
S5 = Stage five of crown calcification

Table 2 □ Percentage of stage of development of third molars in black females (see footnotes).

Age	Right maxillary		Right mandibular		Left maxillary		Left mandibular		Maxilla R & L sides		Mandible R & L sides	
6	92	S0	84	S0	92	S0	84	S0	92	S0	84	S0
	8	S2	8	S1-8 S2	8	S2	9	S1-8 S2	8	S2	8	S1-8 S2
	100	S0	63	S0	100	S0	56	S0	100	S0	60	S0
7			37	S1			44	S1			40	S1
	56	S0	45	S0	56	S0	45	S0	56	S0	45	S0
8	11	S1	33	S1	11	S1	33	S1	11	S1	33	S1
	33	S2	22	S2	33	S2	22	S2	33	S2	22	S2
	18	S0	18	S0	9	S0	18	S1	13	S0	18	S1
9	27	S2	64	S2	9	S1	64	S2	5	S1	64	S2
	55	S3	18	S3	55	S3	18	S3	55	S3	18	S3
	55	S3			55	S3			55	S3		
	36	S2	29	S1	7	S0	7	S0	4	S0	4	S0
10	64	S3	57	S2	7	S1	14	S1	3	S1	22	S1
			14	S3	29	S2	64	S2	33	S2	60	S2
					57	S3	15	S3	60	S3	14	S3
	7	S0	7	S0	7	S0	7	S0	7	S0	7	S0
11	7	S2	33	S2	40	S2	40	S2	24	S2	28	S2
	46	S3	60	S3	53	S3	7	S4	23	S3	42	S3
	40	S4					7	S4	46	S4	23	S4
	9	S0	55	S2	45	S3	18	S1	5	S0	9	S1
12	36	S3	36	S3	55	S4	36	S2	40	S3	45	S2
	55	S4	9	S4			10	S4	55	S4	36	S3
							10	S4			10	S4
	15	S0	8	S0	8	S0	15	S0	12	S0	12	S0
	8	S3	8	S1	8	S1	8	S1	4	S1	8	S1
13	23	S4	38	S3	15	S3	23	S3	12	S3	30	S3
	54	S5	15	S5	46	S5	30	S4	23	S4	30	S4
			15	S5	46	S5	23	S5	50	S5	20	S5
	20	S4	7	S0	7	S3	7	S0	4	S3	7	S0
14	80	S5	13	S3	13	S4	7	S3	16	S4	10	S3
			20	S4	80	S5	20	S4	80	S5	20	S4
			60	S5			66	S5			64	S5

S0 = No sign of crypt formation
S1 = Stage one of crown calcification
S2 = Stage two of crown calcification
S3 = Stage three of crown calcification
S4 = Stage four of crown calcification
S5 = Stage five of crown calcification

the third molars that eventually formed were visible on panoramic radiographs. During the early stages of development, the tooth buds were seen earlier in the mandible, but by age eleven, third-molar development accelerated in the maxilla and calcification became more pronounced in the maxilla. By age twelve, the crowns of these teeth were half to three-quarters calcified in both arches. At age fourteen, the calcification of the crowns was completed in 80 percent of the individuals, with third-molar development being slightly more advanced in the maxilla. Agenesis was found in 10 percent of the individuals with bilateral agenesis occurring in 8 percent of the sample.

☐ *For white females at age nine*, there was evidence of crypt formation and calcification in 70 percent

Calcification of all third molars can be estimated by observing one quadrant.

Table 3 ☐ Percentage of stage of development of third molars in white males (see footnotes).

Age	Right maxillary		Right mandibular		Left maxillary		Left mandibular		Maxilla R & L sides		Mandible R & L sides	
6	100	S0	100	S0	100	S0	100	S0	100	S0	100	S0
7	92	S0	92	S0	92	S0	92	S0	92	S0	92	S0
	8	S1	8	S1	8	S1	8	S1	8	S1	8	S1
8	87	S0	73	S0	87	S0	67	S0	87	S0	70	S0
	13	S1	20	S1	13	S1	27	S1	13	S1	23	S1
			7	S2			7	S2			7	S2
9	50	S0	40	S0	50	S0	50	S0	50	S0	45	S0
	30	S1	40	S1	10	S1	20	S1	20	S1	30	S1
	10	S2	20	S2	30	S2	30	S2	20	S2	25	S2
	10	S3			10	S3			10	S3		
10	25	S0	8	S0	33	S0	25	S0	29	S0	17	S0
	33	S1	58	S1	17	S1	33	S1	25	S1	45	S1
	33	S2	25	S2	33	S2	33	S2	33	S2	29	S2
	8	S4	8	S3	8	S3	8	S3	4	S3	8	S3
					8	S4			8	S4		
11	8	S0	42	S1	17	S0	17	S0	12	S0	8	S0
	17	S1	42	S2	25	S2	25	S1	8	S1	34	S1
	25	S2	16	S3	58	S3	50	S2	25	S2	46	S2
	50	S3					8	S3	54	S3	12	S3
12	7	S0	7	S0	14	S0	7	S0	10	S0	7	S0
	7	S2	72	S2	7	S2	7	S1	7	S2	3	S1
	57	S3	21	S3	50	S3	50	S2	52	S3	61	S2
	29	S4			28	S4	28	S3	30	S4	25	S3
							7	S4			4	S4
13	9	S0	9	S0	9	S0	18	S0	9	S0	13	S0
	9	S2	9	S1	9	S2	55	S2	9	S2	5	S1
	27	S3	27	S2	27	S3	9	S3	27	S3	41	S2
	36	S4	18	S3	18	S4	9	S4	27	S4	13	S3
	18	S5	27	S4	36	S5	9	S5	27	S5	18	S4
			9	S5					27	S5	9	S5
14	7	S0	7	S0	14	S0	7	S0	10	S0	7	S0
	7	S3	14	S3	7	S3	29	S3	7	S3	21	S3
	29	S4	29	S4	29	S4	14	S4	29	S4	22	S4
	57	S5	50	S5	50	S5	50	S5	54	S5	50	S5

S0 = No sign of crypt formation
S1 = Stage one of crown calcification
S2 = Stage two of crown calcification
S3 = Stage three of crown calcification
S4 = Stage four of crown calcification
S5 = Stage five of crown calcification

Table 4 ☐ Percentage of stage of development of third molars in white females (see footnotes).

Age	Right maxillary		Right mandibular		Left maxillary		Left mandibular		Maxilla R & L sides		Mandible R & L sides	
6	100	S0	93	S0	100	S0	93	S0	100	S0	93	S0
			7	S1			7	S1			7	S1
7	67	S0	22	S0	67	S0	33	S0	67	S0	27	S0
	11	S1	67	S1	11	S1	56	S1	11	S1	40	S1
	22	S2	11	S2	22	S2	11	S2	22	S2	11	S2
8	70	S0	44	S0	75	S0	44	S0	72	S0	44	S0
	12	S1	50	S1	25	S1	50	S1	6	S1	50	S1
	18	S2	6	S2			6	S2	22	S2	6	S2
9	36	S0	36	S0	36	S0	29	S1	36	S0	32	S0
	14	S1	36	S1	14	S1	43	S1	14	S1	40	S1
	36	S2	28	S2	36	S2	28	S2	36	S2	28	S2
	14	S3			14	S3			14	S3		
10	27	S0	27	S0	27	S0	9	S0	27	S0	18	S0
	18	S1	18	S1	9	S1	63	S1	13	S1	40	S1
	36	S2	45	S2	45	S2	27	S2	41	S2	36	S2
	18	S3	9	S3	18	S3			18	S3	5	S3
11	10	S0	10	S0	10	S0	30	S0	10	S0	20	S0
	10	S1	30	S1	10	S1	10	S1	10	S1	10	S1
	50	S2	50	S2	40	S2	50	S2	45	S2	50	S2
	30	S3	10	S3	40	S3	10	S3	35	S3	10	S3
12	14	S0	14	S0	7	S0	14	S0	10	S0	14	S0
	65	S3	7	S1	7	S2	7	S1	3	S2	7	S1
	21	S4	57	S2	50	S3	57	S2	58	S3	57	S2
			22	S3	36	S4	22	S3	29	S4	22	S3
13	25	S0	33	S2	8	S0	8	S1	17	S0	4	S1
	25	S3	50	S3	8	S1	33	S2	4	S1	33	S2
	25	S4	17	S5	17	S2	33	S3	8	S3	42	S3
	25	S5			8	S3	8	S4	17	S3	4	S4
					16	S5	17	S5	20	S5	17	S5
14	10	S2	10	S0	10	S0	5	S0	5	S0	10	S0
	20	S4	40	S3	40	S4	30	S3	5	S4	35	S3
	70	S5	10	S4	50	S5	20	S4	30	S5	15	S4
			40	S5			40	S5	60	S5	40	S5

S0 = No sign of crypt formation
S1 = Stage one of crown calcification
S2 = Stage two of crown calcification
S3 = Stage three of crown calcification
S4 = Stage four of crown calcification
S5 = Stage five of crown calcification

of the individuals. At age eleven, 90 percent of those third molars that eventually formed were visible on panoramic radiographs. Before age nine, the third-molar development was more advanced in the mandible and third-molar crypts were seen earlier in this arch. By age ten, third-molar development in the maxilla accelerated and the development became more pronounced in the maxilla. By age twelve, the crowns of third molars were half to three-quarters calcified in both arches. By age fourteen the crowns of 90 percent of maxillary third molars were fully calcified as compared to the mandibular ones, which were fully calcified in only 50 percent of the individuals. Agenesis of the third molars was about 8 percent with bilateral agenesis occurring in 6 percent of the sample.

CONCLUSIONS

Based on the data collected from the sample and the statistical analyses presented in this study, the following conclusions can be drawn:

☐ The calcification of third molars in different quadrants was highly related. The calcification of all third molars could be estimated, therefore, by observing one quadrant. The range of interquadrant correlation was from .77 to .96 for females and .83 to .96 for males.

☐ Tooth buds were detected at an earlier age for black individuals and stages of development for third molars were earlier for blacks compared to a similar age-group in the white population.

☐ Crown calcification of third molars was completed earlier for black individuals than for white individuals.

☐ The rate of agenesis of third molars was 7 to 10 percent and was similar for both black and white populations. If it occurred, it was bilateral, in 79 percent of the cases.

☐ There were no significant gender differences in the calcification of third molars.

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Pediatric dentists: evolving demography

Demography

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Presentations on the evolving demography of pediatric dentists often emphasized the increasing numbers of practitioners.[1] For example, between 1979 and 1987, the absolute number of pediatric dentists increased from 1,776 to 3,089. During the same period, the ratio per population increased from 7.9 to 12.7 per million individuals.[2,3]

Additional data are now available from a variety of American Dental Association reports on the evolving demography of graduate students in pediatric dental training programs: specifically, for the 1983-84 and 1988-89 academic years, information is available on the gender, racial, and ethnic distribution of students.[4†]

GENDER

Between 1983‡ and 1988, the number of female dental school graduates increased from approximately 930 to

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†Comparisons will be made between advanced training program total enrollments (i.e. enrollment in two, three or more different years of graduate training) and graduates from dental school in a single year. The information should be considered, therefore, as a comparison of general periods of the early and late 1980s and not as an exact year-to-year comparison.

‡Throughout this presentation, except for the recording of a year of graduation, the use of a particular year will indicate the beginning of an academic year.

Minorities represent a third of the enrollment in advanced pediatric dental programs.

1,263 (from 16 percent to 27.5 percent of the graduating class). During this same period, the total number of women enrolled in advanced dental education programs increased from 681 to 910, or from 17.4 percent to 21.6 percent of the total number of students in advanced education programs.

In 1983, women represented 38 percent of the pediatric dental graduate students (more than twice the ratio for all advanced training programs). In 1988, once again, the percent of female students in pediatric dental programs (45.5 percent) was more than double the rate for women in all advanced programs. In dental school affiliated programs, female students outnumbered male students (131 women to 124 men) (Table 1).

Evolving demography

- ☐ There has been an increase in the number of female dental school graduates.
- ☐ The number of women enrolled in advanced dental training programs increased more rapidly than the increase in the number of men.
- ☐ Overall in 1983, the ratio of women to men enrolled in advanced training programs approximated the ratio of female to male graduates from dental schools. In 1988, although there had been marked increases in the number of women enrolled in advanced programs, the ratio of women to men in advanced programs was below the ratio for dental school graduates.
- ☐ In both 1983 and 1988, the ratio of women to men in pediatric dental programs more than doubled the ratio of women-to-men dental school graduates.

RACE AND ETHNICITY

Between 1983 and 1988, the percent of minority dental school graduates increased from 9.9 percent to 20.1 percent. During this same period, the overall percent of minority students enrolled in advanced dental education programs increased from 14.9 percent to 17.6 percent.

Between 1983 and 1988, the proportion of minorities in pediatric dental programs increased from 31.8 percent to 33.8 percent, with particularly high representation by Asian and Hispanic minority students. Despite

Table 1 ☐ Total enrollment in pediatric dental training programs and all advanced dental education programs, and dental school graduates by gender: 1983, 1988.[4-7]

	Male		Female		
Program	Number	Percent	Number	Percent	Total
1983					
Pediatric dentistry					
Dental School	153	62.9%	90	37.1%	243
Nondental school	47	60.3	31	39.7	78
Total	200	62.3	121	37.7	321
All advanced programs	3,241	82.6	681	17.4	3,925
Dental school graduates	4,826	83.8	930*	16.2	5,756
1988					
Pediatric dentistry					
Dental school	124	48.6%	131	52.2**	255
Nondental school	58	73.4	21	26.6	79
Total	182	54.5	152	45.5	334
All advanced programs	3,305	78.4	910	21.6	4,215
Dental school graduates	3,298	72.5	1,263	27.5	4,581

*Number of female graduates in 1983 was not reported in ADA reports. The estimate is based upon the number of women in year four dental school classes in 1982–83.

**Females represented 24.7 percent students in all dental school advanced education programs.

Table 2 □ Total enrollment in pediatric dental training programs and all advanced dental education programs, and dental school graduates by race and ethnicity: 1983.[4-7]

	White		Black		Hispanic		Native American		Asian		Total
Program	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Pediatric dentistry											
Dental school	160	65.8%	11	4.5%	46	18.9%		0.0%	26	10.7%	243
Nondental school	59	75.6	7	8.9	9	11.5		0.0	3	3.8	78
Total	219	68.2	18	5.6	55	17.1		0.0	29	9.0	321
			Total minorities: 102—31.8%								
All advanced programs	3,339	85.1	115	2.9	220	5.6	6	0.2	245	6.2	3,925
			Total minorities: 586—14.9%								
Dental school graduates	5,185	90.1	200	3.5	144	2.5	12	0.2	215	3.7	5,756
			Total minorities: 571—9.9%								

Table 3 □ Total enrollment in pediatric dental training programs and all advanced dental education programs, and dental school graduates by race and ethnicity: 1988.[4-7]

	White		Black		Hispanic		Native American		Asian		Total
Program	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Pediatric dentistry											
Dental school	149	58.4%	9	3.5	47	18.4	2	0.8	48	18.8	255
Nondental school	72	91.1	4	5.1		0.0		0.0	3	3.8	79
Total	221	66.2	13	3.9	47	14.1	2	0.6	51	15.3	334
			Total minorities: 113—33.8%								
All advanced programs	3,469	82.3	143	3.4	210	4.9	6	0.1	387	9.2	4,215
			Total minorities: 746—17.6%								
Dental school graduates	3,660	79.9	*								4,581
			Total minorities: 921—20.1%								

*Individual category minority group data are not available for 1988.

these increases, however, in 1988, there were virtually no Asian or Hispanic students enrolled in nondental school pediatric programs (Tables 2 and 3).

Evolving demography

- □ Minorities represent an increasing percent of dental school graduating classes, enrollment in advanced training programs, and most specifically in pediatric dental programs.
- □ Minorities represent a third of the enrollment in advanced pediatric dental programs.

IN GENERAL

Enrollment in dental school and advanced dental education programs is undergoing marked changes as the profession comes to terms with the evolving demand for dental services and fluctuations in the perceived need for personnel and the perceived economic returns of practice. One of the more dramatic developments has been the transformation from an almost all-white, male profession to one that closely resembles the heterogenous mix of our general population.

But as the dental profession in general, and pediatric dentistry in particular, attempt to reach out to serve more varied segments of our communities, the evolving demography of the profession may facilitate this process. These developments should not be construed, however, in such a manner that the newer entrants into the profession should (must?) serve "their" particular groups. Rather, the evolving demography of the profession provides positive role-models and the opportunity for providers of dental services to understand better and deal with the ethnic and cultural varieties that exist in our communities. This only can enhance the efforts of pediatric dentists to provide services to the youth of our country.

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We need to know more about the economics of pediatric dental practice

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Reports by the American Dental Association, the U.S. Department of Commerce and the Health Care Financing Administration all confirm the improving economics of dental practice.[1-5] In part, this general improvement is a reflection of the increasing use of dental services by children of all ages.[6-8]

But these reports on the improving economics of dental practice are for the composite average dentist. Minimal income data are available for practitioners in each of the specialties, and much of the information that is available raises far more questions than it answers. The need is for more specific information about the economics of pediatric dental practice.

SOME OF THE DIFFICULTIES

In addition to an absence of specific economic information about pediatric dental practice, many of the problems result from questionable survey procedures, and a frequent incompatibility of data presentations by professional journals and proprietary publications, which precluded comparative analysis. For example the American Dental Association (ADA) no longer provides economic information by specific specialties (see section below on "response rate"), *Dental Management* (DM) provides data in a "means" format, and *Dental Economics* (DE) reports its findings in a series of data ranges.

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The most important fact to remember when reading statistical information is that the validity of the findings depends upon two basic factors:

- ☐ The method of determining the required sample size and procedures used to collect the required sample data.
- ☐ The statistical techniques and procedures used to evaluate the data and report the findings.

These factors, taken together, constitute the experimental design of any survey. In reality, a survey is simply an experiment whose purpose is to collect and organize information from a small portion of a population in order to estimate or infer certain properties of the population-at-large.

Response rates

At times, readers are admonished to use data with extreme care when the number of respondents is small or when respondent rates of return are too low. For example, DM readers were cautioned when reading the material from the 1988 survey that, "(t)his low response rate (27 percent) should be taken into account when results are reviewed."[9]

The extremes to which respondent rates can sink and still be presented as representative data, probably are best illustrated with the annual reports on the finances of dental practice that are published in DE. The information presented in the monthly issues of this proprietary publication are based upon surveys with a consistent response rate that ranges from a "high" of 2.5 percent to less than 2.0 percent (Table I). Nevertheless, DE continues to publish annual economic data despite a *97.5 percent to 98 plus percent nonresponse rate*. (Note: Because of the extraordinarily high nonresponse rate to the DE series of surveys, data from these reports were not used in the development of the material for this review.) Throughout this same period, nearly a half of the sampled dentists responded to the various ADA Surveys of Dental Practice (Table 1).

Since 1981, however, the American Dental Association no longer reports individual specialty income data in the Survey of Dental Practice. All income information is supplied in the composite "specialist" category. The ADA Bureau of Economic and Behavioral Research reports that despite an over-sampling process of specialists, too few specialists respond to the Survey of Dental Practice to permit the reporting of economic data by individual specialty categories.[24]† In addition, the American Society of Dentistry for Children and the American Academy of Pediatric Dentistry maintain no specific information on the economics of pediatric dental practice.[26,27]

†To a great extent, the difficulties faced in reviewing the economics of pediatric dental practice are similar to those found in the review of any of the dental specialties. As a result, some of the introductory material used in this presentation were reviewed elsewhere by this writer.[25]

Table 1 ☐ Percent response rate to economic studies carried out by the American Dental Association, Dental Economics and Dental Management: 1980–1988.[1,9–23]

Year studied	American Dental Assoc.	Dental Economics	Dental Management
1980	*	< 2.0%	38.6%
1981	54.2%	< 2.0	19.9
1982	*	2.0	39.0
1983	52.0	2.2	31.2
1984	47.5	< 2.5	32.0
1985	50.4	< 2.2	30.0
1986	57.5	< 2.2	34.0
1987	43.1	1.9	27.0
1988			30.3

*No income studies carried out.
Note: American Dental Association and *Dental Management* studies employ a random sample design. Response rates are based on mailings to this sample. *Dental Economics* studies are base upon the return of a questionnaire that is placed in one of its monthly publications which are mailed to between 100,000 and 110,000 dentists.

The 'glitzy' format may cover up an unsound method of determining the economic development of specialty practice.

AVAILABLE DATA

The 1970s

Data from four ADA Surveys of Dental Practice during the 1970s provided some specific economic information on pediatric dental practice. Throughout the period, independent‡ pediatric dental practitioners reported that their mean gross income, mean net income, and median net income generally were less than the reports for "all independent specialists," and greater than the reports by independent general practitioners (Table 2).

The 1980s

The various proprietary publications have become the prime source of economic information for the individual specialties. For many specialists, the "how am I

‡All dentists who own or share in the ownership of a dental practice. This ownership status includes sole proprietorship, partnership and a shareholder in an incorporated practice.[1]

Table 2 ☐ ADA Survey of Dental Practice: Mean gross, mean net and median net incomes of independent pediatric dentists, all independent specialists and independent general practitioners: 1970–1978.[1]

	Mean gross income			Mean net income			Median net income		
Year	Pediatric dentists	All specialists	General pract.	Pediatric dentists	All specialists	General pract.	Pediatric dentists	All specialists	General pract.
1970	$75,152	$ 78,062	$56,550	$39,440	$43,853	$28,776	$36,300	$40,000	$27,000
1974	97,000	97,000	74,000	42,000	45,000	33,000	45,000	40,000	30,000
1977	*	124,320	92,540	*	56,987	40,616	*	53,983	39,000
1978	*	*	*	51,119	67,275	45,742	48,120	60,000	42,000

*Data not reported.

doing glance" at the results of the annual income survey publication in *Dental Management* and *Dental Economics* may be the only opportunity for comparative analysis with other specialists. Unfortunately, the "glitzy" format of these publications may cover up a totally unsound approach to determining the economic developments in specialty practice (especially the DE surveys with a 2.5 percent or less response rate).

Although DM reports a general response rate of approximately a third from its random sample, there is no indication of the responding number of practitioners in each of the specialties. If the ADA, (with an approximate 50 percent response rate to its Surveys of Dental Practice) is reluctant to publish its data on specialists because of an insufficient number of responses to its random sample, one should consider with care the results from the DM surveys. Nevertheless, the DM income surveys (with their "reasonable rate of response") provide the only available indications of developments in the economics of pediatric dental practice.

In addition, in an effort to compare ("verify" would be too strong a word!) DM findings with some other available data on the economics of specialty practice, a review was conducted of the ADA Survey of Dental Practice reports on the mean and median income data for the composite category "all independent specialists." One must recognize, however, the limitations of assuming that the income relationship of the various specialists during the seventies is comparable to that in the 1980s.

Gross receipt income

Between 1982 (the first year for which DM reported income data) and 1988, *pediatric dentist mean gross receipt income* increased by more than 50 percent. In approximately the same period (1981-1987), the ADA reported a 78 or greater percent increase in *"all specialist" gross mean and median income*. In addition, DM pediatric dentist mean gross receipt data were less than ADA gross mean and median data for "all specialists."

During the mid-1980s, DM reported a 26 percent increase for pediatric dentist mean gross receipts; the ADA reported 59 percent increase for "all specialists" (Table 3).

Overall, pediatric dentist gross income remained lower and increased at a slower rate than ADA "all specialist" gross income data.

Table 3 ☐ Pediatric dentists and all independent specialists mean and median gross income: 1981–1988.[1,9,19–23]

	Gross income				
	Pediatric dentists DM		All independent specialists ADA		
Year	Mean	Percent change	Mean	Percent change	Median
1981	*		$172,516		$152,500
1982	$182,856		*		*
1983	191,538		193,214		*
1984	181,428	52.8% (1982–1988)	240,991	78.0% (1981–1987); 85.2% (median, 1981–1987)	220,000
1985	198,024	25.9% (1983–1987)	262,910	58.9% (1983–1987)	250,000
1986	194,912		277,330		248,000
1987	241,187		307,140		282,500
1988	279,333				

*No income studies were carried out or data not reported.

Net income

In addition to the difficulties of comparing reported gross income that arise from differing and at times questionable survey procedures and data presentations, the determination of "actual earnings" is complicated by the system of allowable deductions for tax purposes.

Further problems arise as efforts are made by various reporting groups to reflect more accurately the economics of evolving practice arrangements. For example, since 1984, DM divides its report on mean income into incorporated and nonincorporated practices. At infrequent intervals, the ADA Surveys of Dental Practice and the proprietary publications have presented information in terms of the numbers of operatories; numbers of auxiliaries; and variations in employment, partnerships, and shareholder arrangements. The continuing changes in reporting arrangements make it all but impossible to compare these subgroups between different studies and within the same series of studies over a period of time.

In the mid to late 1980s, DM reported: a third increase in the net income of pediatric dentists in incorporated practices, and some variation and an overall increase of 63 percent in the net income of pediatric dentists in nonincorporated practices. The ADA reported an approximate 20 percent increase in "all specialists" mean and median net incomes.

Throughout the 1980s, ADA "all specialist" mean net income data were between the higher income figures that DM reported for incorporated pediatric dentists and the lower incomes of nonincorporated pediatric dentists (Table 4).

In an effort to determine "real" changes in pediatric dental net income, income data also should be considered in terms of constant dollars (i.e. removing the effects of inflation). Overall, between 1984 and 1988, in terms of noninflated dollars, DM reported lower incomes for nonincorporated than incorporated pediatric dentists and greater increases in the income of nonincorporated than incorporated pediatric dentists (44 percent vs. 18 percent). The ADA reported that be-

Table 4 ☐ Pediatric dentists and all independent specialists mean and median current dollar net income: 1981–1988.[1,9,19-23]

	Pediatric dentists DM				All independent specialists ADA			
	Mean				Mean		Median	
	Incorporated		Nonincorporated					
Year	Percent change	Net income	Net income	Percent change	Percent change	Net income	Net income	Percent change
1981		*				$ 77,459	$ 70,000	
1982		$78,571				*		
1983		87,302				86,420	80,000	
1984		99,615	53,222			94,109	84,112	
1985	34.2%	105,909	65,000	63.7%	20.3%	103,390	91,500	18.9%
1986		130,000	59,166			97,920	91,000	
1987		*				113,460	100,000	
1988		133,749	87,142					

*No income studies were carried out.

Table 5 ☐ Pediatric dentists and all independent specialists mean and median constant dollar net income: 1981–1988.[1,9,19-23,28]

	Current dollar net income							
	Pediatric dentists DM				All independent specialists ADA			
	Mean				Mean		Median	
	Incorporated		Nonincorporated					
Year	Percent change	Net income	Net income	Percent change	Percent change	Net income	Net income	Percent change
1981		*				$28,435	$25,697	
1982		$27,177				*		
1983		29,256			17.2%	28,961	26,809	14.3%
1984		32,020	17,107			30,250	27,036	
1985	17.9%	32,870	20,173	43.9%		32,088	28,398	
1986		39,585	18,016			29,817	27,710	
1987		*				33,331	29,377	
1988		37,782	24,616					

*No income studies were carried out.

tween 1981 and 1987 mean net "real" income of "all specialists" increased at a rate of 17 percent; median net "real" income increased 14 percent (Table 5).

SUMMARY

In the 1970s, ADA pediatric dental income figures were below the average figures for "all specialists." During the 1980s, ADA "all specialists" income figures tended to be between DM incorporated and nonincorporated pediatric dental incomes.

Based upon the erratic year-to-year changes in available income information, one is unable to describe with any degree of certainty, pediatric dental gross and net income levels. One is uncertain which figures, if any, present a reasonable approximation of pediatric dental economics. Many of the difficulties arise because of sampling procedures that varied widely, response rates that were low, presentations of data that were different, and the short period of time for which data were available in any one series. There is just a paucity of reliable and consistent information.

We need to know

Accurate data on the income of dentists in general and specialists in particular are essential for planning purposes; as well as efforts to encourage young men and women to seek entrance to the profession. It seems almost beyond belief that pediatric dentists and other specialists must rely upon a series of proprietary publications for some idea of economic developments. Unfortunately, the continued activity of questionable proprietary surveys results in a jaded population of practitioners that is asked continuously to respond to a host of reports and thus, may seldom respond to economic surveys.

The need is not for new studies, but for continuing improvement and wider dissemination of information of available data (possibly using the *ADA News*), and for improvements in the soundness of the survey procedures of some of the proprietary publications. Questionnaires must be modified and/or shortened to get a better rate of response (e.g. let's get rid of the "nice to know" information and stick to the "*need* to know" data!). And practitioners must be pressured, coerced and cajoled to respond. It's inexcusable for us to have to say that "*we just don't know very much about the income of pediatric dentists!*"

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PEDIATRIC PROCEDURES: DO PARENTS WANT TO WATCH?

An important function of parents is to help their children master stressful situations. During times of stress and pain, young children want to be with their parents, expecting to be protected and, if that is not possible, at least comforted. Separation from their parents at this time exacerbates the stress. Although we did not actually observe children having blood drawn or an intravenous catheter inserted, it is our experience that many children are calmed by the presence of a parent, either by verbal or physical contact, and seem to better tolerate the procedure if the parents are present. In addition to the presence of parents, other factors, including the age and illness of the child, the emotional and psychologic dynamics of the situation, and the particular parents and physicians involved, influence how well children tolerate procedures. Unfortunately, because it is difficult before the procedure to predict which child will be or will not be helped by the presence of a parent, parents, in general, should be encouraged to be present to comfort their child during a procedure.

Many procedures are done in busy emergency departments where the physician does not know the family. Physicians may be more anxious when parents observe and may prefer that they do not watch. It is unclear how detrimental it is for any of the participants if an anxious physician is observed by an anxious parent. In addition, it is unknown whether it is helpful for the child, parent, or physician, if a parent who expresses reluctance to be with his or her child when they undergo procedures is asked to remain.

Bauchner, H. *et al:* Pediatric procedures: do parents want to watch?
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Accuracy of clinical diagnosis for the detection of dentoalveolar anomalies with panoramic radiography as validating criterion

Clinic

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International health organizations recommend that a radiographic examination be ordered after a clinical or histologic examination is made.[1-3] In many community school dental services, however, panoramic radiography is used for routine screening of dental anomalies in young children.

It is noteworthy that little attention has been paid to the balance between economy, discomfort, and risk to the patient (costs) and the clinical significance (benefit) of panoramic radiography as a routine screening procedure. Investigations comparing information obtained from clinical and radiographic examination have shown that the majority of the radiographic findings duplicated findings that were clinically detectable or suspected.[4,5] White and associates estimated that the number of panoramic radiographs taken in a screening procedure could be reduced by more than 70 percent with the risk of missing only 7 percent of findings that would influence the treatment plan.[6] This estimation has been substantiated by other investigators who have shown that findings from panoramic screening of young adults contributed to the proposed treatment plan, based on a clinical examination with selective intraoral radiography in only 2 percent of the patients.[7]

No investigations, however, have examined the ac-

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curacy of clinical examination for the detection of dentoalveolar anomalies, with panoramic screening as reference. It was the aim of the present study, therefore, to evaluate the accuracy of clinical examination for the detection of dentoalveolar anomalies in young children with orthopantomographs as the validating criterion.

METHODS AND MATERIALS

Seven hundred and twenty-one children from thirteen community school dental services were preselected for this investigation. A criterion for inclusion in the study required that a panoramic radiograph taken in a routine procedure as part of an orthodontic screening examination should be available. Thirteen of the children were sick or otherwise missing on the days for the clinical examination, and for fifty of the children a radiograph was not available. The reduced sample included 658 children. Their sex- and age-distributions (mean age: 10 years) are shown in Table 1.

The panoramic examination had taken place routinely in the 3rd or 4th grade. Thus no child was exposed because of the present investigation. The majority (94 percent) of the radiographs were orthopantomographs of reduced size as previously described by Locht.[8]

A clinical examination was performed by the first author, and took place at the same time as the orthodontic examination or at the routine six-monthly general dental examination to keep the disruption to the children and their teachers to a minimum. The examination required approximately two minutes per child and only mouth mirror and illumination were used. At the clinical examination the following factors were assessed:

- ☐ Number, position and size of primary and permanent teeth.
- ☐ Stage of eruption (including infraclusion).
- ☐ Space and occlusion conditions.
- ☐ Mobility of primary teeth.
- ☐ Palpability of upper unerupted permanent canines.
- ☐ Morbidity (swelling, inflammation, retained roots, fractured teeth, etc.)

Dental anomalies and eruption disturbances were defined as previously described.[9-11] During the clinical examination, the investigator decided whether a radiographic examination was needed, based on signs predefined in cooperation with orthodontists (Table 2).

Three to twelve months after the clinical examination, the investigator examined the radiographs to assess most of the factors listed above (first three and last), together with stage of development of unerupted permanent teeth and degree of resorption of primary teeth. For these examinations a standard view box was used. Anomalies and deviations were defined as previously described.[9,10,12,13] Radiographic findings of significance were defined as shown in Table 3. As shown in an earlier study, orthodontists did not consider it important to report all malposed, unerupted teeth; only those in the most severe malpositions (ectopic and transposed teeth, and canines in high labial positions) were defined as significant radiographic findings.[14] Inter- and intra-observer agreements concerning the radiographic readings have been reported elsewhere.[14]

The results of the clinical examination were compared to the radiographic findings, to evaluate accuracy, which was expressed in terms of nosological sensitivity and specificity. The nosological sensitivity was defined as the probability of a child being sus-

Table 1 ☐ Age and sex distribution of the final sample.

Age	Girls	Boys	Total
8–9 years	1	1	2
9–10 years	101	89	190
10–11 years	207	231	438
11–12 years	13	15	28
All ages	322	336	658

Table 2 ☐ Clinical selection criteria for radiographic examination and number of children with findings.

Clinical selection criteria	Number of children
1. Persistence of primary incisors	26
2. Absence of permanent incisors or first molars with no history of extraction or exarticulation	28
3. Infraclusion of primary molars	65
4. Upper incisors in inverted position behind the bite	7
5. Ectopic teeth	2
6. Lack/excess of space	3
7. Swelling, inflammation, atypical tooth forms (fused teeth), enamel hypoplasia, etc.	8
8. Doubt as to whether a tooth is of primary or permanent origin	6
Total	145

Table 3 ☐ Radiographic findings of significance and number of children and teeth with these findings.

Radiographic finding	Number of children (Number of teeth in brackets)
1. Aplasia of permanent teeth	60 (123)
2. Supernumerary teeth/odontogenic tumors	6 (9)
3. Impacted permanent teeth	2 (3)
4. Malformation of crowns of permanent teeth	2 (3)
5. Periapical inflammation in permanent teeth	1 (1)
6. Cysts	13 (13)
7. Ectopic/transposed unerupted permanent teeth	19 (29)
8. Unerupted permanent canines in abnormally high labial positions	53 (95)

pected of anomaly and selected for radiographic examination, when actually exhibiting anomaly ($P(C|D)$).[15] The nosological specificity was defined as the probability of a child not being selected for radiographic examination during clinical examination, when no anomaly existed ($P(\bar{C}|\bar{D})$).[15] For the clinical factors, the predictive value of a positive (diagnostic specificity) ($P(D|C)$) and a negative (diagnostic sensitivity) ($P(\bar{D}|\bar{C})$) test were used.[15] The predictive value of a positive test was defined as the probability of a child exhibiting anomaly when clinically selected for radiographic examination. The predictive value of a negative test was defined as the probability of a child not exhibiting anomaly when clinically not selected for radiographic examination. Data from the study were keyed into a personal computer (Olivetti M240). Statistical analysis was performed with the SPSS-PC system.

More than 80 percent of children not selected for radiographic examination had no significant findings.

RESULTS

In 603 children (92 percent), the interval between the date for radiography and the clinical examination for the present study was less than six months; in thirty children, it was six to eighteen months; and in twenty-five, it was more than eighteen months. At the clinical examination, six children had all their permanent teeth (except the 3rd molars) erupted; twenty-three children had all their permanent teeth, mesial to the second permanent molars, erupted; the rest of the children had mixed dentitions. In total, 123 children had one clinical criterion for a radiographic examination (Table 2); twenty children had two criteria; and two children three criteria. From the radiographic assessments, 143 children produced significant findings (Table 3). The majority (72 percent) of these findings comprises dental aplasia and canines in abnormally high positions.

The consistence between the clinical and radiographic assessments can be seen in Table 4. Of the 143 children with significant radiographic findings, one third were identified by the clinical examination (nosological sensitivity = 0.33 (47/143)). Of the 515 children with absence of significant radiographic findings, 439 were correctly classified by the clinical examination (nosological specificity = 0.85 (439/515). Of the children selected for radiographic examination, approximately a third exhibited significant radiographic findings (predictive value of a positive test = 0.38 (47/123)). Of the children not selected for radiographic examination, more than 80 percent had no significant findings (predictive value of a negative test = 0.82 (439/535)).

The sensitivity and specificity for radiographic examination in predicting aplasia were 0.55 (33/60) and 0.87 (523/598), respectively. Of the 108 children selected for radiographic examination in predicting aplasia, thirty-three actually showed aplasia, giving a predictive value for the positive test = 0.31 (33/108). The predictive value for the negative test was 0.95 (523/

Table 4 □ Overall consistency between clinical and radiographic assessments.†

Clinical assessment	Significant radiographic findings		
	Present	Absent	Total
Selected for radiographic examination	47	76	123
Not selected for radiographic examination	96	439	535
Total	143	515	658

†Sensitivity = 0.33, specificity = 0.85, predictive value of a positive test = 0.38, predictive value of a negative test = 0.82.

Table 5 □ Distribution of children selected for radiographic examination on prediction of aplasia of permanent teeth.†

Clinical assessment	Radiographic assessment		
	Aplasia	No aplasia	Total
Selected for radiologic examination*	33	75	108
Not selected for radiologic examination	27	523	550
Total	60	598	658

*Selected on basis of nos. 1, 2, 3, 8 in Table 2.
†Sensitivity = 0.55, specificity = 0.87, predictive value of a positive test = 0.31, predictive value of a negative test = 0.95.

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Table 6 ☐ Distribution of children selected for radiographic examination on prediction of aplasia of permanent incisors.†

Clinical examination	Radiographic examination		
	Aplasia of perm. inc.	No aplasia of perm. inc.	Total
Selected for radiographic examination*	23	23	46
Not selected for radiographic examination.	0	612	612
Total	23	635	658

*Selected on basis of nos. 1, 2 and 8 in Table 2.
†Sensitivity = 1.00, specificity = 0.96, predictive value of a positive test = 0.50, predictive value of a negative test = 1.00.

Table 7 ☐ Distribution of children selected for radiographic examination on basis of infraclusion of primary molar(s).†

Clinical examination	Radiographic examination		
	Aplasia of premolar	No aplasia of premolar	Total
Selected for radiographic examination*	8	57	65
Not selected for radiographic examination	29	564	593
Total	37	621	658

*Selected on basis of no. 3 in Table 2.
†Sensitivity = 0.22, specificity = 0.91, predictive value of a positive test = 0.12, predictive value of a negative test = 0.95.

550) (Table 5). Twenty-three children had aplastic permanent incisors (Table 6) by the radiographic examination. All these children were selected for radiographic examinations, based on observations made in the clinical examinations. Forty-six children were selected on prediction of aplastic permanent incisors (sensitivity = 1.00 (23/23) and predictive value of a positive test = 0.50 (23/46)). The majority, 635 children, showed no aplasia of the permanent incisors and 612 of these were correctly classified by the clinical examination (specificity = 0.96 (612/635) and predictive value of a negative test = 1.00 (612/612)) (Table 6).

During the clinical examination, sixty-five children were selected for radiographic examination on prediction of aplastic premolars (Table 7). Of these, eight actually showed aplasia (predictive value of a positive test = 0.12 (8/65). Totally, thirty-seven children showed aplasia by the radiographic examination (sensitivity = 0.22 (8/37) and specificity = 0.91 (564/621)). The predictive value of the negative test was 0.95 (564/593).

Even though only ectopic and transposed unerupted teeth and canines in abnormally high labial positions were defined as significant radiographic findings, all malposed teeth were recorded. In total, 383 children exhibited 799 malposed teeth. Two hundred and fifty-four children showed malposed, unerupted permanent teeth, and 193 exhibited malposed erupted permanent teeth.

Six children had nine supernumerary teeth. None of these was selected by the clinical examination on suspicion of supernumerary teeth. Three were selected, however, for radiographic examination on prediction of another finding. Of the thirteen children exhibiting cysts by the radiographic examination, only one was selected for radiographic examination on prediction of a cyst. Two were selected for radiographic examination on another basis, and ten were not detected by the clinical examination.

DISCUSSION

Panoramic screening of young children has been recommended by several authors for the identification of dental anomalies and few have questioned the expedience of the screening procedure, even though a comparison with clinical examinations has not been evaluated adequately.[4,7,16-19] To assess the value of a diagnostic test, a number of factors must be taken into account:

- ☐ The reliability of the test results in terms of precision (inter- and intraobserver variations).
- ☐ The reliability of the test results in terms of accuracy (validity).
- ☐ The consequences for the patient of establishing or excluding the diagnosis.
- ☐ Discomfort and risk to the patient.
- ☐ Economic costs.

An earlier investigation evaluated reliability in terms of precision (first factor named above) of observations in the panoramic radiographs.[14] Because no investigations, to date, have evaluated the clinical examination for accuracy in detecting dental anomalies in children, with panoramic radiography as a reference, this was the aim of the present study.

The observation of the congenital absence of permanent teeth is a radiographic finding of major significance in planning orthodontic treatment for children.[14] The present results showed that 55 percent of congenitally missing teeth could be detected clinically. Of the children not selected for radiographic examination on prediction of aplasia, only 5 percent actually showed aplasia of one or more permanent teeth. The clinical examination proved to be very effective (sensitivity of 1.00) for the identification of children with congenitally missing incisors. This might have been predicted, because the majority of the children in the age-groups under study should have these teeth.[9,20] The clinical method, however, proved not to be effective for the identification of children with premolars missing (sensitivity = 0.22), because these teeth are not expected to erupt until ten to twelve years of age.[9,20] The congenital absence of premolars was predicted, because of the infraclusion of the predecessors. Other authors found no direct connection between infraclusion of primary molars and aplasia of the permanent successors.[21,22] The present predictive value of the positive test indicated that in only 12 percent of the children with primary molars in infraclusion were the premolars missing. It must be concluded, therefore, that infraclusion is not an effective criterion for identifying children with congenitally missing premolars.

In the present investigation, 254 children had malposed, unerupted teeth. It is difficult to speculate how many of these might be of orthodontic significance. Hintze *et al* showed that orthodontists did not agree (among three orthodontists only total agreement in 4 percent of cases) on the assessment of tooth aberrations and deviations.[14] Neal and Bowden examined 982 radiographs of nine- to ten-year-old children for dental anomalies and found that in 127 radiographs malposed teeth were diagnosable.[16] They postulated that these were of significance, but did not distinguish between erupted, unerupted, and impacted teeth. It may be claimed that for assessment of malposed, erupted teeth, radiographs are actually not necessary. Neither is it necessary to screen children, when all permanent teeth are erupted. In the present study, six children in this category were found. This indicated that the selection of children for panoramic radiography had not been effective. In the study by Neal and Bowden more than a quarter of the radiographs showed findings considered as significant for orthodontic diagnosis and treatment planning.[16] On this basis they concluded that all the panoramic films examined were of value in assessing the developing occlusion. They did not say how many of the children exhibiting significant radiographic findings might have been selected by a clinical examination.

In conclusion, the results from the present study revealed that 515 (78 percent) of the children studied were exposed to x-ray radiation without benefit. Looking at perhaps the most significant finding for orthodontic diagnostics, aplasia of permanent teeth, 523 children had been exposed unnecessarily to identify the 9 percent of the sample with aplasia. What implications this has as regards discomfort, risk to the children, and economic costs, will be discussed in a future report.

Twenty-seven children with aplasia of permanent teeth would not have been identified without the radiographic examination in the present age-categories. Whether this will have consequences for treatment planning and possible orthodontic treatment, is yet to be assessed. Usually, orthodontic treatment is begun in conjunction with the eruption of the premolars; one can expect that the absence of permanent teeth in these children would be suspected clinically before or at the time for beginning orthodontic treatment. This problem will be looked into in a future study.

The authors wish to thank the staff of the school dental services involved, for their contribution to the accomplishment of this project.

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Eruption cysts: a retrograde study

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The *eruption cyst* is a specific type of cyst reportedly associated with erupting primary or permanent teeth. It is classified as a form of dentigerous cyst, but recognized as a separate clinical entity.[1] There are several proposed etiologies explaining the development of this cyst:

- ☐ It could derive from one of the clusters of epithelial cells that are remnants of the dental lamina or the epithelia coils.
- ☐ It could arise from the enamel organ, after the occlusal enamel has been formed.
- ☐ It may have originated as a primordial cyst.
- ☐ It may result from epithelial rests of Malassez, present in the periodontal ligament of the overlying tooth, when it occurs over a permanent tooth.[2]

When the fluid in the cyst is mixed with blood, the cyst is referred to as an eruption hematoma.[3]

There are few references in the dental literature reporting large series of eruption cysts. This may be attributed to several factors:

- ☐ General acceptance of this lesion when it occurs with erupting teeth.
- ☐ Confusion among some clinicians in distinguishing or classifying it separately from a dentigerous cyst.

Several authors specifically referred to it as a benign cystic lesion, and recorded it as a separate clinical entity from the follicular or dentigerous cyst.[2-7]

The purpose of this retrograde study was to determine the frequency of occurrence of these lesions and to document the sites, age, sex, and race of affected individuals.

MATERIALS AND METHODS

All cases accessioned as eruption cysts from January 1972 to January 1988 were retrieved from the files of the Oral Pathology Laboratory, Temple University, and reviewed. The clinical data, such as patient age, sex, race, site of lesion, symptomatology and clinical appearance, were recorded. All slides were reviewed histologically.

Percentage comparisons of the number of cases included were done between different ethnic-, sex-, and age-groups. Comparisons were also made on the locations of the lesions, whether mandibular or maxillary, unilateral or bilateral, and on the symptomatologies.†

RESULTS

- ☐ The data were derived from fifty-four cases. The subjects ranged in age from a month to twelve years, as shown in Table 1. The greater percentage was in the two-to-five-year age-group. Forty-two cases (77.8 percent) were diagnosed between the ages of six and eleven years. Six cases (11.1

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†Symptomatology = pain and/or inflammation.

Occurrence of an eruption cyst may be related to stimulation of overlying tissues.

percent) were found in the age-period of one month to five years; and six cases (11.1 percent) were found in the twelve-year age-group.

☐ The male sex was the most predominate group in the sex distribution of the cases shown in Table 2. Thirty-five of the fifty-four subjects (64.8 percent) analyzed were male.

Table 1 ☐ Distribution of eruption cysts in the study population (54 cases), according to patient age.

Age (years)	0–1	2–3	4–5	6–7	8–9	10–11	12
Number of cases	5	0	1	12	15	15	6
Percentage of cases	9.2	0	1.9	22.2	27.8	27.8	11.1

Table 2 ☐ Distribution of eruption cysts in the study population (54 cases), according to sex.

	Male	Female
Number of cases	35	19
Percentage of cases	64.8	35.2

Table 3 ☐ Distribution of eruption cysts in the study population (54 cases), according to race.

	Caucasian	Black
Number of cases	41	11
Percentage of cases	76	20.3

Table 4 ☐ Distribution of cases (54) according to symptomatology.

	Symptomatic*	Asymptomatic
Number of cases	16	38
Percentage of cases	29.6	70.3

*Pain and/or inflammation.

☐ Forty-one subjects were Caucasian (76 percent), and eleven (20.3 percent) were black, while two subjects were listed as other, as presented in Table 3.

☐ The clinical histories submitted by the practitioners were checked for symptomatology; sixteen cases (29.6 percent) were asymptomatic (Table 4).

☐ The distribution of the locations of the fifty-four lesions is presented in Figure 1. Thirty-three of the fifty-four cysts (61 percent) were located in the maxilla; twentyone (38.8 percent) were located in the mandible. The total number of cysts per quadrant is illustrated in Figure 1 by encirclement; the number per arch is illustrated by square. Twenty-four cysts (44.4 percent) occurred

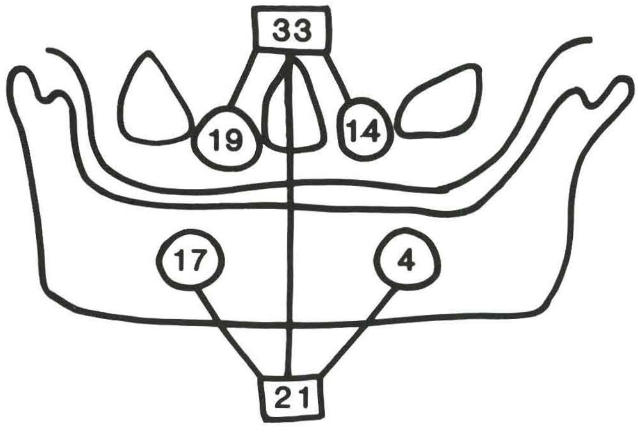

Figure 1. Overall locations of the eruption-cysts.

Figure 2. Intraoral appearance of intact eruption-cyst in mandibular arch of four-month-old infant. Notice raised translucent mass on alveolar ridge (arrow). (Photograph courtesy of Dr. Theodore Croll)

in the incisal areas of the maxilla and mandible; seventeen cysts (31.4 percent) occurred in the molar areas; and the remaining eleven cysts (20.5 percent) occurred in the canine-premolar areas.

☐ In most cases, the clinical appearance was recorded as a raised or bluish mass on the alveolar ridge. The size of the cyst was variable and depended on whether it was associated with an unerupted primary or permanent tooth. Peters and Schock are the only authors to record the size of an eruption cyst.[9] They noted they were generally about 0.6 cm in diameter. Photographs of some lesions were submitted as well as radiographs (Figures 2 and 3). Slides were randomly selected to make microphotographs of good histological cross sections of some cases (Figures 4,5,6). Excisional biopsies were performed on all patients in the study. All sectional slides were reviewed microscopically for confirmations of the cysts and variances from the norm. Microscopic examination of the slides revealed a wide histological range; all showed to some degree a fibrous connective tissue wall and a thin lining of nonkeratonized squamous cell epithelium.

Figure 3. Radiograph showing the eruption-cyst as a radiolucency below the crown of the unerupted lateral incisor and above the resorbed roots of the primary lateral and canine teeth. (Courtesy of Dr. Arthur S. Miller)

DISCUSSION

The majority of cysts were reported to be on the right side of the oral cavity, and distributed between the maxillary and mandibular arches. Since the greater portion of the general population is right-handed and masticates on the right side of the mouth, this finding gives support to the idea that the more frequent stimulus of these tissues may encourage the formation of a cyst.

Our data show more eruption cysts in Caucasians than in blacks. The incidence of eruption cysts according to sex revealed more frequent occurrence in males than females, in a ratio of 2 to 1. The greater prevalence of the cysts occurred in the maxillary arch. Both of these findings are in direct contrast to the data presented by Clarke in 1962 and Seward in 1973.[7,8] The study by Seward is not statistically significant enough to establish a precedence of accuracy over the present study.

According to the reports by practitioners, 29.6 percent of the patients demonstrated some type of symptom. These symptoms were not specifically identified. Pain has been illicited upon palpation, when the eruption cyst becomes secondarily infected, usually due to trauma.

In this study, eruption cysts appear to be more prev-

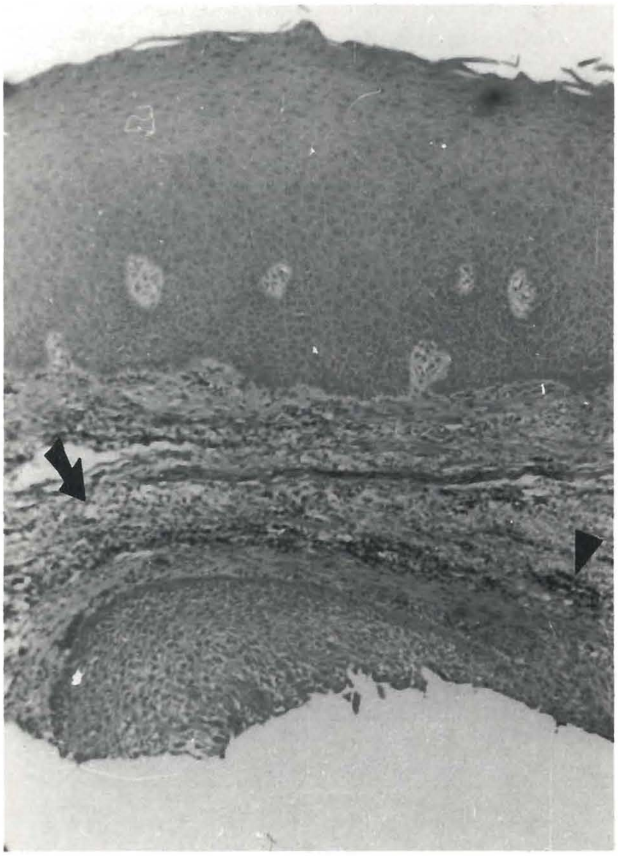

Figure 4. Eruption-cyst wall lined by keratinized stratified squamous epithelium. connective tissue below the surface epithelium includes mucosa-containing cells (arrow) and infiltrated inflammatory-cell aggregates (arrowhead) (H&E, 16X).

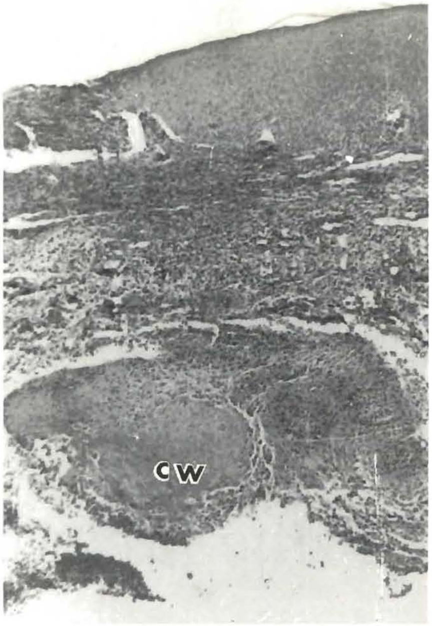

Figure 5. Section of eruption-cyst wall (CW) surrounding connective tissue contains round cell infiltrate. At top of photomicrograph is keratinized oral mucosa (H&E, 16X).

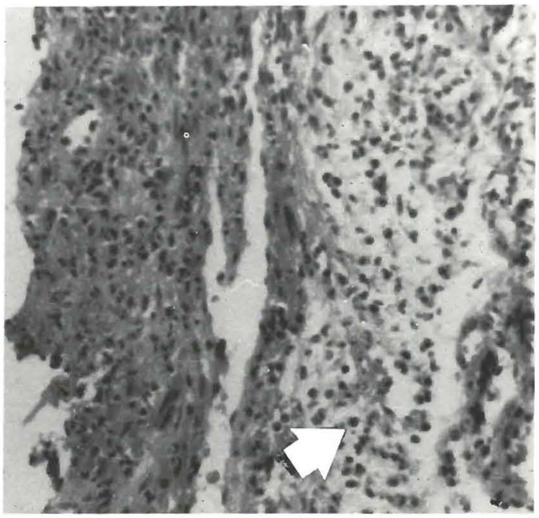

Figure 6. Connective tissue from area adjacent to epithelial cyst lining infiltrated by inflammatory cells. Clear cells are present at arrow in lower third of photomicrograph (H&E, 40X).

alent in the six-to-eleven-year age-group. Early in this age-group, patients are experiencing the eruption of the first permanent molars and in the latter part, eruption of the second permanent molars. Treatment of a cyst is not performed immediately in newborn infants. After several months, it is common for these teeth to erupt fully,[9,10] In older children, the cyst has been punctured or marsupialized allowing eruption of the formed crown of the tooth. More commonly the removal of the tissue overlying the crown of the tooth has been performed, facilitating eruption of the tooth. The pathological reports on excised tissues, in this current study, showed thin linings of nonkeratonized squamous cell epithelium and some degree of a fibrous connective tissue, in most cases. They do not appear to have a racial or sexual predilection, since this study is in direct contrast to previous studies. These cysts appear more frequently in the area of the oral cavity receiving the most frequently repeated stimulus.

When these lesions are radiographed, a common finding is a crescent-shaped, radiolucent area above the crown of the tooth.

CONCLUSIONS

- ☐ Eruption cysts appear to be more prevalent in the maxillary arch.
- ☐ They appear to be more prevalent in the Caucasian race than any other ethnic group.
- ☐ There appears to be a narrow age-range of subjects having eruption cysts; ages six to twelve have the greatest percentage.
- ☐ The histological characteristics appear to be consistent in all eruption cysts.
- ☐ The symptomatology of the eruption cysts is related to secondary factors, such as trauma.

SUMMARY

A retrograde study was done using laboratory data. Most eruption cysts occurred in the maxilla. The findings in this study were in direct contrast to those of previously published studies.

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I am grateful to Drs. Arthur S. Miller and Robert Carrell for their help and guidance in the preparation of this study. To Dr. Michael Kahn for his microphotography, Susan Howell for preparation of the illustrations and photographs, and Norma Evans for secretarial assistance.

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Premature eruption of the premolars

Jeffrey H. Camm, DMD
John L. Schuler, DDS

Exfoliation of the primary teeth and eruption of the permanent teeth is a normal and predictable physiologic process. Norms that correspond to the child's age and development have been determined by many investigators. There are, however, a variety of factors that may hasten, retard, or otherwise affect the normal developmental process. Specifically, early extraction or exfoliation of abscessed primary teeth may produce a marked influence on eruption of the permanent teeth. This paper will present a variety of cases in which very early loss of abscessed primary molars caused early eruption of the permanent successors. The clinical significance of this phenomenon will be discussed.

LITERATURE

There are many factors, not fully understood, that are responsible for the eruption of teeth. These include elongation of the root, growth and pull of the periodontal membrane, forces exerted by vascular tissue around and beneath the bone, resorption of the alveolar crest, or a combination of factors.[1-3] What is known more definitively is the sequence of eruption and the approximate age at which it occurs. For example, over 90 percent of the time the maxillary and mandibular first premolars erupt before their respective second premolars.[4] The age-range for the eruption of premolars is usually ten to twelve years.[1,15]

There is a variety of factors that may influence the normal sequence and timing of eruption of the permanent dentition. Primary teeth that have undergone pulp therapy may cause delayed eruption of their respective permanent successors by delayed exfoliation.[1] In some patients, these same primary teeth may exfoliate prematurely for no apparent reason.[1] Eruption of the premolars generally will be delayed in children who lose their primary molars eighteen to thirty-six months or more before their normal exfoliation time.[1,2] On the other hand, extraction of primary teeth within eighteen to thirty-six months of their normal exfoliation time will hasten the eruption of their permanent successors.[1,2] If a primary tooth is extracted before half of the root of its permanent successor is formed, emergence of the successor will be delayed.[3] An abscess of a primary tooth may resorb the bone overlying the permanent tooth, however, and regardless of its stage of development, the permanent tooth may erupt.[6]

When primary molars are exfoliated or extracted early, and the permanent teeth erupt prematurely, numerous clinically significant events may occur. If the path of least resistance is followed through a previously abscessed bony area, ectopic eruption in the form of deflections and rotations can occur.[6]

Also significant is alteration of the eruption sequence.[7] For example, in the mandibular arch, the ideal eruption sequence for proper occlusion is canine, first premolar, second premolar.[1,4] Eruption of the

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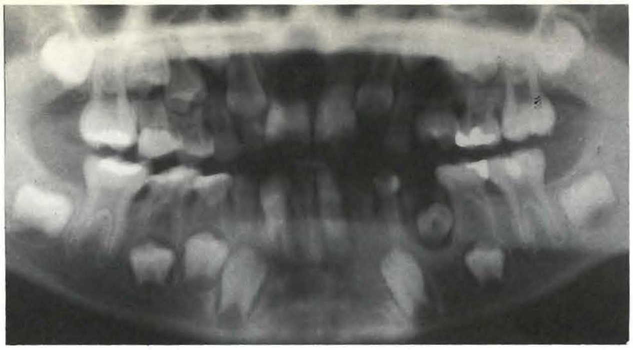

Figure 1. Panoramic radiograph of Case 1, showing both temporary and permanent restorations for caries control of extensively decayed dentition. Note premature eruption of the maxillary and mandibular left first premolars.

mandibular premolars before the eruption of the mandibular canines may contribute to delayed canine eruption and lingual tipping of the mandibular incisors.[1] The result is arch-length inadequacy.

Arch-length inadequacy in either arch may lead to lingual or labial eruption of the permanent canines. In severe cases of arch-length inadequacy, the canines may in fact be impacted.[1] Frequently the only treatment under these circumstances is serial extraction and orthodontic care.[2] Changing the sequence of eruption may compromise serial extraction, because ideally the first premolar should erupt and be extracted before the eruption of the second premolar.[2,4]

An increased rate of impaction of the premolars is also seen with alteration of the timing of emergence.[8] When a tooth has erupted farther than it's neighbor, it's crown can pass occlusally beyond the other, and the two occupy the same sagittal space.[8] While many of these impactions are transient and correct themselves, those that do erupt are often ectopic.[8,9]

The altered sequence of eruption may also contribute to a midline discrepancy. The mesiodistal width of a premolar is less than that of its primary predecessor.[2] A unilateral posterior change can cause an arch-asymmetry and resultant midline shift.

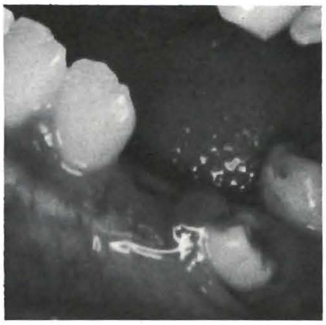

Figure 2. Labial ectopic eruption of mandibular left first premolar.

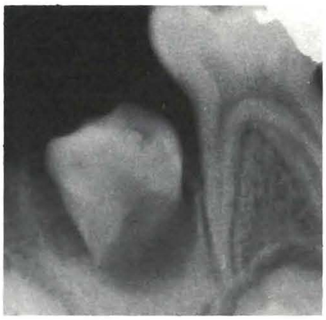

Figure 3. Erupting mandibular left first premolar with no root development.

CASE REPORTS

Case 1

JB, an 8-year, 0-month male presented for routine dental treatment with extensive decay and no oral hygiene. Layers of plaque were 3-4 mm thick and it was impossible to discern where one tooth ended and another began. The immediate treatment of choice was a combination of permanent restorations and temporary, caries-control restorations (Figure 1). Three weeks following the extraction of the root tips of the abscessed lower left primary molar, the first premolar had erupted ectopically through the alveolar mucosa (Figure 2). The buccal path of eruption was caused by the absence of buccal bone, secondary to the abscessed primary tooth. The tooth had a mobility of 1 mm, due to the absence of root development (Figure 3). A diagnosis of premature eruption of the mandibular left first premolar is confirmed by comparison with the contralateral side (Figure 1). It has a more normal development pattern. The opposing arch also shows evidence of premature eruption of the first premolar.

Figure 4. Extensive decay and poor oral hygiene of Case 2.

Case 2

RF was a five-year, five-month male, who presented for routine dental treatment with extensive decay and minimal oral hygiene (Figure 4). Due to the extent of treatment required and the patient's tentative behavior, complete dental rehabilitation was accomplished under general anesthesia. All primary molars were nonrestorable and were extracted (Figure 5). Since no permanent molars had erupted, space maintenance could not be attempted.

The patient was seen on recall at age six years, six months. The maxillary left first premolar was erupting prematurely and ectopically, through the alveolar mucosa (Figure 6). Clinical observation revealed enamel decalcification and mobility of 1-2 mm.

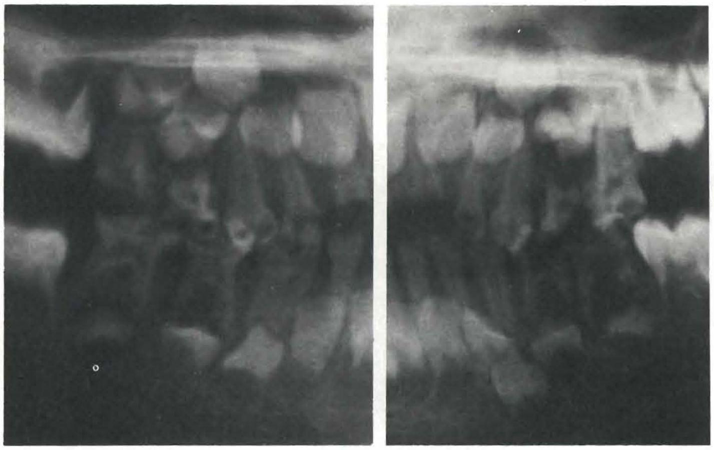

Figure 5. Panoramic radiograph showing nonrestorable primary molars.

Figure 6. Ectopic eruption of maxillary left first premolar in a buccal direction.

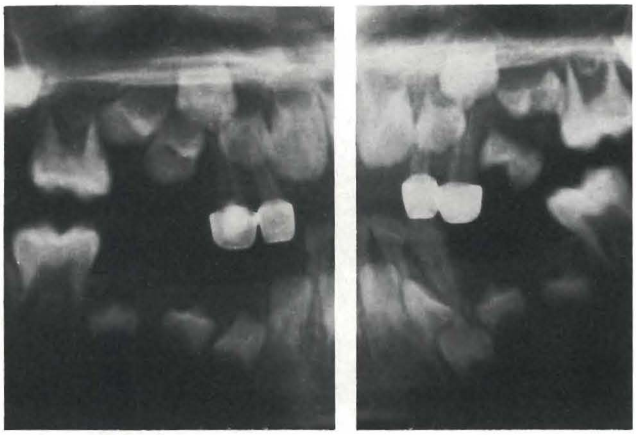

Figure 7. Panoramic radiograph of maxillary left first premolar with no root development, in a stage of premature eruption.

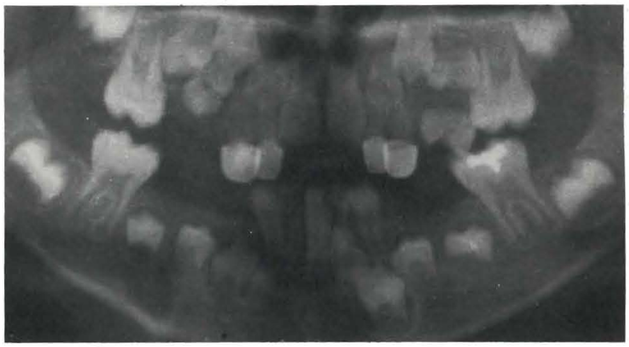

Figure 8. Panoramic radiograph showing continued premature and ectopic eruption of maxillary left first premolar with no further root development. Note impacted maxillary left second premolar.

The cause of mobility was evident radiographically, because no root formation had occurred (Figure 7). The tooth was symptomatic on percussion and had a questionable prognosis.

Follow-up examination at seven years, six months shows little further tooth development and continued ectopic eruption (Figure 8). Impaction of the second premolar is predicted because of the ectopic eruption in conjunction with loss of space caused by mesial eruption of the first molar.

Case 3

VK was a 5-year, 0-month female who presented for routine treatment with extensive decay and poor oral hygiene. Radiographs revealed bone loss in the primary first molar furcations because of abscesses (Figure 9). Pulpotomies were performed and stainless steel crowns placed on all primary second molars. All primary first molars were extracted and within six weeks, the maxillary right and left first premolars began to erupt (Figure 10). Although the mandibular first premolars have yet to erupt, and despite having less root development than the mandibular canines (Figure 10), they appear radiographically to be moving to a position superior to them. Further evaluation and space analysis is being conducted to insure that the mandibular canines do not become impacted.

Case 4

JC was a six-year, three-month male who presented to our dental clinic with his parent's chief complaint of "bad teeth", specifically pain in the mandibular left quadrant. Examination of the symptomatic area revealed edematous tissue and carious and abscessed root tips of the mandibular left second primary molar (Figure 11). Symptomatic treatment was rendered and the patient was referred to the department of pediatric dentistry for total care. Three months elapsed before

Figure 9. Bitewing radiographs of Case 3 showing bone loss in furcation of severely abscessed primary first molars.

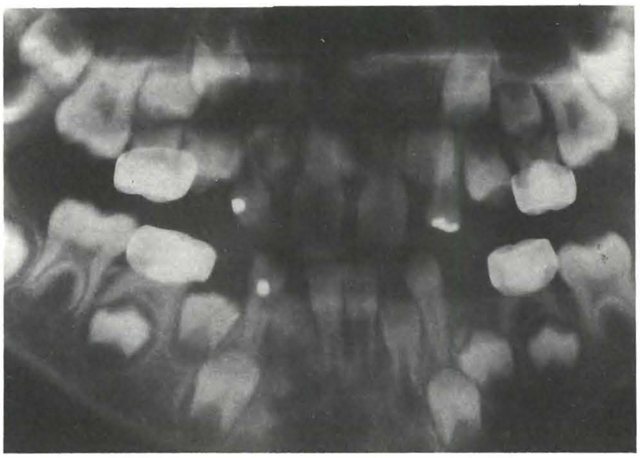

Figure 10. Panoramic radiograph showing premature eruption of maxillary first premolars. Note mandibular first premolars in a position superior to mandibular canines.

Figure 11. Abscessed root tips of mandibular left second primary molar in Case 4.

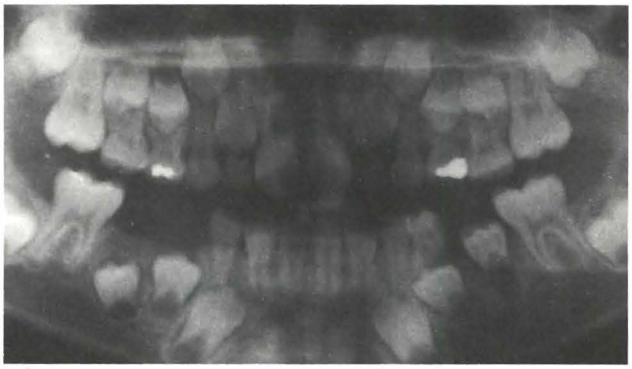

Figure 13. Panoramic radiograph of mandibular left second premolar with minimal root development in a stage of premature eruption. Note alteration of eruption sequence compared to contralateral arch.

Figure 12. Clinical view of mandibular left second premolar, in stage of premature eruption.

the patient returned to the Pediatric Dentistry Department. The mandibular left second premolar was already clinically visible (Figure 12). Radiographic examination revealed a tooth erupting well in advance of its' contralateral counterpart, and a tooth with very little root structure (Figure 13). Not only is this tooth erupting prematurely, it is erupting out of sequence. The panorex clearly shows the contralateral first premolar erupting before the second premolar.

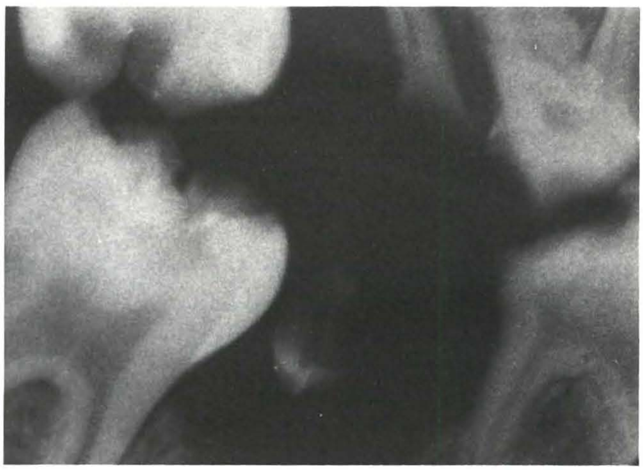

Figure 14. Right bitewing radiograph of numerous root tips and extensive decay of Case 5.

Case 5

MR was a five-year, seven-month female who presented for routine dental treatment. Extensive decay was present, including numerous root tips and edematous tissue from poor oral hygiene and abscessed teeth (Figure 14). Because of the patient's inability to cooperate in the dental chair, treatment was accomplished two months later under general anesthesia. At the time of treatment, the mandibular left primary second molar had already exfoliated, presumably due to decay, abscess, and bone resorption. The second premolar had erupted prematurely and out of sequence. Clinically it displayed occlusal decalcification (Figure 15). In an effort to maintain every tooth possible for function, this tooth was not extracted. Restoration was not attempted since caries was not present, and the clinical crown was all that existed of the tooth: very little root formation had occurred. At postoperative evaluation, the patient complained of occasional pain, probably due to the increased function required of it. Radiographic evaluation reveals a tooth with little root structure and very little bony support (Figure 16). Long-term prognosis is poor.

Altering the normal sequence of eruption can cause serious malocclusion.

Figure 15. Clinical appearance of prematurely erupted mandibular left second premolar. Note occlusal decalcification.

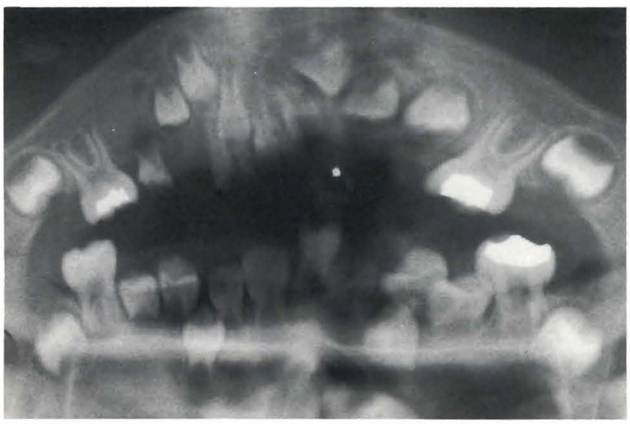

Figure 16. Postoperative panoramic radiograph showing prematurely erupted mandibular left second premolar with minimal root development and bone support.

DISCUSSION

The cases presented in this paper demonstrate the clinical significance of premature eruption of premolars. An abscess of a primary molar, followed by bone resorption and early extraction or exfoliation may lead to a variety of clinical sequelae: ectopic eruption, impaction of a canine or premolar, inadequate arch-length, and improper sequence of eruption. Often, more than one of these sequelae may occur.

The premolar may erupt prematurely into an area of bone resorption caused by an abscess of the primary tooth. This occurs despite a lack of root formation (Cases 1-5). If the buccal plate has resorbed, the subsequent eruption may be ectopic (Cases 1,2). Ectopic eruption through alveolar mucosa compromises the periodontal health of the erupting tooth. Inadequately attached gingiva is a serious complication. Perhaps more important in the buccal eruption of a tooth is the reduction in arch-length. The full mesiodistal dimension of the tooth is not present within the arch. Mesial migration of the distal tooth may occur.

The ectopic eruption may also take place in a mesiodistal direction. This can be a contributing factor to impaction of the premolar (Case 2). Rotation and mi-

The authors with to express sincere thanks to SSgt McArthur Allen of the 13th Air Force Medical Center Visual Information Services for his assistance in the preparation of this manuscript.

gration of the first premolar can compromise the room needed for the second premolar and thus interfere with its normal path of eruption.

Premature eruption of the first premolar can also alter the ideal sequence of eruption (Case 3). In the mandible, if the premolar erupts before the canine, impaction of the latter may occur, causing lingual tipping of the incisors and loss in arch-length in the anterior region. Inadequacy of length in both the anterior and posterior regions is often treated by serial extraction. By altering the sequence of eruption, this treatment modality may be affected.

Ideally, in serial extraction the first premolar is extracted when it erupts before the second premolar. Premature eruption of the second premolar (Cases 4,5) may force a compromise in this type of treatment. Extraction of the second premolar may have to be considered, to treat an inadequacy of arch-length.

The opinions expressed in this article, unless otherwise specifically indicated, are those of the authors. They do not purport to express views of the Department of the Air Force or any other Department or Agency of the United States Government.

As noted, a variety of sequelae may occur with premature eruption of the premolars. Care should be taken to recognize and minimize the developmental, periodontal, and orthodontic effects of premature eruption. Parents and patients must be advised that although the abscessed tooth may be gone, dental care and planning must continue, to assure a healthy dentition.

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ATHLETICS FOR PREADOLESCENT CHILDREN

The important objective for parents, coaches, and officials should be to enhance the child's self-image. Mastery of the sport (the athlete's performance within the activity) should be emphasized, instead of winning or pleasing others. Coaches and parents should assist children in setting realistic goals. Good effort should be praised, and mistakes should be met with encouragement and corrective instruction. Adults must clearly show that the child's worth is unrelated to the outcome of the game. Unconditional approval should be given for participating and having fun. Athletic programs should deemphasize playoffs and avoid all-star contests, excessive publicity, and elaborate recognition ceremonies that single out individuals. Ceremonies should recognize all participants.

Committee on sports medicine (Am Acad Pediatr):
Organized athletics for preadolescent children.
Pediatrics, 84:583–584, 3 September 1989.

Utah dentists sealant usage survey

Peggy A. Bowman, RDH
C. Michael Fitzgerald, DDS, MPH

Children's caries-rate is decreasing; the occlusal surface decay rate, however, is not experiencing the same significant reduction.[1] Sealants, which are used to protect these vulnerable surfaces, are effective in preventing decay as long as they are intact. A seven-year study in Augusta, Georgia showed Delton to have a 66 percent retention rate, and Nuva-Seal to have a 31 percent retention rate.[2] Simonsen found total retention in 56.7 percent of the teeth, ten years after placement of the sealant.[3]

In spite of proven sealant effectiveness, many dentists are reluctant to place them. Some of this reluctance is based on concerns such as: lack of data regarding retention and efficacy; possibility of sealing in decay; lack of patient awareness of the need for sealants; lack of third-party payment; belief that amalgam is better; insufficient instruction in a technique, considered difficult by some; and restrictive state dental practice acts. These concerns have all been answered in the literature.[4]

According to a national survey by the American Dental Association Health Foundation, 38 percent of the dentists in 1974 and 58 percent of the dentists in 1982 used sealants.[5] A 1985 national survey by Cohen *et al* found that nearly a third of U.S. dentists said that none of their patients received sealants, concluding that there was a need for increased promotion of sealants to dentists as well as to patients.[6]

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Several states have surveyed dentists to determine their use of sealants. The Minnesota pediatric dentists were surveyed in May 1987. They all reported using sealants and 46 percent applied sealants more frequently than ten times a week.[7] In January 1985, 72.5 percent of the general dentists, 97.1 percent of the pediatric dentists, and 55.3 percent of the hygienists in Virginia reported using sealants.[8] According to a Washington state survey, in April 1985, 80.7 percent of the dentists were using sealants.[9] In 1983, 54 percent of the dental hygienists in Minnesota and Wisconsin placed sealants; more than two thirds did so three or fewer times per week.[10]

In 1982 the Dental Health Bureau, Utah Department of Health, surveyed dentists to determine how many were using sealants.

Because of the low percentage of usage in Utah, the Dental Health Bureau developed and began implementing the *Utah Sealant Education Program* in 1982. This program continued throughout the state through 1987, consisting of a focused educational effort aimed at three target populations: dental professionals, public health professionals, and the public. Follow-up postcard surveys were mailed to dentists in 1983, 1985, 1987.

METHODS

A survey of dentists was conducted in 1982 to obtain baseline data and again in 1983, 1985, and 1987 to determine the extent of change in usage of sealants.

The questions on the survey were in identical format for the four mailings. The postcard survey was sent to all Utah licensed dentists having a Utah address. The mailing list of these dentists was obtained from the Department of Business Regulations, Utah's dental licensing board.

The postcard, with return postage paid, asked whether any of their patients had received sealants in the past thirty days, with a yes and no box to check; which teeth are normally considered for sealants, with a box to check for permanent molars, bicuspids, primary molars, and other; approximately how many patients receive sealants each month, with a box to check for none, 1-5, 6-10, and more than 10; and who applies the sealant, with a dentist, hygienist, and assistant box to check. The survey also asked in which county the dentist practices and for any comments (Figure 1).

In May 1982, 895 surveys were mailed; in May 1983, 1100 surveys were mailed; in April 1985, 1122 surveys were mailed; and in September 1987, 1090 surveys were mailed. As this was an anonymous survey, there were no follow-up mailings.

RESULTS

On the postcard survey, the rate of usable returns, which excludes returns that indicated a type of practice inappropriate for sealant use, increased from 33 percent in 1983 to 44 percent in 1987 (Table 1).

Table 1 □ Dentists who returned the survey and provided usable data.

	1982 (N = 895) No.	%	1983 (N = 1100) No.	%	1985 (N = 1122) No.	%	1987 (N = 1090) No.	%
Returned the survey	340	38%	412	37%	461	41%	501	46%
Provided usable data*	315	35%	366	33%	425	38%	482	44%

* Excludes dentists who indicated a practice such as oral surgery, retired, etc., where sealants would not be placed.

Table 2 □ Dentists reporting sealant usage.

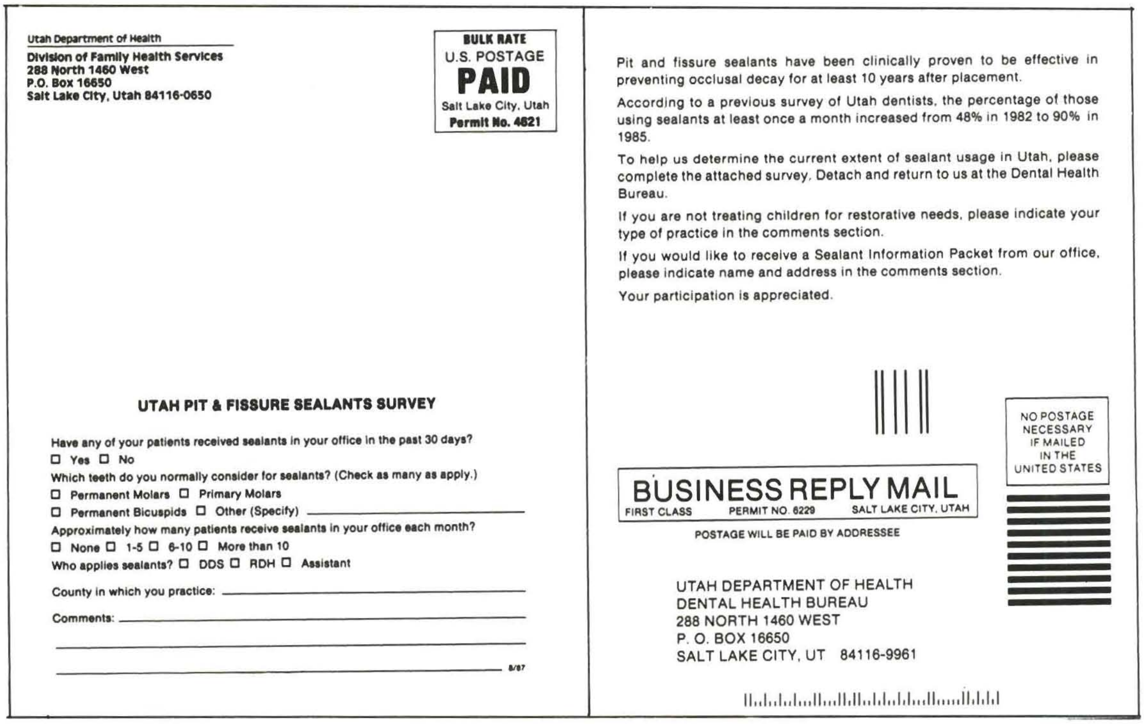
Sealants placed in past 30 days	1982 (N = 315) No.	%	1983 (N = 366) No.	%	1985 (N = 425) No.	%	1987 (N = 482) No.	%
Yes	152	48%	249	68%	381	90%	472	98%
No	163	52%	117	32%	44	10%	10	2%

In 1982, 48 percent of the dentists indicated that they used sealants. This increased to 98 percent by 1987 (Table 2).

The number of sealant patients per month also increased, as the percentage of dentists placing sealants on more than ten patients increased from 10 percent in 1982 to 48 percent in 1987 (Figure 2).

The teeth most frequently indicated for sealant

Figure 1. Copy of the postcard survey mailed to Utah dentists.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UTAH PIT & FISSURE SEALANTS SURVEY

Have any of your patients received sealants in your office in the past 30 days?
□ Yes □ No
Which teeth do you normally consider for sealants? (Check as many as apply.)
□ Permanent Molars □ Primary Molars
□ Permanent Bicuspids □ Other (Specify) ______
Approximately how many patients receive sealants in your office each month?
□ None □ 1-5 □ 6-10 □ More than 10
Who applies sealants? □ DDS □ RDH □ Assistant
County in which you practice: ______
Comments: ______
8/87

Pit and fissure sealants have been clinically proven to be effective in preventing occlusal decay for at least 10 years after placement.

According to a previous survey of Utah dentists, the percentage of those using sealants at least once a month increased from 48% in 1982 to 90% in 1985.

To help us determine the current extent of sealant usage in Utah, please complete the attached survey. Detach and return to us at the Dental Health Bureau.

If you are not treating children for restorative needs, please indicate your type of practice in the comments section.

If you would like to receive a Sealant Information Packet from our office, please indicate name and address in the comments section.

Your participation is appreciated.

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placement were the permanent molars, at 97-98 percent. Premolars were chosen for sealants by 55-67 percent of the dentists. Primary molars were sealant candidates to 31-34 percent. These percentages were consistent in all four years of the survey (Table 3).

In offices in which sealants were used, 76-86 percent report that the dentist applies the sealants; 32-41 percent, the hygienist; and 8-17 percent, the assistant. These responses were consistent for all four surveys (Table 4).

Table 3 □ Dentists using sealants, by type of teeth sealed*.

Type of teeth sealed	1982 (N = 152) No.	%	1983 (N = 249) No.	%	1985 (N = 381) No.	%.	1987 (N = 472) No.	%
Permanent molars	150	97%	244	98%	371	97%	463	98%
Premolars	87	57%	55	55%	241	63%	315	67%
Primary molars	52	34%	31	31%	126	33%	158	33%
Other	8	3%			2	1%	25	5%
No answer							2	.4%

* Percentages do not add up to 100 because dentists often report in more than one category.

Table 4 □ Dentists using sealants, by who applies sealants*.

Person applying the sealants	1982 (N = 152) No.	%	1983 (N = 249) No.	%	1985 (N = 381) No.	%.	1987 (N = 472) No.	%
Dentist	116	76%	215	86%	318	83%	404	86%
Hygienist	62	41%	87	35%	116	36%	153	32%
Assistant	22	14%	21	8%	49	13%	80	17%
No answer					5	1%	8	2%

* Percentages do not add up to 100 because dentists often report in more than one category.

DISCUSSION

The Dental Health Bureau conducted this usage survey as part of a Sealant Education Program in Utah from 1982 through 1987. Information packets with some relevant reprints of scientific articles as well as patient-education materials were distributed to dental professionals by visits to their offices by table clinics at annual

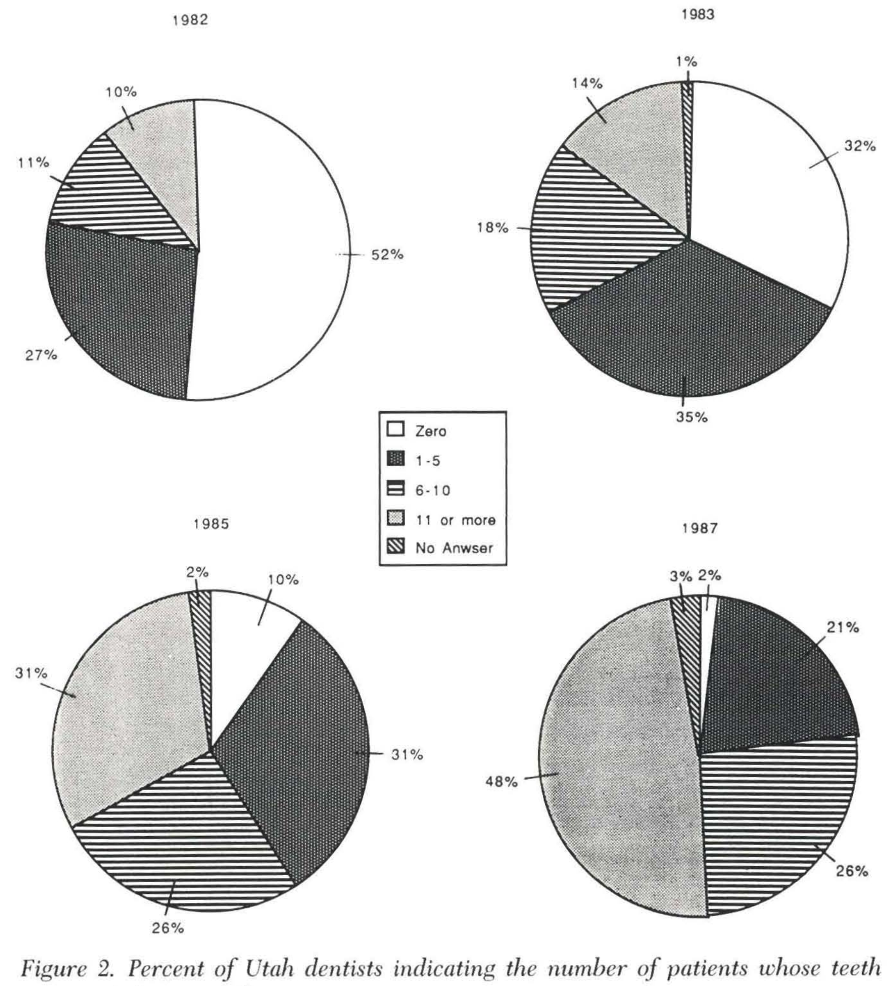

Figure 2. Percent of Utah dentists indicating the number of patients whose teeth were sealed per month.

By 1987, 98 percent of Utah dentists responding to the survey were using sealants.

state dental meetings, or by mail. Inservice workshops were also held for dental hygienists and hygiene students. The postcard surveys also included some information on sealants. Public health nurses and health educators received information on sealants at local health department inservice staff meetings. Sealant information was disseminated to the public in displays and booths at health fairs, presentations to civic groups, appearances on television and radio shows, and newspaper articles.

The postcard survey showed that the percent of dentists using sealants increased from 48 in 1982 to 98 in 1987. Although Utah's percentage in 1982 was lower than the national rate (58 percent, there has been a substantial gain since that survey to a level in 1987 well above the reported national rate. For example, Cohen *et al* found in 1985 that 31 percent of U.S. dentists were not using sealants; whereas, Utah's rate of dentists not using sealants was only 10 percent in the same year.[6] This was one and a half years after the National Institute of Dental Research sponsored a Consensus Development Conference: Dental Sealants in the Prevention of Tooth Decay.

The Utah response rate of 33-44 percent was less than desired. Even if it is assumed, however, that all of the nonrespondents did not use sealants, the increase would still be considered dramatic, changing from 17 percent in 1982 to 43 percent in 1987.

According to statewide DMF surveys conducted by the Dental Health Bureau, the number of children found to have sealants demonstrated the increase in usage during this period. In 1982, 5 percent of eight- to twelve-year-old children examined had sealants. This increased to 31 percent in 1987.[1] Nationally, 7.6 percent of the children have sealants, based on the National Institute of Dental Research Survey of 1987.[12]

The routine use of sealants was defined as sealing the teeth of more than ten patients per month. This figure increased almost five times, from 10 percent of dentists in 1982 to 48 percent in 1987.

It is also encouraging to note that most dentists routinely seal the permanent molars. Since the morphology of the permanent molars increases the likelihood of occlusal decay, sealants are more efficient on these teeth than on other teeth.[13]

Because the surveys were addressed to dentists, it is to be expected that in a large percentage of the offices where sealants are used, the dentist would indicate that they place the sealants. There are about a third as many hygienists as there are dentists in Utah and a third of the responses indicated that the hygienist places the sealant. It is suspected that if there is a hygienist in the office, the hygienist is probably the one who will place the sealants. Most of the responses from assistants indicated that placement of sealants was made in conjunction with the dentist and/or the hygienist. This may mean assistants are placing the sealants themselves or they are assisting the dentist or hygienist.

The most frequently made comment on the postcard survey concerned the lack of insurance coverage for sealants. It may be helpful to provide information on sealants to an insurance company considering sealants as a dental benefit. After providing information, however, progress might be more likely if employees become aware of sealants and request sealant coverage during benefit negotiations with their employers. This emphasizes the need for further education of parents on the benefits of sealants.

It is important to remember that Utah's sealant education program was statewide and there was also extensive national promotion of sealants during this time.

CONCLUSIONS/SUMMARY

The Dental Health Bureau conducted a Sealant Education Program in Utah from 1982 through 1987. National organizations such as the American Dental Association and NIDR have also promoted sealants.

A portion of the dental education program was a postcard survey of dentists to determine the extent of their use of sealants. The extent of usage has increased from 48 percent in 1982 to 98 percent in 1987.

Is Utah's sealant usage rate following a national trend? These figures indicate that Utah exceeded it. With fluoride to protect the smooth surfaces and sealants to protect the occlusal surfaces, Utah may be closer to seeing its goal of a caries-free generation.

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TRANSFER OF DRUGS INTO HUMAN MILK

The following questions should be considered when prescribing drug therapy to lactating women. (1) Is the drug therapy really necessary? Consultation between the pediatrician and the mother's physician can be most useful. (2) Use the safest drug: for example, acetaminophen rather than aspirin for oral analgesia. (3) If there is a possibility that a drug may present a risk to the infant (eg, phenytoin, phenobarbital), consideration should be given to measurement of blood concentrations in the nursing infant. (4) Drug exposure to the nursing infant may be minimized by having the mother take the medication just after completing a breast-feeding and/or just before the infant has his or her lengthy sleep periods.

Committee on Drugs (Am Acad Pediatr):
Transfer of drugs and other chemicals into human milk.
Pediatrics, 84–85, 5 November, 1989.

Anodontia of the permanent dentition: fourteen years after initial diagnosis

Case reports

Warren Scherer, DDS
Harmon Cooper, DDS
Robert Haray, DDS

Total anodontia, the congenital absence of teeth, may involve both the primary and the permanent dentitions. This anomaly has frequently been associated with hereditary ectodermal dysplasia.[1] Genetic analysis suggests that it may be caused by an autosomal recessive trait.[2,3]

In 1977, Herman and Moss originally reported the case of a fourteen-year-old white female with total aplasia of the permanent dentition.[4] A review of the dental literature indicates that this condition is very rare. Heymer, Swallow and Warr, reported on similar cases.[5-7] Shokeir presented a case in which all of the permanent teeth were ankylosed and unerupted.[8] The purpose of this paper is to update the dental history of the patient reported by Herman and Moss in 1977, fourteen years later.

HISTORY

The patient was born in the United States of Greek ancestry in 1961. Her mother's pregnancy was uneventful and the patient experienced no significant medical problems. As the child matured, there were

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no signs or symptoms of ectodermal dysplasia.

Anecdotally, it had been reported that the patient had a cousin on her mother's side living in Greece with the same condition. Attempts to contact this cousin have proven futile and a review of the literature revealed that no such case was reported. In 1974, the patient sought treatment at New York University College of Dentistry because of loose primary second molar teeth and a poor personal appearance. Overlay dentures, constructed a year earlier, may have been the precipitating factor leading to the loosening of these teeth. Upon examination, the patient exhibited a prognathic lower to upper jaw relationship. The following primary teeth were missing: maxillary left first molar, maxillary right lateral incisor and maxillary right second molar. Following the extraction of the loose primary mandibular molars, a second set of upper and lower overlay dentures was constructed. The primary mandibular first molars were retained, because of their ankylosed condition.[4]

In 1975, all of the remaining primary teeth were extracted and the first definitive complete upper/lower dentures were made.

Two years after leaving the New York area, a second set of dentures was fabricated. In 1980 and 1986, third and fourth sets, respectively, were completed.

In 1988, the patient returned to New York University College of Dentistry complaining of discomfort beneath her lower denture. A soft tissue examination of the area revealed two ulcerated lesions. Upon questioning, the patient stated that she wore her dentures for extended periods of time. She also stated that she was recently married, and that her husband was unaware that she was edentulous.

Further examination revealed that upon palpation, excessive overlying soft tissue covered the maxillary ridge and tuberosity areas. The mandibular ridge was extremely thin and quite pronounced. Inspection of the patient's facial profile with the most recently made dentures in place revealed a pronounced lack of upper lip support and concurrent collapse of vertical dimension (Figure 1).

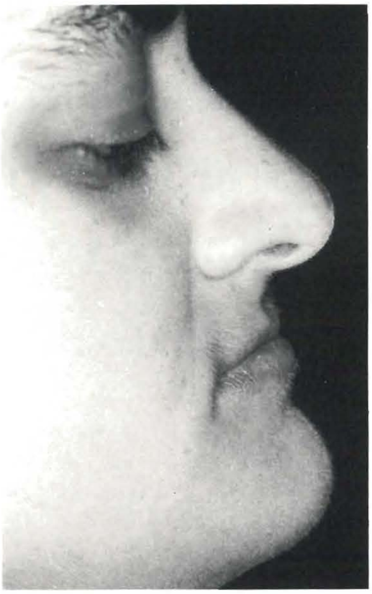

Figure 1. Loss of vertical dimension and lack of upper lip support are evident.

Figure 2. A frontal view of the patient's underdeveloped maxilla.

TREATMENT

The patient was advised to remove her dentures daily for several hours at a time. Within a week the ulcerations had healed. The patient was also advised to obtain new dentures, her fifth set. Unlike her previous dentures, where mandibular posterior teeth were placed lingual to the mandibular ridge, her new dentures had mandibular posterior teeth placed on the alveolar ridge. The new dentures also exhibited a more constricted maxillary arch form and a less constricted mandibular arch form.

The use of osseointegrated implants as a treatment alternative was recently discussed with this patient. After some initial anxiety, she accepted the fact that this modality may be a viable option in the future.

DISCUSSION

The complexity of this case was compounded by the presence of an underdeveloped maxilla and a prognathic mandible (Figures 2,3). As a result, proper oc-

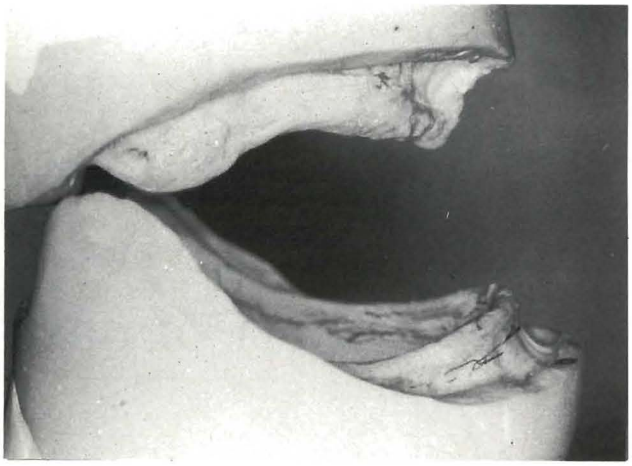

Figure 3. A lateral view showing the prognathic relationship of the jaws.

clusal contacts and pleasing aesthetics were difficult to achieve, evidenced by the fact that five complete upper and lower dentures were made in thirteen years. In general, because of the scarcity of patients suffering from anodontia of the permanent dentition, the psychological effects of this condition upon the individual are unknown. In interviews, the patient stated that she had severe difficulties in coping with the lack of teeth as well as having to explain differences in her facial appearance at different points in her life. One can only speculate on the pressures created by this "unnatural" condition on patient development.

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SEVERITY OF INTENTIONAL INJURIES

Intentional injuries were proportionally more severe than unintentional ones. They accounted for 3.4 percent of all the injury-related visits to the emergency room in this population but led to 9.8 percent of the injury-related hospitalizations and 15.7 percent of the deaths from injuries. In comparing different types of intentional injury, we used the proportion of patients who required hospitalization as a measure of severity. Self-inflicted injuries resulted in a nearly sevenfold greater proportion of hospitalizations as injuries from assault. The highest proportions of hospital admissions for assaults were among the subjects injured as a result of child battering and those injured in fights involving weapons. The decision to hospitalize suicidal young persons and battered children does not necessarily reflect the severity of the injuries alone. The need to conduct a psychosocial assessment of the child and family, to involve other service agencies, and to ensure discharge to a safe environment contribute to this decision.

Eight deaths from intentional injuries were observed, including five suicides and three homicides. The overall ratio of deaths to hospitalizations to visits to the emergency room was 1:26:222. For self-inflicted injuries this ratio was 1:18:27, and for assaults it was 1:33:534.

Guyer, B. *et al*: Intentional injuries among children and adolescents in Massachusetts. N Engl J Med, 321:1584–1589, December 7, 1989.

Precocious puberty in a monozygous twin: report of case

Per Rasmussen, DDS, Lic odont, Dr odont

Of the many factors that influence the growth and development of tissues and organs, the main ones are included in three major categories.

GENETICS

- ☐ Monogenic action (e.g. Chondrodystrophia fetalis)
- ☐ Polygenic action (e.g. The normal growth)
- ☐ Chromosomal aberrations (e.g. Down syndrome)

HORMONES

- ☐ Growth hormone
- ☐ Sex hormones
- ☐ Thyroid hormone

NUTRITION

- ☐ Dietary deficiencies
- ☐ Malabsorption

The purpose of the present report is to describe some effects of premature production of sex hormones as observed in a boy with precocious puberty (pubertas praecox). The figures presented will be compared to corresponding skeletal and oral factors in an unaffected monozygous twin brother.

Precocious puberty may be defined as sexual maturation before the age of ten years in boys and eight years in girls (these limits will vary according to race and population). The cause is either early production of hypothalamic releasing hormones (GnRH), pituitary gonadotropins, or the production of sex hormones in adrenal or gonadal tumors. In boys, about a third of the cases of precocious puberty are of known central or cerebral etiology. In girls, 80 percent of the cases have an unknown cause (idiopathic). Their characteristic features are comparable, however, to those of the central type.[1]

In the central/cerebral type the cause will in most cases be a tumor or trauma in the hypophyseal stalk or hypothalamus, activating the so-called hypothalamic-pituitary-gonadal axis (Figure 1).

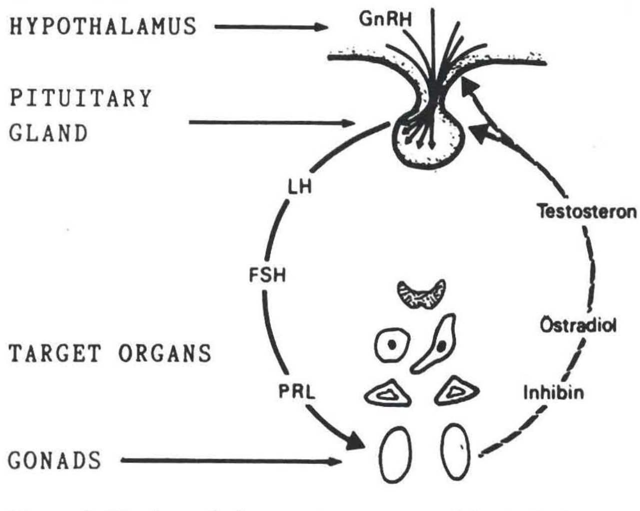

Figure 1. The hypothalamic-pituitary-gonadal axis designates the hormonal link between the brain stem and the sex glands.

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Figure 2. RV (left) and OV (right) at age of six years. The difference in height corresponding to two and one half years.

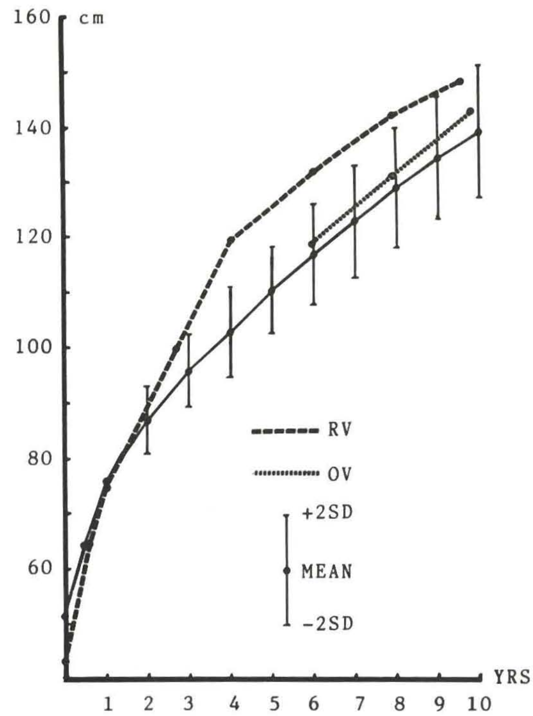

Figure 3. Growth curves for RV from birth to ten years and for OV from six to ten years. From an age of three years, RV has been more than 2SD above the mean values.

In cases of precocious puberty, somatic changes that are characteristic for a normal puberty are observed. In addition to the sexual development, the most conspicuous features in precocious puberty are increased skeletal growth and early skeletal maturation, thus giving the child a body height above the mean values for some years (Figure 2); but if untreated will end up with a height lower than the mean.

CASE REPORT

The present case is a boy born as the first to two twins, a month before term. Neonatal icterus was the only birth complication. The first sign of precocious puberty was recorded at the age of six months, as the mother noticed an increased penis size as compared to the brother twin. At the age of a year a biopsy of the testes was performed. The histological examination indicated centrally stimulated testes hyperplasia. Computertomography of the skull disclosed a tumor in the hypothalamus, which after explorative surgery was diagnosed as an astrocytoma. The tumor was nonlimited, and thus inoperable. As these tumors are slow-growing, no beneficial effects of radiation or cytostatica were to be expected. The tumor, however, caused no symptoms of intracranial pressure or any neurological problems. No further development of the tumor has been observed. Thus, other than starting the development of the precocious puberty, the tumor so far has had no adverse effects. To counteract the effects of the stimulation resulting from the sex hormones, the patient has been treated with antiandrogenics, with feed-back inhibition of the interstitial-stimulating and the follicle-stimulating hormones.

At the present time the patient (RV) is about ten years of age, and has been observed every second year from the age of six, with casts, panoramic radiographs, lateral cephalometric radiographs and hand-wrist

Figure 4. Hand-wrist radiographs of RV (left) and OV (right) at age of eight years. The difference in skeletal maturity corresponds to seven and one half years.

radiographs. The unaffected twin brother (OV) has been subjected to the same examination. Interest has been focused on:

- ☐ Skeletal development.
- ☐ Cranial development.
- ☐ Dental development.

From an odontological point of view it has been of special interest to watch whether the well-known effects of sex hormones on skeletal growth and maturation also occurred in the craniofacial and dental areas.

Skeletal development

The growth curves for RV and OV are presented in Figure 3. The birth weight of RV was approximately

2000g. His growth between two and four years was especially rapid, and he reached well over 2SD above the mean. OV has been recorded since six years of age, and has kept a little above the mean values. The differences between the brothers' heights corresponds to two years, but are at present decreasing. Somatic bone growth and maturation were evaluated on hand-wrist radiographs (Figure 4). Measurements of the third metacarpals are presented in Table 1. The differences in bone length, corresponding to two years, were of the same magnitude as for the body height. The figures for skeletal maturity are presented in Table 2. The differences between the brothers were marked at all ages.

Figure 5. Photographs in profile at an age of eight years. The difference between RV (right) and OV (left) with respect to facial size and maturity is clearly demonstrated.

Cranial development

The cranial development has been followed by photographs and radiographs every second year. Photographs at eight years (Figure 5) clearly demonstrate the differences between the twins in facial size as well as in maturity. At that time RV had numerous acnes.

The sizes of the neurocraniums were compared by superimposing tracings of cephalographs (Figure 6). Furthermore, planimetric determinations of the areas limited by the cranial contours were performed. No measurable differences between the twins were found. Thus, precocious puberty does not seem to have any major influence on the growth of the neurocranium.

Tracings of the visceral craniums are presented in Figure 7. The differences between the twins in skeletal as well as soft tissue profiles are noticeable. By measuring the positions of maxilla and mandible expressed as SA and SM distances (Table 3), it was found that the downward/forward growth of the face was considerably increased in RV. The differences between the brothers were greatest at six years, and the growth of the mandible was more accentuated than that of the maxilla.

Dental development

Of greatest interest to the pedodontist is the dental development, expressed as tooth formation/maturation and tooth eruption. These factors are reported to be influenced in precocious puberty.

Dental age assessment was performed according to the method of Demirjian *et al* on panoramic radiographs at six, eight and ten years (Figure 8).[3] Table 4 shows that tooth maturation is accelerated in RV. The differences between the twins are most clearly visible at the time of root formation of canines and premolars. Also tooth eruption was more advanced in RV as shown in Table 5. The differences were most accentuated at

Table 1 ☐ Bone length: 3rd metacarpal in mm.

	Chronological age		
	6yrs	8yrs	10yrs
RV	51	55	59
OV	44	51	57
Diff.	+16%	+8%	+4%

Table 2 ☐ Skelatal maturity (in yrs): according to Greulich and Pyle.[2]

	Chronological age		
	6yrs	8yrs	10yrs
RV	13.5	15.5	16
OV	6	8	10.5
Diff.	+7.5	+7.5	+5.5

Table 3 ☐ Growth of visceral cranium.

		Chronological age		
		6yrs	8yrs	10yrs
SA(mm)	RV	81	81	84
	OV	76	79	82
	Diff.	+6.6%	+2.5%	+2.4%
SM(mm)	RV	109	110	115
	OV	100	105	112
	Diff.	+9.0%	+4.8%	+2.7%

Table 4 ☐ Dental age (in yrs): (method of Demirjian and Goldstein[3]).

	Chronological age		
	6yrs	8yrs	10yrs
RV	8.4	11.2	13.2
OV	7.2	9.0	11.2
Diff.	+1.2	+2.2	+2.0

Table 5 ☐ Eruption age (in yrs).

	Chronological age		
	6yrs	8yrs	10yrs
RV	8.6	11.3	12.1
OV	7.2	9.4	9.6
Diff.	+1.4	+1.9	+2.5

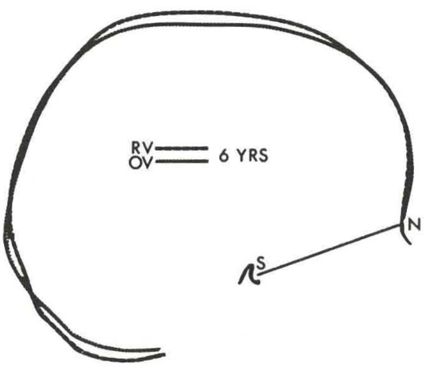

Figure 6. Tracings of neurocraniums superimposed on SN-lines. No noticeable differences are observed.

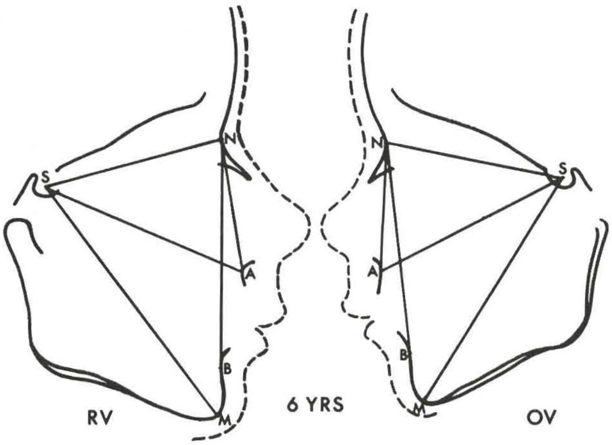

Figure 7. Tracings of visceral craniums arranged face-to-face with RV to the left and OV to the right. The lines SA and SM indicate the size and position of the maxilla and the mandible, respectively.

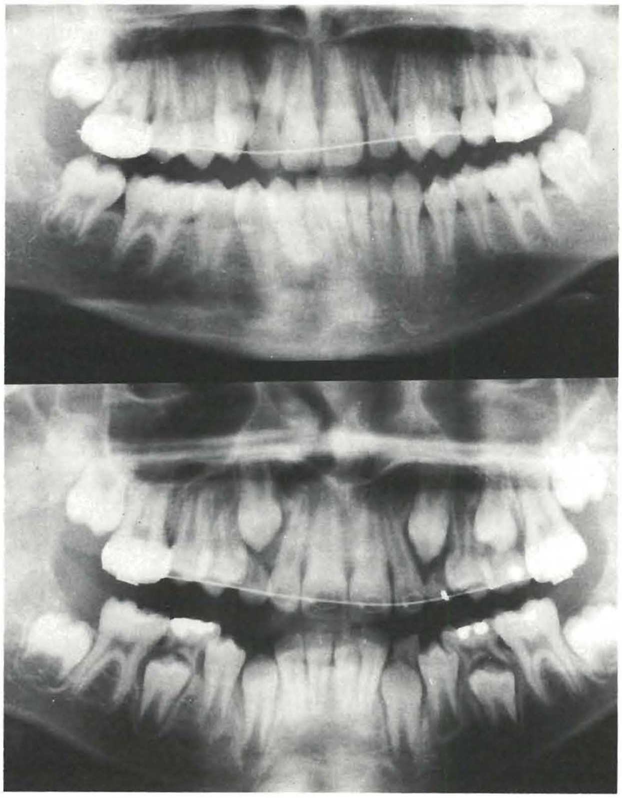

Figure 8. Panoramic radiographs at ten years clearly demonstrate the differences between the twins in tooth development as well as in tooth eruption. RV at top, OV at bottom.

ten years, where RV had an almost completely erupted permanent dentition (Figure 8).

DISCUSSION AND CONCLUSION

It is well known that sex hormones speed up skeletal growth, mostly accentuated in males. They also speed up skeletal maturation, however, with premature closure of epiphyseal plates. The typical growth pattern in untreated precocious puberty is thus one of increased height during childhood, and a lower than normal height as an adult.[1]

The present case does not so far deviate from this pattern. At the age of six years, the PP-twin was 2.5 years in advance in body height and 7.5 years in advance in skeletal maturation as compared to his unaffected brother. At ten years these differences had decreased to 1.5 and 5.5 years, respectively.

The pattern of craniofacial growth in precocious puberty has not been paid much attention. The size and form of the neurocranium normally reflect the growth of the brain. As the nervous tissues seem to be unaffected by sex hormone, the brain case will be of approximately the same volume, as found in the present and previous cases.[4] The growth of the visceral cranium however, seems to be measurably influenced by the early and excessive production of sex hormones, although to a lesser extent than that of the skeleton; and the maxilla is affected to a lesser extent than the mandible. These findings are in accordance with the few studies of precocious puberty where measurements of facial factors were included.[4-6]

The effects of the sex hormones on tooth development and tooth eruption have been discussed in several papers concerning precocious puberty of various etiologies. The observations reported have been very equivocal, ranging from retarded tooth development, via unaffected to accelerated development.[4-11]

Some of these divergent observations may be due to lack of homogeneity of the material, comprising precocious puberty of various etiologies, e.g. central/cerebral, idiopathic, adrenal. In the present case (central/cerebral type) tooth development and tooth eruption have been one to two years in advance, and that is much more than previously reported.

Objections may be raised against drawing conclusions from the comparison of single cases with mean figures from a population. The present case has not been compared as much to population figures, however, as to the figures of his monozygous twin. It is well known that concordance between monozygous twins is very high with respect to most factors. Thus, their mean difference in body height is only 1.7cm, as compared to 4.4cm in dizygous twins.[12] Furthermore, the mean correlation coefficient between dental factors in monozygous twins has been found to be 0.9, which is very close to the side-to-side concordance within individuals.[13] The mean correlation coefficient between dental factors in siblings, however, is as low as 0.3.[13] Thus, it seems justified to draw conclusions from observations on monozygous twins, even if statistical approaches cannot be used in single cases.

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ACQUIRED PELLICLE

Acquired pellicle. The thin (0.1 to 0.8 μm) structures, primarily protein film that forms on erupted teeth and can be removed by abrasives (e.g., polishing materials). It quickly reforms after being removed. The source of pellicle is apparently from constituents of saliva. It can form whether or not bacteria are present. Acquired pellicle will stain light pink by erythrosin, a red dye commonly used to stain bacterial plaque. Pellicle is not removed by forceful rinsing, and its role in periodontal disease is unknown.

Fedi, P.F.: *The periodontic syllabus*. 2nd ed.
Philadelphia: Lea & Febiger, 1989, p 14.

Talon cusp: a review and two case reports on supernumerary primary and permanent teeth

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A process of horn-like shape on the lingual surface of an upper left central incisor was first described by Mitchell in 1892.[1] This projection has been termed talon cusp because it resembles an eagle's talon in shape.[2] The term *talon cusp* has been applied somewhat loosely to cusp-like formations that vary in size, shape, length, and degree of attachment to the lingual surface of a tooth. Thoma considered a talon cusp as a very high accessory cusp projecting from the cingulum area of an anterior tooth or mesiodens, which may connect with the incisal edge to produce a T- or Y-shaped crown.[3] Gardner and Girgis stated that the talon cusp is a markedly enlarged cingulum found on maxillary incisor teeth.[4] Worth used the term hyperplasia of the cingulum and described three variations: conical, bifid, and talon-like.[5] Chawla, *et al* defined talon cusp as a delineated projection of a millimeter or more present on the lingual surface of an anterior tooth.[6] In their sample population of North Indian children a prevalence of 7.7 percent was reported for this condition which had previously been considered relatively rare.[6,7]

Attempts have been made to define precise criteria for categorization of an accessory cusp as a talon cusp. Recent definition reserves the term talon cusp for a morphologically well delineated cusp that projects from the lingual surface of the primary or permanent anterior tooth and extends at least half the distance from the cementoenamel junction to the incisal edge. Lesser cusp-like formations should be referred to as enlarged or prominent cingula.[8-10]

The tip of the talon cusp may stand away from the rest of the crown or it may be in close approximation to the lingual surface of the tooth.[10] The cusp tip may coincide with the midline of the long axis of the tooth or deviate toward the mesial aspect.[10]

Permanent maxillary incisors have been reported to be most frequently affected.[10] There have been reports, however, of talon cusps on permanent mandibular incisors and primary maxillary incisors.[2,9,11,14] Davis and Brook report a male-to- female ratio of 32:18.[10]

It is suggested that the accessory cusp has a multifactorial etiology combining both genetics and environmental factors.[10,15] It may be due to hyperactivity of the dental lamina, which occurs more commonly in the anterior region.[7] Increased incidence of talon cusp has been reported in orofacialdigital II syndrome (Mohr syndrome) and Rubinstein-Taybi syndrome.[4,16] Talon cusp with other associated odontogenic anomalies has been reported with or without developmental syndromes.[8,12,16]

Clinical problems that may arise because of the pres-

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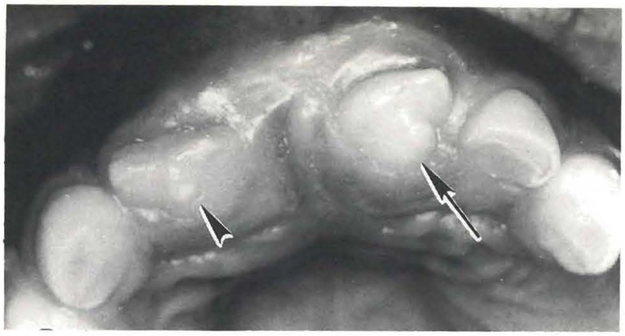

Figure 1. Photograph showing bilateral erupted supernumerary teeth, one with talon cusp (arrow) and the other with exaggerated cingulum (arrowhead).

ence of a talon cusp include stagnation of food, caries, soft tissue irritation, esthetics, occlusal interference, periapical lesions, and problems in diagnosis and clinical management for dentists.[2,3]

Radiographically, a separate enamel, dentin, and pulp can be seen in the talon cusp continuous with that of the tooth.[2] On an unerupted tooth, a talon cusp may be mistaken for a supernumerary tooth or a compound odontoma; diagnosis before eruption is, therefore, desirable.[2] Management of the talon cusp varies with the circumstances of the individual case. It is desirable, however, to evaluate and treat the talon cusp soon after eruption to avoid clinical problems. Sealants or composite resin restorations can be used in the deep lingual grooves adjacent to the talon cusp to prevent caries.[2,11] In the case of occlusal interference, different approaches have been reported. One calls for reduction of the cusp tip in one appointment and would include endodontic treatment, if the reduction resulted in pulpal exposure.[17,18] In another approach small portions of the cusp are removed at four month intervals followed by topical applications of fluoride after each grinding procedure over a period of a year and over a period of five years.[10,19]

REPORT OF CASES

Case 1

A 6.5-year-old white male presented to the Pediatric Dentistry Clinic at the Medical College of Georgia for a recall examination. Clinical examination revealed bilateral erupted supernumerary teeth (mesiodens) (Figure 1). The left mesiodens had a talon cusp with a connection to the lingual surface that had a T-shape or pyramidal-shape outline (Figure 2). The right mesiodens showed an exaggerated cingulum that was not well delineated. The two mesiodens were extracted under local anesthesia and preserved in 10 percent formalin.

Case 2

A three-year-old white male, born with incomplete cleft lip and distorted nasal alae presented to the Pediatric Dentistry Clinic for examination. The cleft lip was repaired at age three months. The patient had a complete primary dentition and a supernumerary tooth with talon cusp. The talon cusp was attached to the lingual surface forming a Y-shape (Figures 3,4). The supernumerary

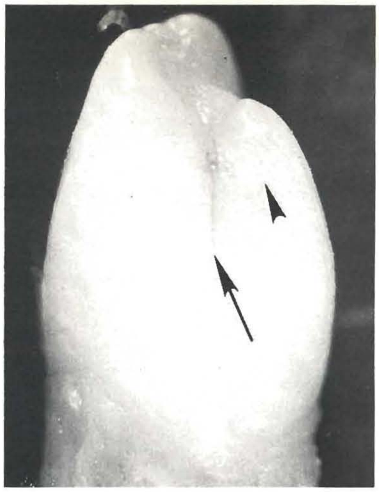

Figure 2. Photomicrograph showing extracted supernumerary tooth with talon cusp (arrowhead) connected to lingual surface (arrow).

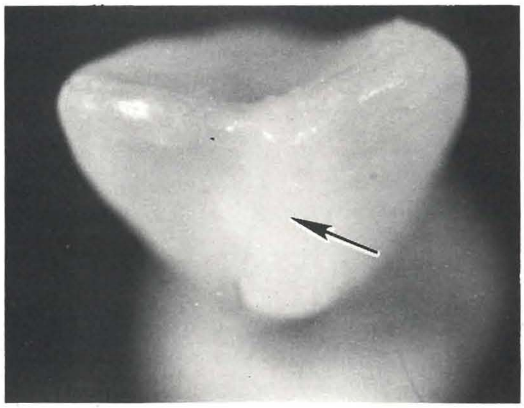

Figure 3. Photomicrograph (incisal view) of extracted supernumerary primary tooth with talon cusp (arrow) attached to lingual surface forming a Y-shape.

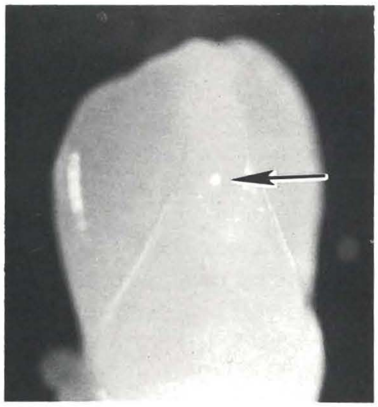

Figure 4. Photomicrograph (lingual view) showing talon cusp (arrow) attached to the lingual surface.

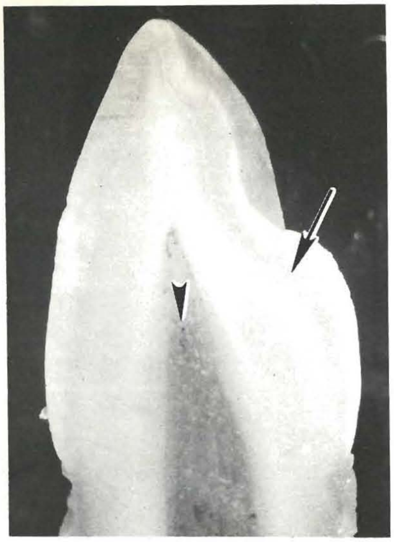

Figure 5. Photomicrograph of labiolingual section of supernumerary tooth showing absence of pulp (arrowhead) extension into talon cusp (arrow).

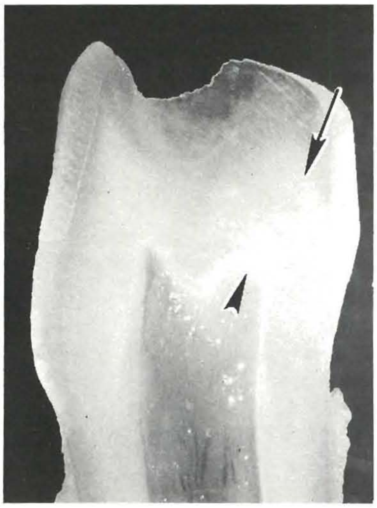

Figure 6. Photomicrograph of labiolingual section of supernumerary tooth showing small extension of pulp (arrowhead) toward talon cusp (arrow).

tooth was extracted under local anesthesia and preserved in 10 percent formalin.

Processing of the specimens

The extracted teeth with talon cusps were radiographed from the labial and proximal surfaces. The teeth were then examined and photographed using a dissecting microscope. Labiolingual sections were prepared, examined, and photographed using a dissecting microscope.

DISCUSSION

The cases of talon cusp reported here are associated with supernumerary teeth. Case 2 was associated with an incomplete cleft lip. As in the cases reported by Mader and Natkin, there was no sign of a syndrome in either case.[8,12] Since a talon cusp is likely the result of hyperproduction of the dental components from the dental lamina, the supernumerary teeth could be expected. Another manifestation of this hyperplasia of the dental lamina was noted in Case 1, in which the right supernumerary showed an exaggerated cingulum.

Talon cusps have been reported to contain an extension of the pulp.[2,11] In the first case no extension of the pulp into the talon cusp either radiographically or stereoscopically could be detected (Figure 5). In the second case, however, a slight extension of the pulp was noted (Figure 6). The absence of a pulpal horn has also been reported previously, suggesting that pulpal horns should not be routinely expected in talon cusps.[12]

In both of these cases, the talon cusps extended more than half the distance from the cementoenamel junction to the incisal edge. Most cases of talon cusps have been reported in children and young adults. In order to determine accurately the prevalence of talon cusps, thorough examination procedures and specific criteria for diagnosis are needed.

Early recognition is important so that proper treatment procedures can be begun. In the cases reported here, the extraction of the supernumerary teeth was the treatment of choice.

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ABSTRACTS

Skartveit, Liv; Tveit, Anne Bjørg; Tøtdal, Bård; Øvrebø, Rosane; Raadal, Magne: *In vivo* uptake in enamel and dentin from fluoride-containing materials. J Dent Child, 57:97-100, March-April, 1990.
The aim of this study was to register and compare the amounts of fluoride taken up in enamel and dentin from a fluoride-containing amalgam (Fluor-Alloy®), a glass ionomer cement filling material (Fuji II-F®), and a glass ionomer sealant (Fuji III®). Primary molars which had contained F amalgam and glass ionomer fillings for 1-2 years were collected when shed. Teeth with conventional amalgam fillings were used as controls. Glass ionomer sealant was placed in premolars to be extracted for orthodontic reasons. All teeth were sectioned and analyzed in an electron microprobe. The analyses showed F concentrations from 0.6 to 0.9 percent in the dentin surrounding fluoride amalgam, and 1.2 to 3.8 percent in dentin and 0.3 to 2.5 percent in enamel surrounding glass ionomer fillings. In the sealed fissures, F values in enamel up to 1.8 percent were found. Great penetration depths of F were found in all groups, with deeper penetration in dentin compared to enamel. Using fluoride-containing filling materials and fissure sealants can be a measure to combat secondary caries.
Fluoride; Fillings, glass ionomer (and) amalgam; Enamel; Dentin; Sealants; Caries, secondary

Foreman, Frank J. and Retzlaff, Arthur E.: Effects of systemic fluoride on the morphology of occlusal grooves of primary and permanent molars. J Dent Child, 57:101-105, March-April, 1990.
The purpose of this study was to determine whether the presence of systemic fluoride during amelogenesis affects the occlusal anatomy of molars. A replication study was first accomplished in which replicate impressions, models, and multiple cross-section series were obtained of primary second molars and permanent first molars. These were enlarged, traced, and two reproducible measurements of groove-width and groove-depth were obtained. Impressions were then obtained of the mandibular primary second and permanent first molars of 75 children between 6 and 9 years of age with varying fluoride histories. Both water fluoridation and fluoride supplementation were found to have no significant effect upon either the groove-depths or groove-widths of these molars.
Systemic fluoride; Groove morphology; Effects on amelogenesis; Groove-depth and groove-width

Grogani, Nosrat; Sullivan, Robert E.; DuBois, Linda: A radiographic investigation of third-molar development. J Dent Child, 57:106-110, March-April, 1990.
The results of this study suggested that the calcification of third molars in different quadrants was highly related; the calcification of all third molars could be estimated, therefore, by observing one quadrant. The results also indicated that
Continued on page 90

ABSTRACTS *continued from p. 87*

crown calcification of the third molars started and was completed earlier in blacks. They further indicated that there were no significant gender differences in the calcification of third molars.
Radiography; Third molars; Calcification; Impaction

Waldman, H. Barry: Pediatric dentists: evolving demography. J Dent Child, 57:111-113, March-April, 1990.
A review is provided of the changing gender, racial and ethnic distribution of enrollees in advanced dental education programs; with particular emphasis on pediatric dental programs. A more heterogeneous make-up among dental providers reflects the general population and should enhance efforts at providing services to American children.
Demography; Pediatric dentists

Waldman, H. Barry: We need to know more about the economics of pediatric dental practice. J Dent Child, 57:114-118, March-April, 1990.
A review is provided of the available limited data on the economics of pediatric dentistry. Sampling procedures, low response rates, data presentations, and short intervals compound the problems. A call is made for increased information, especially to determine "real" changes in pediatric dental net income.
Pediatric dentistry; Dental economics

Hintze, Hanne, and Wenzel, Ann: Accuracy of clinical diagnosis for the detection of dentoalveolar anomalies with panoramic radiography as validating criterion. J Dent Child, 57:119-123, March-April, 1990.
The aim of this study was to evaluate accuracy of clinical examination for the detection of dentoalveolar anomalies with panoramic radiographs as the validating criterion. A sample of 658 children each had a panoramic radiograph taken in a routine procedure as part of an orthodontic screening examination. A clinical examination was performed before assessing the radiographs. From this examination it was decided whether the child exhibited symptoms indicating the need for a radiographic examination. In total, 143 children exhibited significant radiographic findings. Of these, one third were identified by the clinical examination. Eighty-five percent of the children did not benefit from the radiographic examination. The clinical examination was very effective for identifying aplasia of permanent incisors (sensitivity = 1.00); less effective in cases of missing premolars (sensitivity = 0.22).
Panoramic radiography; Screening radiography; Clinical; Dental anomalies; Accuracy, verifying

Camm, Jeffrey H. and Schuler, John L.: Premature eruption of the premolars. J Dent Child, 57:128-133, March-April, 1990.
Early exfoliation or extraction of abscessed primary molars may lead to premature eruption of permanent premolars. Clinical sequelae including ectopic eruption, alteration of eruption sequence, arch-length inadequacy and tooth impaction are illustrated.
Eruption, premature; Eruption, ectopic; Arch-length; Tooth, abscessed; Impaction; Exfoliation

Bowman, Peggy A. and Fitzgerald, C. Michael: Utah dentists sealant usage survey. J Dent Child, 57:134-138, March-April, 1990.
The Utah Department of Health, Dental Health Bureau, conducted a Sealant Education Program from 1982 through 1987. An anonymous survey was sent to Utah dentists in 1982, 1983, 1985, and 1987 to determine the extent of their sealant usage. The extent of reported sealant usage increased from 48 percent in 1982 to 98 percent in 1987. The percentage of dentists reporting routine sealant usage (more than ten patients' teeth sealed per month) increased from 10 percent to 48 percent during this period.
Dental practice; Sealants; Surveys

DR. ALBUM TO RECEIVE ACHIEVEMENT AWARD

Dr. Manny Album was named the first recipient of the Special Career Achievement Award. The enthusiastic and unanimous approval of the Board of Directors for the establishment of this award and for Dr. Album to be its first recipient occurred at the First Annual National Conference of Special Care Issues in Dentistry in May, 1989.

Manny Album

As clinical professor at the University of Pennsylvania School of Dental Medicine, Dr. Album has contributed extensively to the education of many who now treat the handicapped. The University of Pennsylvania was the site of the first university course on dental care for the handicapped and the first special care patient clinic, both established by Dr. Album.

Dr. Album will be presented with the award at the 2nd Conference on Special Care Issues in Dentistry, to be held in Chicago, March 30 to April 1, 1990, in the Harold Hillenbrand Auditorium, ADA Building, 211 East Chicago Avenue. Dr. Doris Stiefel will make the presentation, Friday March 30, after Dr. Album has presented the first Max L. Bramer, DDS Memorial Lecture, 1-4 PM.