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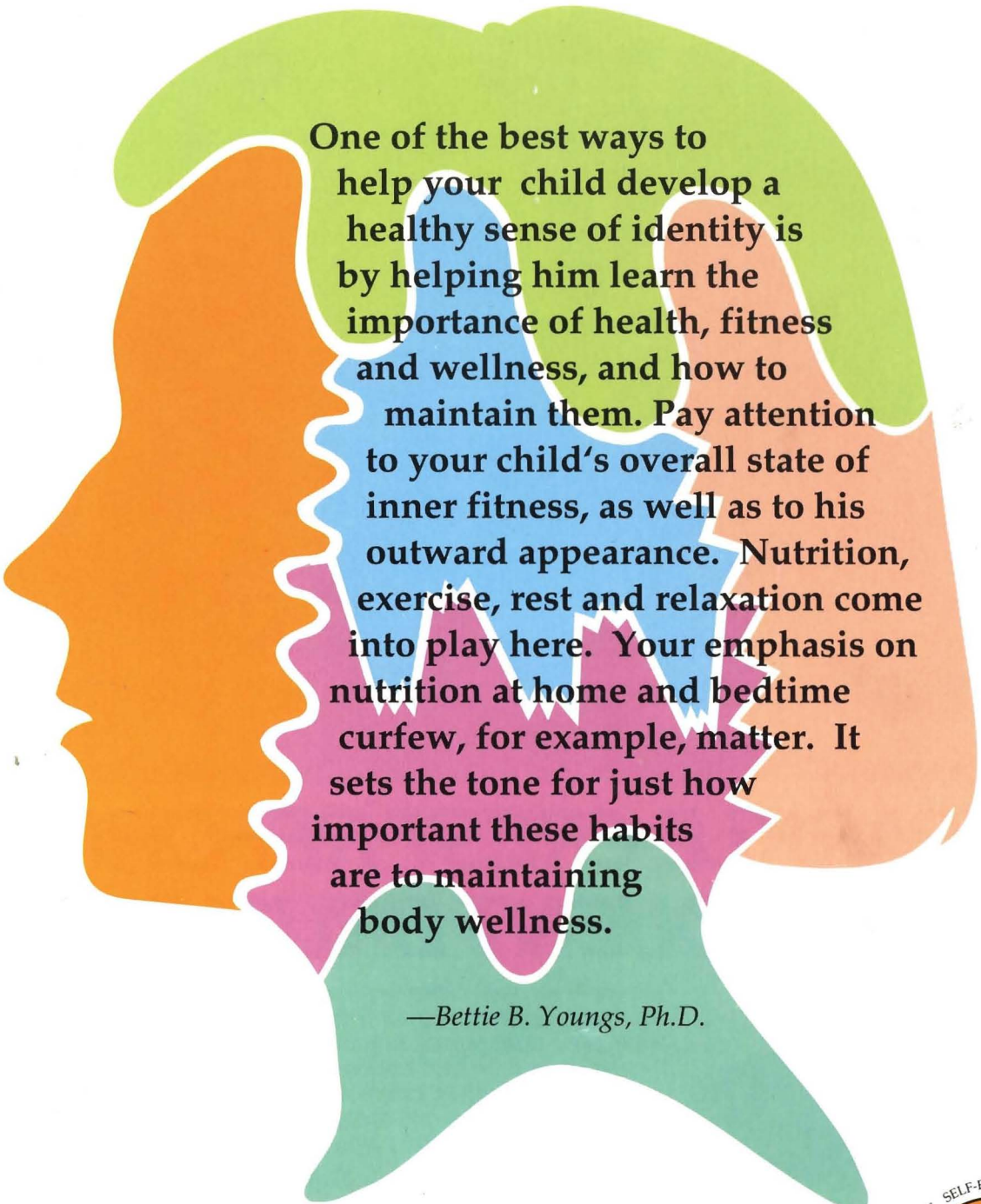

HEALTH AND CHEERFULNESS MUTUALLY BEGET EACH OTHER.
—*Joseph Addison*: The Spectator

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AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN
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Good health is dependent on a wholesome relationship between mind and body. Each supports the other, in unique and mysterious fashion.

Cover art and design by Sharlene Nowak-Stellmach.

CLINIC

BEHAVIOR

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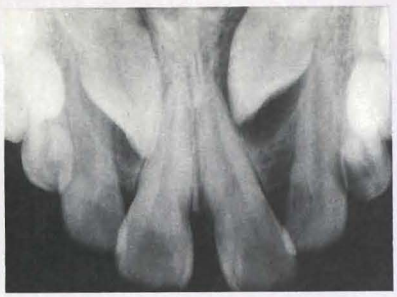

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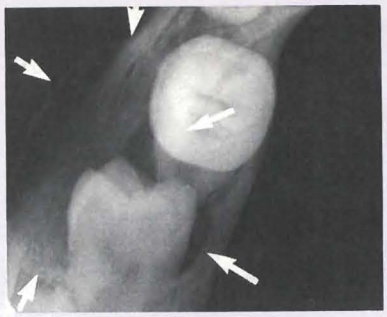

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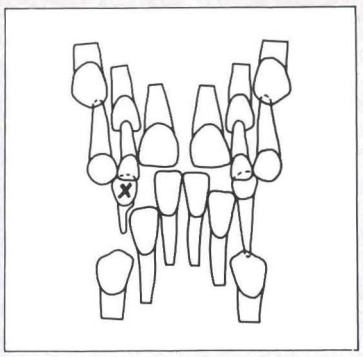

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The amount of extracoronal material placed when a tooth is restored with preventive resin was measured along with the projected area of cavity preparation, using computer profilometry.

Requests for reprints should be directed to Dr. John P. Conry, Division of Pediatric Dentistry, Department of Preventive Science, School of Dentistry, University of Minnesota, 515 Delaware Street, S.E., Minneapolis, MN 55455.

Dental erosion associated with asymptomatic gastroesophageal reflux—page 182

Treatment of this devastating disorder, capable of extensive and rapid erosion of the teeth, is discussed. Metoclopramide and ranitidine were used to decrease acid; and sodium fluoride was applied twice daily. Fissure sealants were applied to retard erosion.

Requests for reprints should be directed to Dr. Gregory Taylor, Department of Pediatric Dentistry, The Children's Hospital - Box B290, 1056 E. 19th Avenue, Denver, CO 80218.

Mesiodens in the primary dentition stage: A radiographic study—page 186

Early diagnosis and treatment of mesiodens could be essential to the developing occlusion. Distribution by sex, location, and direction was studied in this Chinese population.

Requests for reprints should be directed to Dr. Wen-Hsi Huang, Division of Pediatric Dentistry, Department of Dentistry, Chang Gung Memorial Hospital, 199 Tung Hwa North Road, Taipei, Taiwan, Republic of China.

Multispecialty team management of a case with impacted maxillary permanent canines—page 190

Both impacted maxillary permanent canines were transplanted in preference to surgical exposure and orthodontic traction. Pulp therapy was used on both teeth, and orthodontic procedures were applied to establish normal occlusion.

Requests for reprints should be directed to Dr. Endarra L.K. Tang, Department of Children's Dentistry and Orthodontics, 2/F, Prince Philip Dental Hospital, 34, Hospital Road, Sai Ying Pun, Hong Kong.

Dental management considerations in children with attention-deficit hyperactivity disorder—page 196

Attention-deficit hyperactivity disorder frequently impairs the ability to maintain adequate oral hygiene, and makes dental treatment difficult. The patient is also at risk of physical abuse by family and peers.

Requests for reprints should be directed to Dr. Arthur H. Friedlander, Hospital Dental Service, UCLA Medical Center, Los Angeles, CA 90024.

Dental management considerations in children who stutter—page 202

Stuttering is one of the most common speech disorders of childhood, and may contribute to difficulty in dental treatment of a child. The dentist should become acquainted with the verbal and nonverbal manifestations of the disorder.

Requests for reprints should be directed to Dr. Arthur H. Friedlander, Hospital Dental Service, UCLA Medical Center, Los Angeles, CA 90024.

Midline correction by extraction of the remaining mandibular canine: Myth or reality— page 207

The authors suggest that when a primary mandibular canine is lost prematurely, the antimere should be retained, to allow for maximum intercanine growth.

Requests for reprints should be directed to Dr. Clemens A. Full, Professor, University of Iowa, College of Dentistry, Department of Pediatric Dentistry, Iowa City, IA 52242.

Pediatric dental education and community service: A combined approach—page 212

Availability of pediatric clinical experience to undergraduate dental students is a major concern in some schools. A successful program using extramural clinics to increase patient pools is described.

Requests for reprints should be directed to Dr. Brenda S. Bohaty, UMKC School of Dentistry, 650 E. 25th Street, Kansas City, KS 64108.

"Rediscovering" the health status of Native Americans—page 216

A review of the demographic and health characteristics of Native Americans is presented.

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 11794-8715.

Hispanic children: An increasing reality in pediatric dental practice—page 221

Almost 48 percent of all Hispanic persons living in poverty were children (1989). By the year 2000, 11.5 million Hispanic children will represent the largest population of minority children.

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 11794-8715.

Root canal filling materials for primary teeth: A review of the literature—page 225

There is no known ideal root canal filling material for primary teeth. The criteria for such material for primary and permanent teeth differ greatly. The closest to the ideal, according to the authors, is a calcium hydroxide-iodoform mixture.

Requests for reprints should be directed to Dr. Kazumi Kubota, Department of Pediatric Dentistry, Nagasaki University School of Dentistry. 7-1 Sakamoto-Machi Nagasaki 852, Japan.

Ectopic eruption of a mandibular first permanent molar: Report of an unusual case— page 228

Requests for reprints should be directed to Dr. John N. Groper, 10921 N. Wilshire Blvd., Suite 1101, Los Angeles, CA 90024.

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Requests for reprints should be directed to Dr. Tadamichi Takehara, Department of Preventive Dentistry, Kyushu Dental College, Kokurakita-ku, Kitakyushu 803, Japan.

Primary maxillary bilateral birooted canines—page 235

Requests for reprints should be directed to Dr. David J. Hayutin, Senior Pediatric resident at Children's Hospital of Michigan, 3901 Beaubien Blvd., Detroit, MI 46201.

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ABSTRACTS *(cont from p 173)*

Yamashita, Yoshihisa; Miyazaki, Hideo; Ueno, Sachiko; Takehara, Tadamichi: Dentocraniofacial structure with complete anodontia of permanent teeth: Report of case. J Dent Child, 59:231-234, May-June 1992.

Dentocraniofacial structure with ectodermal dysplasia, showing complete anodontia of permanent teeth, was examined. Except for a slight decrease of the sweat pore count, the patient was free of signs of ectodermal dysplasia, other than odontoplasia. Furthermore, her family history had no record of hypodontia or anodontia. We attempted to clarify the role of tooth growth in the dentocraniofacial development. Cephalometric analyses revealed the extreme limitation of the maxillary and vertical growth of the lower face, and a retracted mandibular alveolus front. We concluded that the role of tooth growth was significant in the development of the maxillary and alveolar bone, but not in the development of the mandible.

Ectodermal dysplasia; Anodontia, permanent teeth; Facial growth; Dental growth

CLINIC

Measurement of preventive resin restorations using computer profilometry

J.P. Conry, BDSc, MS
J.P. Beyer, DDS,
M.R. Pintado, MPH
W.H. Douglas, PhD

The preventive resin restoration (PRR) has emerged as an alternative aesthetic and conservative replacement for Class I amalgam restorations in permanent molar teeth. Recent studies have reported on the clinical durability and longevity of preventive resin restorations, while others have compared it to amalgam.[1-5] The preventive resin restoration combines an intracoronal restoration with an extracoronal sealant. Loss of sealant alone may not necessarily impair the clinical performance of the remaining restoration. This complicates measurement of clinical performance. The traditional method, described by Cvar and Ryge, is not capable of detecting changes in occlusal contour of less than 150μ.[6-7] A more discriminating and unambiguous method of measurement is required. In a recent comprehensive review, Kreulen suggests that an evaluation method appropriate for a longitudinal clinical study of posterior composite restorations should have the following characteristics:

- ☐ It should not rely exclusively on human observation.
- ☐ It should afford direct computer-aided 3-D reconstruction of the restoration.
- ☐ Use polyvinylsiloxane impressions and epoxy replicas.
- ☐ Use references which do not involve alteration of the tooth or restoration.
- ☐ It should have a data acquisition method that can detect differences in height of 10μm.[8]

The computer guided profilometry system, developed at the Biomaterials Research Center at the University of Minnesota, fulfills these criteria. This system has been used successfully in a number of clinical studies to measure pit and fissure sealants quantitatively, enamel wear, and amalgam.[9-14]

A stated advantage of preventive resin restorations is that they result in less destruction of sound tooth structure. By contrast, the traditional "extension for prevention" philosophy of Class I amalgam restorations requires that greater amounts of tooth structure be removed. In a recent clinical study Walls and Welbury have suggested that minimal composite restorations resulted in removal of only 5% of the molar tooth surface, a remarkably low figure.[5-15] To date, no one has used a quantitative measurement method to substantiate those claims.

This question is of more than academic interest, since dentists vary considerably in the treatments they recommend for occlusal surfaces.[16,17] Several studies have shown that amalgam restorations require frequent replacement.[18,19] Walls *et al* reported the five-year sur-

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vival rate of occlusal amalgam restorations in first permanent molars to be 30 percent for patients five to seven years of age and 43 percent for children seven to nine years.[18] Each time a defective amalgam is replaced the cavity periphery is increased significantly[17] The attractions of a minimally destructive restorative method are obvious.

The volume, depth, and area of extra-coronal material deposited on occlusal surfaces as a consequence of preventive resin restorations have not been previously reported. The surface area of preventive resin restoration cavity preparations has not been quantified. These measurements provide an absolute baseline for assessing clinical performance over an extended period. The specific objectives of this study were:

- ☐ To measure quantitatively volume, depth and area of extracoronal material (sealant and posterior composite) applied, when first permanent molars are restored with a preventive resin restoration and obtain, furthermore, three-dimensional graphic representation of this material on the occlusal surface.
- ☐ Measure the projected surface area of the cavity preparations.
- ☐ Report cavity area as a percentage of occlusal area.

MATERIALS AND METHODS

Approval for this study was received from the University of Minnesota Committee on the Use of Human Subjects in Research. Thirty-three pediatric patients (mean age 11 y 6m ± 2y 11m) who required a preventive resin restoration (PRR) in a lower first permanent molar were identified, and informed consent was obtained. Each subject received a comprehensive dental examination and bitewing radiographs were available. One or more of the following criteria were used to determine whether the tooth should be restored with a preventive resin restoration:

- ☐ Explorer catch in the pit or fissure of an otherwise intact occlusal surface
- ☐ Deep pit or fissure that prohibited complete penetration of sealant.
- ☐ Opaque or chalky appearance along a pit or fissure suggesting incipient caries.
- ☐ Small carious lesion confined to one area of the occlusal surface.

Teeth with extensive occlusal caries; proximal caries, requiring pulp therapy; or where centric occlusal stops would have been entirely on composite were excluded. After administration of local anesthetic and isolation with rubber dam, the lesion was entered with a #330 bur. Where necessary, additional caries was removed with small round burs. Only carious and questionably carious areas of pits and fissures were included in the preparation. No additional mechanical retention was placed. All exposed dentin was protected with a layer of glass ionomer cement. In deeper preparations, a thin layer of calcium hydroxide was placed beneath the glass ionomer. All occlusal enamel was etched with 37 percent phosphoric acid for 60 seconds. The tooth was washed with air and water for 30 seconds and dried with a continuous stream of dry air until the enamel surface appeared chalky. A thin layer of bonding resin was applied to the walls and margins of the preparation and was cured for 15 seconds. The cavity was then filled incrementally with a light-cured posterior composite.* Each increment was cured for 60 seconds in a standard manner. The preparation was not filled beyond the cavosurface margin.

Finally an opaque light-cured fissure sealant** was applied over the restoration and to the adjacent pits and fissures. A minimal technique was used. The sealant was light-cured for 40 seconds. The occlusion was checked and adjusted when necessary with multifluted finishing burs and fine diamonds. Polyvinylsiloxane*** impressions were taken of each tooth before cavity preparation, immediately following cavity preparation, and before dismissing the patient. Epoxy† replicas were made from the "before preparation", "after preparation", and "after restoration" impressions. All tooth replicas were mounted with Die Keen stone‡ in a nylon ring using an index jig. Surfaces of each replica were profiled and digitized, using a precise displacement stylus and programmable data retrieval system. The stylus was scribed across the replica surface and the coordinates for each consecutive surface point were fed into a dedicated microcomputer and stored on magnetic disk. The process is described in more detail elsewhere[20] As sequential profiles of surfaces were made, three-dimensional coordinates for all surface points became available, thus capturing occlusal anatomy. Computer generated graphic images of occlusal surfaces "before preparation" (original anatomy), and "after res-

*P-50 -3M, St. Paul, Minnesota.

**Concise -3M, St. Paul, Minnesota.

***Express -3M, St. Paul, Minnesota.

†Epoxy-Die -Ivoclar, Liechtenstein.

‡Columbus Dental, St. Louis, Missouri.

toration" (final anatomy) were superimposed using a "goodness of fit" mathematical program, AnSur©. For each tooth, the clinician/investigator viewed both images in profile slices cut at intervals of 100μm across the occlusal surface. Where necessary, customized adjustments were made to the superimposed fit. The program calculated the absolute volume difference, absolute area, maximum depth difference and mean depth difference between surfaces, i.e. the dimensions of the extracoronal material. The "before preparation" (original anatomy) and "after preparation" occlusal surfaces were compared in a similar way, thus, yielding the area of the cavity preparation.

The image processing features of the program were used to define and measure the occlusal area of each tooth. This was done by "tagging" the maximal cusp height buccally and lingually with a cursor line at each successive horizontal profile (xlOOμm). The maximal height of contour of the marginal ridges defined the mesial and distal occlusal boundaries. The computer then calculated the area within the cursor lines, giving the occlusal area.

RESULTS

The results are summarized in Tables 1 and 2. The percent of occlusal surface occupied by each preventive resin cavity preparation is shown in Figure. A Pearson correlation matrix was used to examine the relationship between the restoration variables (extra-coronal volume, resin depth, and resin area) and variables in preparation (occlusal area and area of preparation). There was a moderate correlation between sealant area and preparation area ($r = 0.401$, $p = 0.021$) and between sealant area and occlusal area ($r = 0.498$, $p = 0.003$). There was no correlation between sealant depth and preparation area ($r = -0.082$, $p = 0.649$) or sealant depth and occlusal area ($r = -0.109$, $p = 0.545$). The third variable, extracoronal volume, showed a similar lack of relationship with the independent variables, preparation area ($r = 0.083$, $p = 0.646$), occlusal area ($r = 0.18$, $p = 0.316$). Because the occlusal area and preparation area did not correlate with each other ($r = 0.113$, $p = 0.528$), a partial correlation was undertaken to measure the independent contributions of occlusal area and preparation area to the area of sealant applied. With occlusal area as the fixed effect, preparation area and sealant area showed the same moderate correlation ($r = 0.4001$, $p = 0.023$). Similarly, with preparation area as the fixed effect, occlusal area and sealant area correlated moderately ($r = 0.497$, $p = 0.004$). Finally, a multiple regression procedure was used to measure the combined effect of occlusal area and preparation area on the area of sealant applied. Together, these two variables were better predictors of sealant area than either one individually (R Square $= 0.368$, $F = 8.75$, $p = 0.001$).

Table 1 ☐ Mean extracoronal volume, depth and area of material applied (sealant and resin) to molars.

	Volume (mm3)	Mean area (mm2)	Mean depth (μmm-)†	Maximum depth (μmm)*
Mean	6.52	27.13	222.52	1096.72
S.D.	2.9	5.72	83.09	231.87
Range (n = 33)	14.92–1.62	39.45–17.03	414–47	108.73–108.73

† average depth of material applied to each tooth
* greatest depth of material on each tooth

Table 2 ☐ Mean occlusal area, mean cavity preparation area and percent area occupied by cavity preparation.

	Occlusal area* (mm2)	Preparation area* (mm2)	Percent area occupied
Mean	51.86	9.81	19.02
S.D.	5.75	4.88	9.25
Range (n = 33)	62.71–42.21	24.28–1.40	45.87–2.66

* projected

DISCUSSION

The average amount of extracoronal material deposited was substantial, 6.52 ± 2.9 mm^3. This material represents an initial alteration of the occlusal morphology. The preventive resin restoration does not restore preexisting anatomy. The final morphology is dictated by the quantity of sealant applied and the degree to which the occlusion is adjusted after placement. To what extent this alteration in morphology is permanent depends upon the amount of sealant lost over time. In an earlier study, using the same sealant material and measurement techniques, we reported a 14 percent loss of sealant volume from premolars at six months and a 24 percent loss at 30 months.[11,12] In that study, the more clinically significant measurement factor, sealant area, changed less dramatically. There was a 6.5 percent loss of sealant area at six months increasing moderately to 7.7 percent at 30 months. If the sealant component of preventive resin restorations behaves in a like manner, there can be large changes in volume (and consequently, morphology) without loss of coverage from the susceptible pits and fissures.

In this study, the average area of sealant applied

(27.13 mm^2) was almost three times greater than the average area of the cavity preparation (9.81 mm^2). One can speculate that such a large additional area of bonded material surrounding the cavity contributes to the integrity of the restoration. This benefit has previously been recognized by Hicks.[21]

A review of the raw data and computer graphic representations of surface change showed that the greatest thickness of sealant occurred in the central pit region or over the cavity area. The large difference between mean depth of sealant applied (222.52 μm) and maximum depth of sealant (1096.72 μm) illustrates the degree to which occlusal anatomy was obliterated. There is a tendency for sealant to pool in the center of the tooth during application, but before polymerization. Careful technique or possibly modifying the viscosity of the sealant should minimize this effect.

The preventive resin cavity preparations occupied, on average, 19 percent of the occlusal surface. This figure is larger than that reported in previous studies. Walls and Welbury have stated that preventive resin restorations involve only 5 percent of the occlusal surface.[5,15] There are several possible explanations for this appreciable difference. Walls *et al* did not work exclusively with one tooth-group, but placed restorations in

Cavity preparations occupied, on average, 19 percent of occlusal surfaces.

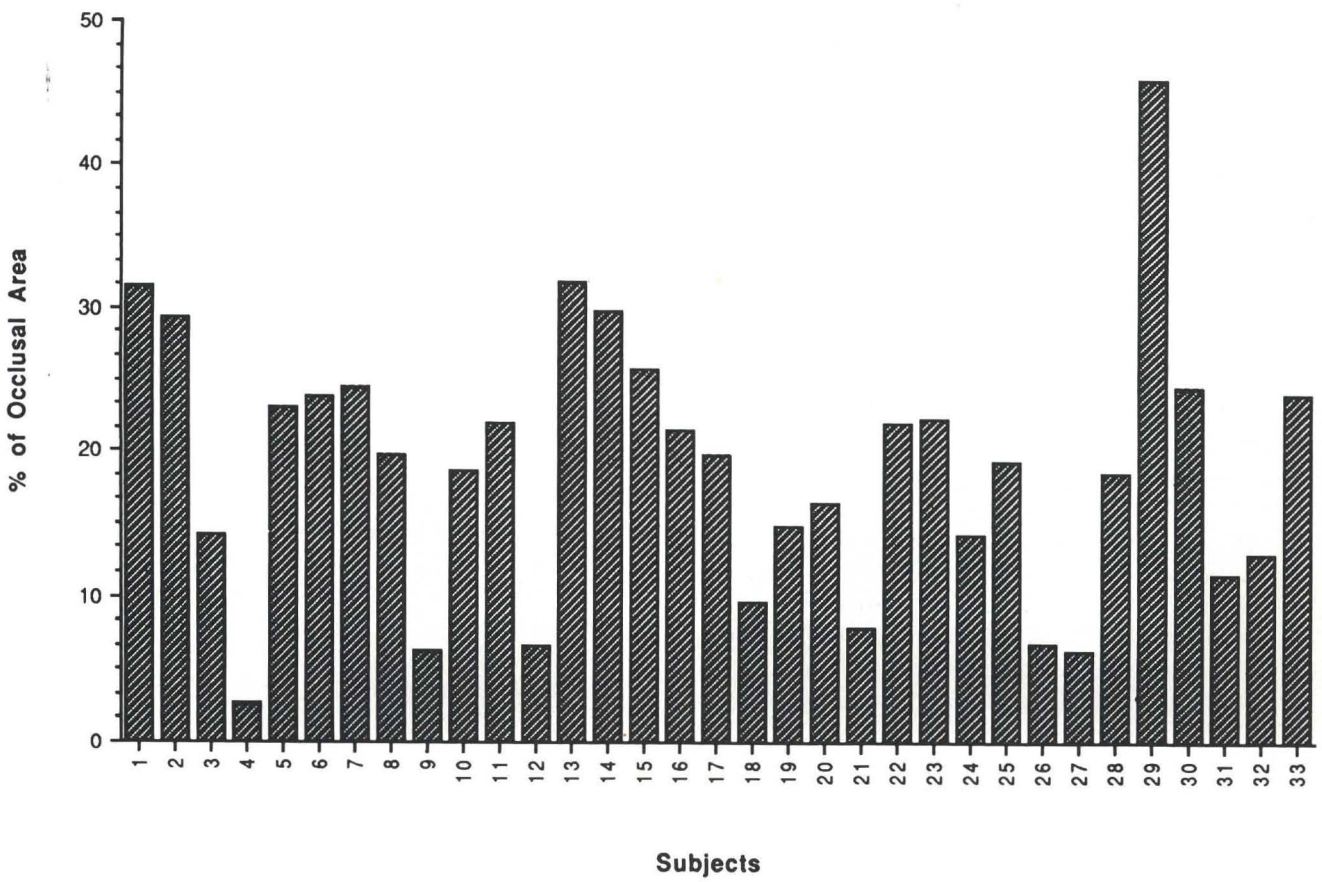

Figure. Percent of the occlusal surface of lower first permanent molar teeth occupied by preventive resin cavity preparations.

maxillary or mandibular first, second or third molar teeth. Diagnosis of caries, especially minimal caries, is highly subjective. Walls *et al* gave a detailed description of the criteria they used to define caries, but it differed from the one used in this study. The method used in their study to measure cavity preparation area was qualitative and indirect. The outline of each cavity was drawn, from memory, on a gridded form. Exactly what constituted the occlusal area was not defined nor were measurements given for the occlusal surface. Our findings suggest that these preparations are more extensive. Subject #29 (Figure 1) should be considered an outlier for the purposes of this discussion. The cavity in that tooth occupied 46 percent of the occlusal surface. During preparation, it was found to be more extensively decayed, but restoration with composite and sealant was still considered clinically prudent.

There were some interesting relationships between restoration variables (extra-coronal volume, sealant depth, and sealant area) and preparation variables (occlusal area and area of preparation). The area of sealant applied positively correlated with both the area of the occlusal table and the area of the cavity preparation. They both influenced sealant area independently and to a similar degree. The multiple regression analysis showed that, when combined, they gave a better prediction of sealant area. Together, these two variables accounted for approximately 37 percent of sealant area. Sealant volume and depth did not correlate with occlusal area or preparation area, which suggests influences from other factors, most likely, occlusal morphology.

The measurement method used can record occlusal morphology at different times, during and after the restorative process. These records can be compared electronically in multiple configurations to give a complete picture of the restoration and the changes it undergoes with time. This approach is significant in that it is primarily quantitative, providing volume, depth, and area measurements. Additionally, the graphic capabilities of the system provide qualitative information. The exact location of restorative material on the tooth can be identified and recorded. Baseline records will be retained permanently on magnetic disk for comparison with later wear measurements or with other studies.

In summary, a large amount of extracoronal material is applied to occlusal surfaces of lower molars as a consequence of the preventive resin method. The extracoronal volume applied ($6.52 \pm 2.9 mm^3$) resulted in significant changes to the occlusal morphology. Clinicians should avoid using excessive amounts of sealant, when placing these restorations. Preventive resin cavity preparations occupied, on average, 19 percent of the occlusal surfaces of lower first permanent molars. This is higher than previously reported.

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Dental erosion associated with asymptomatic gastroesophageal reflux

Gregory Taylor, DDS
Sharon Taylor, MD
Richard Abrams, DDS
William Mueller, DMD

Dental erosion or perimylolysis is the irreversible loss of tooth structure, beyond that of normal wear. This condition was first described in 1933, associated with chronic vomiting, and since then has been frequently reported in association with many medical, chemical, and local causative agents.[1-16] Here we report the case of severe dental erosion due to completely asymptomatic gastroesophageal reflux.

DENTAL HISTORY AND FINDINGS

In March 1990 an eight-year-old Caucasian female was referred to the Pediatric Dental Clinic at The Children's Hospital, Denver, for further evaluation of the loss of tooth structure of her primary teeth. Her mother was concerned that the permanent teeth appeared to be showing similar early signs of wear and would be lost prematurely.

Intraoral examination showed extensive loss of enamel on all surfaces of the remaining primary teeth (Stage 4 according to Smith and Knight's 1984 classification).[17] The dental erosion in the mandibular arch was more severe than that of the maxillary arch (Figures 1, 2). The pulp chambers of the remaining primary teeth were easily visible from the occlusal surface, and the deposition of secondary dentin was evident. The teeth were not sensitive to pressure, palpation, percussion or cold; the child had no complaints of pain associated with this condition. The permanent teeth showed early signs of erosion (Stage 1, Smith and Knight) and had lost the luster of healthy enamel. Oral hygiene was poor; the gingiva appeared erythematous, inflamed, and bled easily. There was severe loss of vertical dimension in the posterior arch segments (Figure 3). Soft tissue and all related structures appeared within normal limits. Radiographic examination showed almost complete loss of enamel on all remaining primary teeth, marked narrowing of pulp chambers, and deposition of secondary

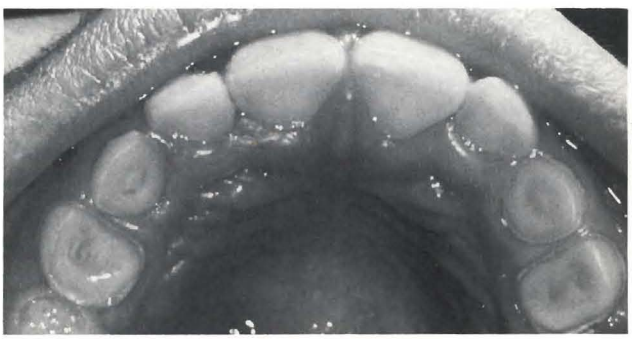

Figure 1. View of maxillary arch showing extensive loss of enamel and outlines of pulp chamber.

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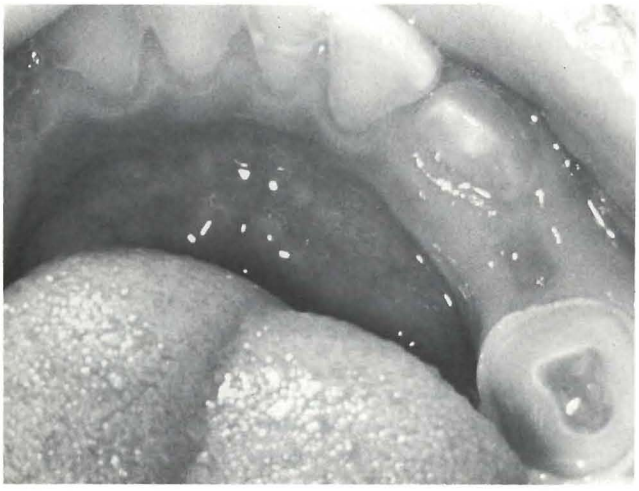

Figure 2. View of mandibular arch showing loss of enamel on lingual surfaces of lower central and lateral permanent incisors, and near exposure of right second primary molar.

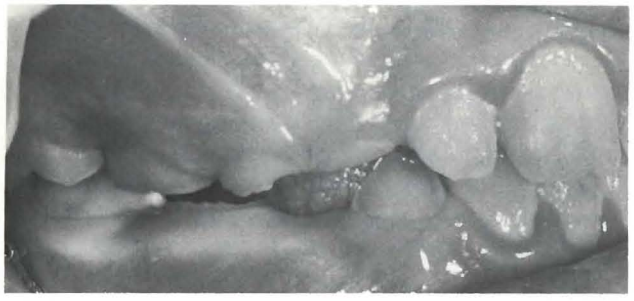

Figure 3. Lateral view showing loss of posterior vertical dimension.

dentin (Figure 4). The eruption sequence of permanent teeth appeared normal.

Salivary flow appeared to be normal. Analysis of a saliva specimen revealed normal values for calcium, phosphorous, total protein content, and pH. Both mother and daughter were questioned in depth as to the patient's eating habits, history of illness, oral habits, dental care, and dental hygiene. She had reportedly received routine dental care since age three, at which time the erosion was noticed but not treated. The patient routinely brushed twice daily with a regular commercial dentifrice. No unusual abnormalities of dental care and hygiene were noted. The patient had a normal birth history with primary tooth eruption first noted at five months of age. The child was breast fed for the first ten months of life, at which time she was weaned to a cup, receiving cow's milk at appropriate daily intakes. Her diet progressed to include table foods at expected intervals. Her intake of juices was limited to usually one serving of apple juice maximally per day. At no time did she ingest large quantities or frequent servings of acidic foods, liquids or medications. Her diet was nearly free of chocolate, carbonated-caffeinated beverages. Chewing gum was enjoyed only occasionally. There was no history of ingestion of nonfood substances. The child was then referred to the Pediatric Gastroenterology Clinic for further evaluation.

MEDICAL HISTORY AND FINDINGS

The patient and her mother denied any gastrointestinal symptoms of weight loss, vomiting, spitting, rumina-

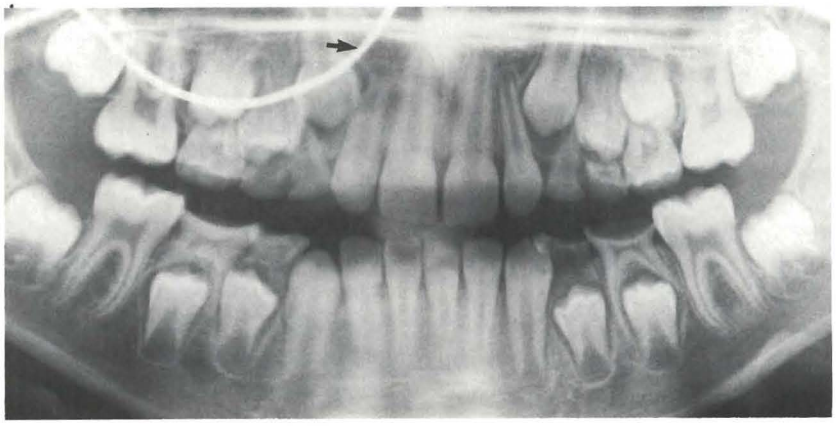

Figure 4. Panoramic radiograph showing extensive loss of enamel and deposition of secondary dentin on all primary teeth. Arrow indicates pH probe.

Acid clearance time averaged 4.3 minutes, twice the normal.

tion, swallowing problems, abdominal or chest pain, early satiety, colic in infancy, or irregularity of bowel movements. The child was supervised by her parents or reliable day-care providers, who noted no emotional disturbances, behavior abnormalities, or discipline problems. Supervision during sleep revealed no bruxism, nocturnal emesis or excessive drooling. There was no evidence of the patient having a chronic malodorous breath.

On physical examination, the child proved to be a bright, cooperative eight-year-old female, well hydrated, and in no acute distress. Height of 131 cm and weight of 27.2 kg were both in a normal range for age. She had no detectable nutritional deficiencies of hair, skin, or nails. HEENT examination was normal except for her dentition. Chest examination, revealed clear breath sounds, normal heart tones and lack of tenderness with palpation of bones and joints. The abdomen was flat and symmetric on inspection with normal bowel sounds. There were no areas of tenderness, organomegaly, masses, or fecal retention.

A pH probe was placed 5 cm above the lower esophageal sphincter with continuous esophageal pH monitoring for twenty-four hours during both periods of wakefulness and sleep. The child was ambulatory with a portable recording unit to allow simulation of usual activities. Her oral intake was ad libitum, with meals at least three hours apart and intake recorded. Results were grossly abnormal, with esophageal pH <4 for 33 percent of monitored time (normal < 5 percent) and an average of 4.7 episodes of acid reflux per hour. There were nineteen episodes of prolonged acid reflux > 5 minutes duration, occurring predominantly during sleep. Acid clearance time averaged 4.3 minutes, over twice the normal time to clear acid from the esophagus.

The child then underwent upper intestinal endoscopy, which revealed no ulcerations, or abnormalities of esophageal, gastric or duodenal mucosa. Specifically, no hiatal hernia, obstruction or esophageal strictures were encountered. Mucosal biopsies of the gastric antrum, distal and mid-esophagus revealed no signs of infections, allergies, or other chronic or acute inflammatory processes.

TREATMENT

The patient was sent home and the parents instructed to take pH readings from both right and left sides of the mouth an hour after the onset of sleep nightly for a week. The readings showed an average of 5.0 on the right side and 5.5 on the left side (average normal 6.5), indicating excessive acid in the mouth during sleep.

The patient was instructed to change from a waterbed to a regular mattress bed and to sleep with head elevation by two to three pillows.[18] Metoclopamide (Reglan®) at a dose of O.1 mg/kg body weight per dose before meals and at bedtime was prescribed to reduce the frequency and volume of the reflux. Ranitidine (Zantac®) (4 mg/kg body weight per day) was given to decrease gastric acid produced and thus available to be refluxed into the oral cavity.

Maxillary and mandibular custom trays were fabricated with the recommendation that a neutral sodium fluoride gel be applied twice daily.[19] In addition, fissure sealants were applied to the permanent first molars, and a sodium bicarbonate mouth rinse recommended three to four times daily.[20-22]

DISCUSSION

Dental erosion has been reported in the literature associated with many system conditions, including vomiting, anorexia, bulimia, hiatus hernia, and in cases of gastroesophageal reflux. In this paper we are reporting the case of a child in whom dental erosion was the only presenting symptom and who was later found to have gastroesophageal reflux by testing. To prevent ongoing damage to dentition, the child is currently being treated symptomatically with metoclopramide to reduce the volume and frequency of acidic gastric content reflux and with ranitidine to suppress excess gastric acidity. In addition, this patient has had custom fluoride trays manufactured and receives twice daily applications of a neutral sodium fluoride gel. Sodium bicarbonate mouth rinses were also recommended, along with placement of fissure sealants.

The dilemma presented by this child is that these

treatments are directed at the oral symptoms rather than the underlying medical problem. Correction of the marked gastroesophageal reflux would require major abdominal surgery in the form of a fundoplication to be curative. Surgery would likely be recommended for evidence of esophageal damage, anemia, aspiration pneumonitis, or chronic malnutrition, none of which existed in this patient. The question that arises is, is loss of tooth structure sufficient indication to recommend abdominal surgery for a child? Without it, our palliative treatment may slow the process, but the child will likely eventually erode her entire permanent dentition. At this point, we are continuing to treat the child symptomatically with the decision to treat surgically delayed until we can evaluate the results of our treatment.

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PERPETUAL POVERTY: CHILD HEALTH AND THE UNDERCLASS

Poverty, albeit a functionally useful economically defined risk for poor health, encompasses a heterogeneous group of people. Groups of poor people have more dissimilaries than similarities. Simple classification based on income is misleading and masks difficult to reach subpopulations such as the underclass. Stating that poverty is associated with high rates of infant mortality does a disservice to the functional, more advantaged working poor who utilize prenatal care services, but also ignores the overwhelming effects of the negative behavioral and environmental factors of the dysfunctional and most disadvantaged people of the underclass. The realization that all poor people are not disadvantaged equally, that poor neighborhoods are not equally "bad," and that being underclass increases the risk of poor child health will eventually help to implement targeted programs to improve the outcome of specific poor and underclass populations.

Kliegman, R.M.: Perpetual poverty: Child health and the underclass. Pediatrics, 89:710-713, April 1992.

Mesiodens in the primary dentition stage: A radiographic study

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Tzong-Ping Tsai, BDS, MS
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The prevalence of hyperdontia in the general Caucasian population is reported in the range of 1-3 percent, and predominantly in the premaxillary region.[1-3] A supernumerary tooth between maxillary incisors is called a mesiodens.[4] The etiology of hyperdontia is still obscure, though several theories have been reported. Originally, it was proposed that hyperdontia was an example of phylogenetic reversion (atavism), post-permanent dentition; this theory, however, is now largely disproved. A second theory proposed that hyperdontia was the result of a split of a tooth bud.[5] This theory holds some appeal, because germination may be a similar, but incomplete, process of dichotomy. A third theory proposed that hyperdontia was the result of local independent hyperactivity of the dental lamina.[1] Although all theories without sufficient embryologic evidence are only hypothetical, most literature supports the dental lamina hyperactivity theory.[1,3,6,7]

The presence of mesiodens may pose some clinical problems, especially in the stages of the primary and early mixed dentitions. The most common clinical complications of mesiodens include an abnormal central diastema, abnormal tooth eruption, and abnormal occlusion development.[1,3,6,8,9] Other complications involving the mesiodens itself include aberrant eruption and cystic degeneration.[6,9-11]

Although mesiodens may cause many possible complications, not all mesiodens should necessarily be removed. Surgical removal of mesiodens is considered, if the developing complications are suspected, or the tooth would serve little function, or the tooth is associated with certain pathological conditions. The prognosis for surgical intervention should also be considered. When to treat mesiodens is highly controversial. Many authors prefer an early approach, hoping to prevent clinical complications or to take advantage of spontaneous correction of clinical complications.[1,6,12] Early intervention should be based on adequate radiographic diagnosis, sound surgical technique, and proper behavior management. At the same time, an early surgical approach also poses the risk of damaging adjacent developing tooth germs or roots.[13,14] Surgical complications, however, may be rare and temporary.[13] Whether an early or delayed approach is used, early diagnosis is most important, and will lead to a more comprehensive long-term treatment plan.

Most literature about mesiodens appears in the form of case reports. Studies of the prevalence of mesiodens involving certain ethnic or racial population, including Scandinavians, Hispanics, and Japanese have been published.[3,7,8,15-17] The present study involving Chinese children was undertaken to describe the prevalence of mesiodens in the primary dentition stage, as well as the preferred location and direction.

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MATERIALS AND METHODS

The present study involved 1869 new patients who attended the Department of Pediatric Dentistry, CGMH from November 1987 to March 1989. All had clinical and radiographic examinations including maxillary and mandibular anterior occlusal films and bilateral posterior bitewing films. Subjects were selected under the following criteria:

- ☐ Native Chinese.
- ☐ In primary dentition stage.
- ☐ No history of trauma, extraction, or exfoliation of maxillary primary anterior teeth.
- ☐ No extensive decay or demorphosis of maxillary primary anterior teeth.
- ☐ No skeletal or systemic disturbances likely to be associated with oral manifestations, for example: cleft lip/palate, cleidocranial dysostosis, craniofacial dysostosis, and oligodontia.

Radiographic examination of the premaxillary region was based on a maxillary anterior occlusal view interpreted independently by three dentists. Any patient with radiographs not disclosing the presence of primary incisors or the toothbuds of the permanent incisors was excluded. The total number of subjects was 543 (male: 288; female: 255). The mean age was 4.45 years; range 2.5-7 years.

Radiographic observations included numbers of mesiodens; location distribution: right, midline, left; as well as direction distribution: normal, inverted, horizontal (Figure 1). Standard films, equipments, exposure technique, and processing procedure were regraded during the radiographic procedure.

RESULT

Distribution of mesiodens

Among 543 patients, thirty-nine patients had fifty mesiodens for an average of 1.3 mesiodens per person. The result is shown in Table 1. Sex distribution was in favor of males in the ratio of 2.55:1 (significant in Chi-square, $p<0.05$). The prevalence of mesiodens in the primary dentition stage was 7.8 percent.

Table 1 ☐ Distribution of patients with mesiodens by sex and number.

	Number		
	One	Two	Totals
Male	18	10	28
Female	10	1	11
Totals	28	11	39

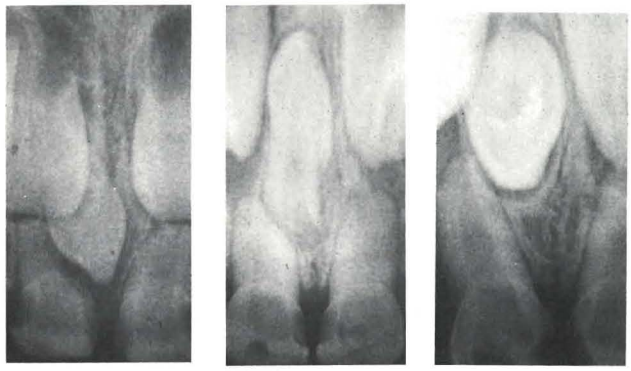

Figure. Anterior occlusal films show mesiodens in different directions. a: normal; b: inverted; c: horizontal.

Location

The results showed that the mesiodens were found slightly more frequently in the right side than the left side, 58 percent and 38 percent respectively, and only 4 percent of mesiodens were found exactly on the midline.

Direction

The correlation of location and direction of mesiodens is shown in Table 2. The mesiodens occurred mostly in a normal direction rather than in an inverted or horizontal direction in the ratio of 58 percent, 34 percent, 8 percent, respectively. Among eleven patients with double mesiodens, seven pairs were in the same direction and mostly in a normal direction (five pairs), as shown in Table 3.

Table 2 ☐ Correlation between location and direction of mesiodens.

	Location			
Direction	Right	Left	Middle	Totals
Normal	16	11	2	29
Inverted	12	5	0	17
Horizontal	1	3	0	4
Totals	29	19	2	58

Table 3 ☐ Distribution of mesiodens by direction.

		Two mesiodens		
	One Mes.	Same D.	Different D.	Totals
Normal	15	5, 5	4	29
Inverted	12	1, 1	3	17
Horizontal	1	1, 1	1	4
Totals	28	14	8	50

DISCUSSION

The present study included children of ages between 2.5 and 7 years. They were examined with clinical and radiographic techniques, and exhibited a 7.8 percent prevalence of mesiodens. Differences from previous reports are shown in Table 4.[3,7,8,15,16] Different racial populations showed different prevalences, and the Mongoloid population showed a higher prevalence of hyperdontia.[17,18]

Besides racial differences, age composition of the subjects and examination methods are the most important factors influencing the results. Prevalence in an older age-group would be underestimated, because a high percentage of primary supernumerary teeth would erupt in a normal direction and would exfoliate or be extracted during the mixed dentition stage. In the present assessment, patients were in a fully primary dentition stage, old enough to allow adequate clinical and radiographic examination, yet had not reached the normal tooth-shedding stage. In this way, the possibility of loss of mesiodens was excluded, so the result showed a higher prevalence than other studies. The patients coming to this hospital, however, did not necessarily represent the general population.

Another important determining factor is the diagnostic methods used. With only visual examination, the results would be far below the true prevalence.[7] Other studies involving panoramic examination would underestimate the prevalence of mesiodens, because panoramic radiographs exhibit some distortion or burned areas especially in the anterior midline region.[3,8,19] In the study, we used the maxillary anterior occlusal view for screening, not only because of its detail and precision, but also because this radiograph shows most structures in the premaxillary region. The maxillary anterior occlusal view is more reliable for diagnosing mesiodens. The technique for taking such films is well tolerated by very young children, and may be recommended for initial screening, during the first visit of very young children.

To determine the dental origin of mesiodens is not practical. Differentiation of the primary or permanent tooth should be based on the neonatal line, not just based on the developmental stage or relative position to adjacent teeth. In this study, we identified some inverted mesiodens with full root development located between permanent maxillary central incisors. This evidence was in conflict with the findings of Hamerfelt.[8]

Panoramic radiographs will not always show the presence of mesiodens.

Sex predilection of male over female (2.55:1) agreed with most studies, but conflicted with the findings of Luten.[1-3,8] Dixon *et al* proposed the possibility of sex-linked inheritance for males in hyperdontia.[20] None of the present thirty-nine patients with mesiodens had any family relationship with one another.

The present study included all erupted and unerupted mesiodens, and the majority (58 percent) were in a normal direction. Among the eleven patients with double mesiodens, four pairs of mesiodens were in different directions. They would be good examples for tracing the directional change of mesiodens during growth.

The immediate clinical importance of mesiodens in the primary dentition stage is not so apparent as in later stages. The prevalence of mesiodens in these selected patients was higher than in other studies. Their presence may be neglected by some dentists or parents until clinical complications become evident. Early radiographic diagnosis of mesiodens would help to predict those possible complications.

Table 4 ☐ Review of prevalence of mesiodens in previous studies.

Author	Sample			Diagnostic methods				Prevalence Percent
	No.	Age (y/o)	Race	V.	PA.	AO.	PAN.	
Mckidden (1971)	1500	3-12.5	Caucasian	+	+			1.53
Jarvinen (1980)	1141	3-4	Finnish	+	±			0.4
Buenviaje (1984)	2439	2-12	Caucasian	+			+	0.45
Hurlen (1985)	63029	*	Norwegian	+	+		+	1.43
Kaler (1988)	3532	4-18	Hispanic	+		+		2.2

V. = visual, PA. = periapical film
AO. = anterior occlusal film, PAN. = panoramic film
* = no special age-group, ± = only to suspected individuals

With regular radiographic follow-up, surgical removal of mesiodens may be performed to prevent potential complications and to take advantage of possible self-correction of malpositioned permanent teeth. Sound surgical intervention should be based on accurate radiographs taken from different directions in order to reduce the risk of damage to adjacent teeth.

Since mesiodens may interfere with normal occlusal development, especially in the mixed dentition stage, early diagnosis of mesiodens with anterior occlusal radiographs during the primary dentition stage may allow a more comprehensive long-term treatment plan and a more favorable prognosis.

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FLUORIDE CONCENTRATIONS OF INFANT FOODS AND DRINKS

It has been suggested that the incidence and severity of enamel fluoride mottling or fluorosis has become greater in the last decade [Leverett, 1982; Driscoll et al., 1983; Szpunar and Burt, 1987]. One of the suggestions for the cause of this apparent increase has been an increase in fluoride in the food chain [Leverett, 1982; Moller, 1982]. Young children may ingest fluoride from many sources including water, drinks and food as well as from non-dietary sources such as fluoride supplements, toothpastes and professionally administered fluorides. The ingestion of toothpastes by young children has been well recognized as a probable source of excessive systemic fluoride during tooth development [Barnhart *et al*, 1974].

In infancy the main sources of fluoride are thought to be from commercially available beverages and foods used during weaning as this period coincides with the calcification of different stages of the developing permanent tooth crowns. This is thought to be a critical time for ensuring that the optimum levels of ingested fluoride are not exceeded. There have been several previous studies on the fluoride content of baby foods and drinks, such as milk [Adair and Wei, 1978; Johnson and Bawden, 1985], dinners and desserts [Ophaug *et al*, 1980, 1985; Debeka *et al*, 1982] and beverages [Adair and Wei, 1979], but these studies have been limited mainly to foods produced in North America.

Vlachou, A. *et al*: Fluoride concentrations of infant foods and drinks in the United Kingdom.
Caries Res, 26:29-32, January-February 1992.

Multispecialty team management of a case with impacted maxillary permanent canines

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Impacted maxillary canines are a common problem.[1] Management options include an initial surgical procedure, followed by orthodontic alignment, except where it is decided to remove the impacted canines. The treatment plan should be made only after interdisciplinary consultation, which should consider the following factors:

- ☐ The postsurgical treatment.
- ☐ The type of orthodontic appliance to guide the impacted teeth into their correct positions.
- ☐ When the appliance should be inserted (i.e. before, after, or during surgery).[2]

SURGICAL EXPOSURE AND ORTHODONTIC TRACTION

Although differing in opinion concerning the indications for surgical exposure of unerupted canines, orthodontists probably would agree that the potential path of eruption of the canine must be toward the surface and unobstructed, if treatment is to succeed. When eruption is complete, the apex must be near to normal position in all planes for reasonable aesthetic results. These criteria are fulfilled only, if the path of eruption of the tooth passes through the site at which the canine apex is normally situated.[3]

Occasionally a tooth will erupt into its correct position, once obstacles to eruption have been removed by surgical exposure; but this is rarely the case after root formation is complete. Even a tooth that is aimed in the right direction usually requires orthodontic forces to bring it into position after surgical exposure.[1] Attachment should be bonded to the crown either during or soon after the surgical exposure is made; and orthodontic traction to move an unerupted tooth toward the line of the arch should begin as soon as possible after surgery. Ideally a fixed orthodontic appliance should be in place, before the unerupted tooth is exposed. If this is not practical, active orthodontic movement should begin no later than two or three weeks postsurgically.[1]

AUTOTRANSPLANTATION

Autologous tooth transplantation was originally described by Widman in 1915, for transplanting an impacted canine to its normal site.[4] Transplantation of an impacted maxillary canine to its normal anatomic site is a very difficult procedure from a surgical point of view, because the impacted tooth is not easily extricated without injury to its surface, and the primary canine alveolus is comparatively small.[4] It was suggested that preparation of the recipient alveolus following removal of the primary canine is best accomplished by removing the labial plate.[2] Without an erupted permanent canine, there is no canine eminence to accommodate the transplanted permanent canine in its normal position. Furthermore, creation of a new socket from the palatal aspect, without removal of the labial plate, would position the canine too far palatally.[4]

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The prognosis for autotransplants is significantly better, when the donor tooth is immature, has an open apex, and the root is about two-thirds formed.[4] It is crucial to maintain viability of the surface periodontal ligament and cementum; handling should be kept minimal, therefore, to ensure normal reattachment. With normal reattachment, an autotransplant can be expected to survive as long as a normal tooth.

Antibiotic prophylaxis should start three days before and continued until ten days after transplantation, to prevent infection during the early attachment phase. The transplant generally begins to stabilize by three weeks and is often immobile by four weeks. The splint placed at the time of surgery can be removed at that point. During the initial three-week postoperative period, the diet should be restricted to fluids and soft foods; and the transplant must be kept slightly out of occlusion, if irreversible damage is to be avoided.[4] The prognosis for an autotransplant is highly dependent on case selection and the care with which surgery is performed. In carefully selected cases, the success rate can be as high as 90 percent.[5,6] For autotransplants performed when the tooth is fully developed, however, the ten-year survival rate reported by Hansen and Fibaek was as low as 44 percent.[7]

Autotransplant failures are usually evident within a year.[4] When a transplant shows no signs of root resorption and root maturation continues for two years, the prognosis for long-term survival is excellent. If it is pain-free and firm, with normal pocket depth, and without progressive root resorption after five years, it may be considered capable of indefinite survival—an unqualified success.[4]

SURGICAL REPOSITIONING

In surgical repositioning, the tooth is forcibly torqued and moved into a new alignment, after first performing an osteotomy to prepare the alveolus for reception of the repositioned tooth. The apex of the root should be carefully kept in the same relative position, so that revascularization of the pulp tissue may occur postoperatively.[2] Surgical repositioning alone, however, is seldom adequate to upright an impacted canine excluding cases where the canine is in a gross malposition.

BLEACHING OF NONVITAL TEETH

It is common to find nonvital teeth turning gray. Staining due to pulpal bleeding can be the result of either trauma or bleeding during extirpation of vital pulp tissue. Haemoglobin released from erythrocytes breaks down to release compounds such as hematoidin and hemosiderin, which will stain dentine. The breakdown products of bacteria and other remnants of necrotic pulp tissue will also cause staining as they permeate the dental tubules. Restorative materials used to fill the access cavity may also stain the tooth, such as silver amalgam; the stain it causes can be difficult to remove.[8]

Bleaching procedure performed on nonvital teeth requires removal of the restorative material and thorough debridement of the access cavity and pulp chamber. To prevent any of the chemicals permeating the root canal, the root filling must completely seal the canal space, and a lining of hardsetting cement, such as zinc phosphate cement, must be placed in the pulp chamber.[8] Cotton pledgets saturated with 30 percent hydrogen peroxide should then be used to cover the surface of the tooth crown, and placed in the pulp chamber. The hydrogen peroxide can be heated using a hot instrument or a heating light, when several teeth are to be bleached at the same time. The patient should be reviewed in five to seven days and the procedure re-

In transplanting a tooth, it is necessary to maintain the viability of periodontal ligament and cementum, to ensure normal reattachment.

peated, if necessary. If little improvement is observed after two visits, the prognosis is considered poor.[8]

Nutting and Poe described a method of bleaching called the 'Walking Bleach Technique', because the chemicals gradually bleach the teeth between appointments.[9] In essence, this technique involves the sealing of a mixture of sodium perborate and a few drops of hydrogen peroxide in the pulp chamber of a nonvital tooth. The advantage of this technique is the saving of clinic time and the fact that it can be used in combination with bleaching done in the dental surgery.

CASE REPORT

A fifteen-year-old Chinese girl was referred by a general dental practitioner to the Prince Philip Dental Hospital in March 1987. She presented with a maxillary median diastema and retained maxillary primary canines. Radiographic examination revealed the ectopically positioned maxillary canines impacted against the distal aspects of the roots of the central incisors (Figure 1). The apices of the canines were closed.

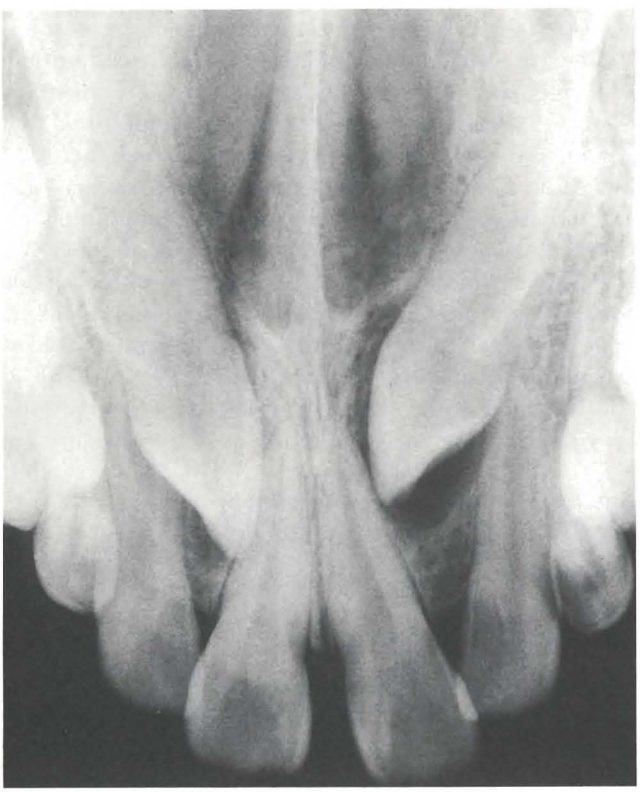


Figure 1. Maxillary anterior occlusal radiograph showed the unerupted permanent canines impacted against the roots of the central incisors, causing the roots to tip toward each other.

A treatment plan was made jointly by an oral surgeon and an orthodontist. It was decided to transplant the canines into their normal positions, following the extraction of the primary canines. The surgeries were performed, one side at a time in two visits, using local anesthesia and intravenous sedation in the Department of Oral Surgery and Oral Medicine of the Prince Philip Dental Hospital. The labial plates were removed in both transplantations. The cuspal tip of the canine left was also sacrificed during the surgery, to facilitate elevation of this tooth and to avoid damaging the root of the central incisor against which the canine was closely impacted. Pulpal extirpation was done subsequent to transplantation. The canals were filled with gutta percha and AH26, and the access cavities with amalgam. Two months later, they started to turn gray in color.

Orthodontic treatment was started two months after the surgeries. The patient's dentition was in an Angle Class I molar and incisal relationship, well-aligned lower arch and maxillary posterior segments. The maxillary anterior teeth were malaligned, however, and a 3mm diastema existed between the central incisors (Figure 2). A fixed maxillary appliance was used to make the required corrections during six months of active treatment (Figure 3).

The canines, by this time, had turned dark gray (Figures 4 and 5). It was decided to bleach them in an attempt to restore normal esthetics. The amalgam in the access cavities was removed, along with the gutta percha in the more coronal parts of the canals. The

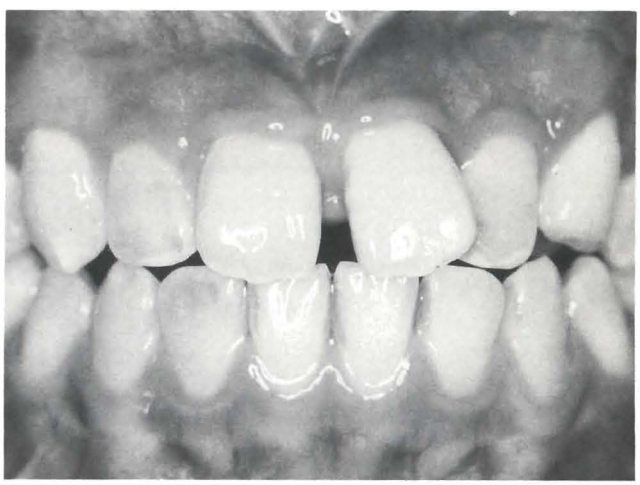


Figure 2. After transplantation of the maxillary permanent canines into the arch, maxillary median diastema and malalignment of the maxillary anterior teeth still persisted.

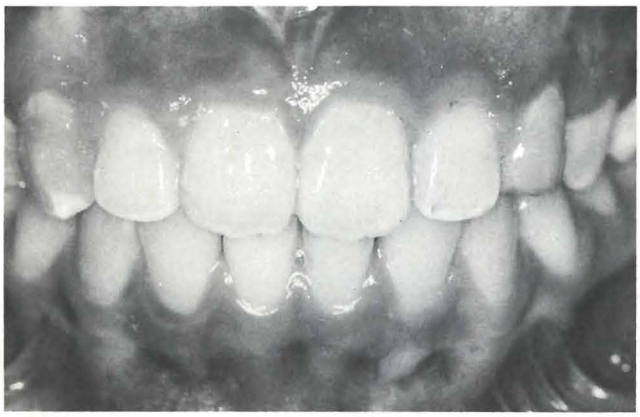
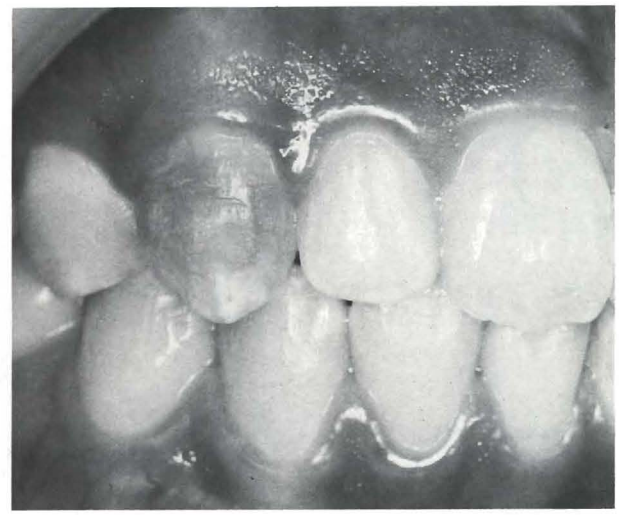
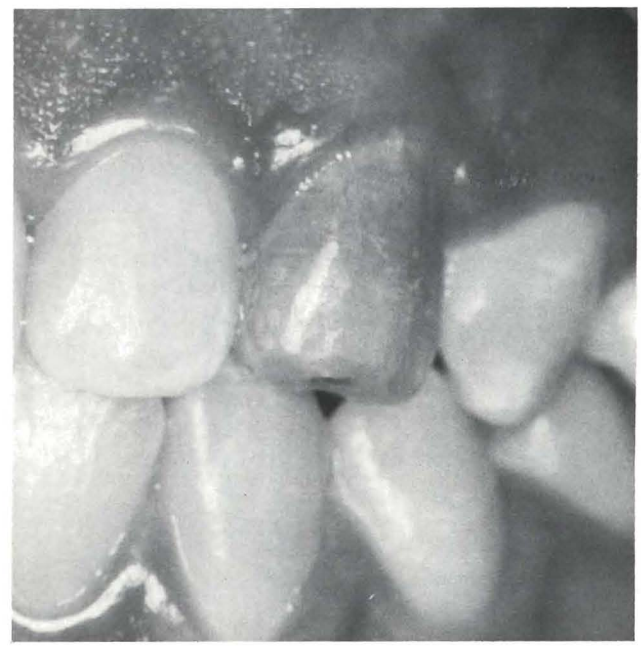


Figure 3. The maxillary labial segment has been aligned using a fixed orthodontic appliance. Note the grayish color of the maxillary canines.





Figures 4 and 5. Close-up's showing the discolored maxillary canines. Note the absence of the cuspal tip of the left canine, which had been sacrificed during the surgery.

gutta percha root fillings were then covered using a thin layer of zinc oxide eugenol. This was to prevent the oxygen liberated by the heated hydrogen peroxide from damaging the mechanical seal of the root canals.

The teeth to be bleached were isolated by using the rubber dam. After dental prophylaxis and acid-etching with 37 percent phosphoric acid gel for one minute, 30 percent hydrogen peroxide was applied on a cotton pledget on both the buccal and lingual surfaces of the canines. Cotton pledgets saturated with hydrogen peroxide were also placed in the lingual access cavities. A bleaching light (Union Broach, U.S.A.) was used to heat the hydrogen peroxide solution for thirty minutes. After two visits, the canines attained a shade similar to that of the maxillary incisors (Figures 6 and 7). Composite resin (hybrid type) was used to fill the access cavities and restore the cuspal tip of the left canine. The patient was pleased with the results of treatment.

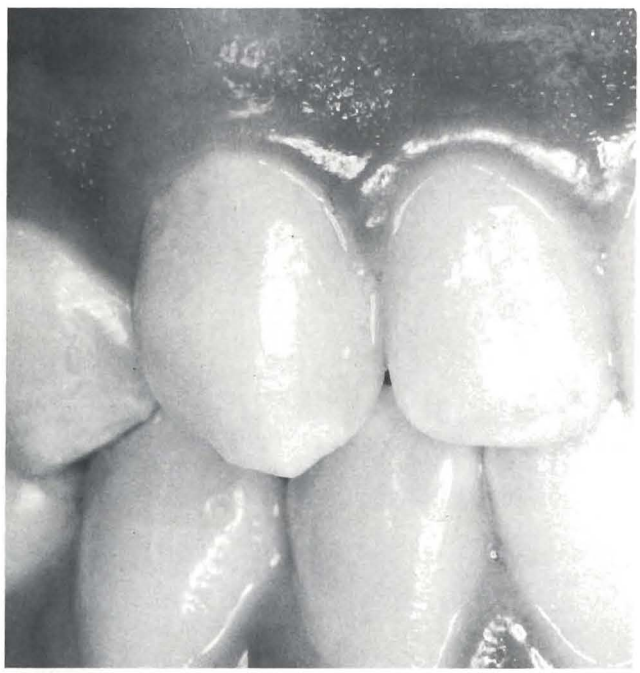
The transplanted canines were regularly reviewed. At the three-year review appointment, periapical radiographs showed healthy bone support and no sign of root resorption (Figures 8 and 9). Clinically, the transplants were firm, and there was no periodontal pocket greater than 3mm existed.

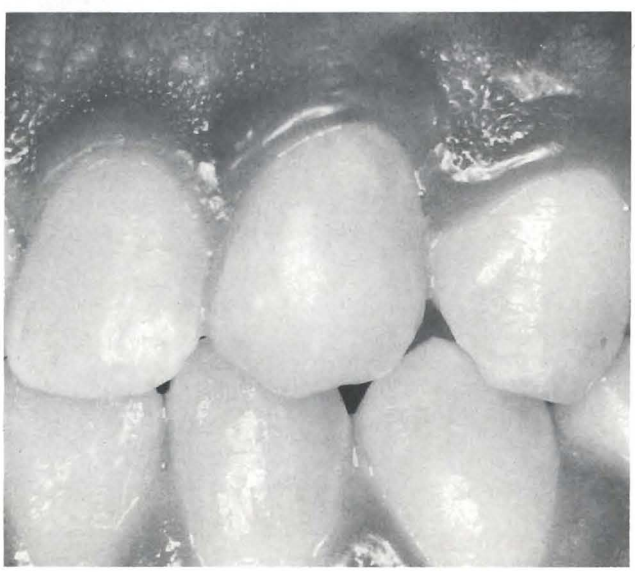
DISCUSSION

Grossly impacted canines

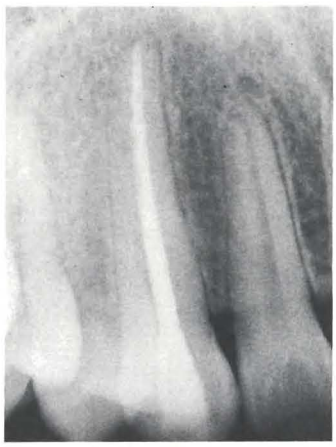
The impacted canines in this patient were grossly malpositioned, and their crowns were actually trapped between the roots of the central and lateral incisors. They were impacted against the distal aspects of the roots of the central incisors, causing them to tip toward each other. The paths of eruption of the canines, therefore, would be unfavorable for orthodontic traction, which is unlikely to be successful in this case.

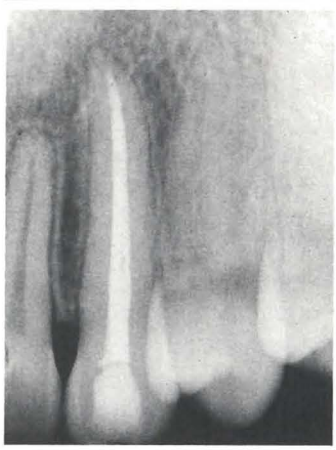
In this patient, if transplantation could not be performed due to factors such as a lack of expert care or the lack of patient cooperation, the remaining treatment alternative would be extraction of the permanent canines and retention of the primary canines, anticipating the need for prosthetic replacement at a later stage.





Figures 6 and 7. After nonvital bleaching, color of the maxillary canines had been restored. Cuspal tip of the left canine had been restored using hybrid type of composite resin.





Figures 8 and 9. Periapical radiographs taken of the canines showed intact lamina dura, with no signs of root resorption.

Prognosis of the transplanted canines

The apices of the canines had already closed when the transplantation surgeries were carried out. One would thus expect a poorer prognosis as compared to more favorable immature transplants, with open apices, and roots only two-thirds formed.[4] The ten-year survival rate of transplants that were fully formed was reported by Hansen and Fibaek to be as low as 44 percent.[7]

An autotransplant could be considered, similar to an avulsed, but immediately replanted tooth. Root treatment should always be performed on avulsed teeth with closed apices.[10] It would be rational, therefore, to perform root canal treatment on the transplanted canines as was done in this case.

The signs of a successful transplantation are the absence of root resorption, pain, and periodontal pockets; and positive signs of continued root maturation. In this case, no continued root maturation could be expected. The patient has been free of pain since root canal treatment was completed on the transplanted canines, and no periodontal pocket greater than 3mm was detected at the three-year-review appointment. Periapical radiographs of the transplanted canines also revealed healthy bone support and no sign of root resorption (Figures 8 and 9). The two transplants have excellent prognosis, therefore, for long-term survival.

Amalgam-stained nonvital teeth

It was a mistake to place amalgam in the access cavities of the canines after endodontic treatment. This caused a severe staining, which became evident two months after the amalgam was inserted. Staining caused by silver amalgam can be difficult to remove; thus it should be avoided, whenever possible.[8]

Fortunately, this case responded well to the bleaching, and esthetics was restored after two applications of warmed 30 percent hydrogen peroxide. Otherwise, less conservative treatment modalities such as porcelain veneers or even full veneer crowns would have to be considered.

CONCLUSION

The results of the multispecialty team management of this patient have proved satisfactory to the patient and the operators: both esthetics and function were restored to their optimal expectancy. The transplants have survived favorably for three years, suggesting a favorable prognosis for indefinite survival.

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ORAL CHANGES DURING CHEMOTHERAPY AND RADIOTHERAPY

The general dental practitioner should be aware of the oral changes that take place during chemotherapy and radiotherapy for neoplasms in the head and neck regions. Some of the changes make patients more vulnerable to dental diseases and complications, if teeth need to be extracted. Ideally, patients should be made dentally fit before treatment, in order to avoid the risk of extractions later. In the long term, periodontal diseases and caries can be controlled with adequate monitoring and with appropriate use of chlorhexidine and fluoride.

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BEHAVIOR

Dental management considerations in children with attention-deficit hyperactivity disorder

Arthur H. Friedlander, DDS
Ida Kreinik Friedlander, RN, BSN, MS

Attention-Deficit Hyperactivity Disorder (ADHD) is the most common and serious neurobehavioral problem of childhood. A short attention span, diminished impulse control, and excessive physical activity place these children at serious risk for long-term academic and social problems. Dentists must be familiar with the disorder in order to make the necessary modifications in the dental treatment plan, to account for the patient's impairment and medication regimen.

ATTENTION-DEFICIT HYPERACTIVITY DISORDER

The cardinal symptoms of Attention-Deficit Hyperactivity Disorder (ADHD) include chronic difficulties in concentrating, restraining movements, and inhibiting impulses. Those with moderate or severe forms of the disorder are likely to have problems functioning at home, in school, and with friends. When at home or at school these children have difficulty sitting quietly and are constantly squirming in their seats and fidgeting, with their hands and feet. They perform normally when standardized intelligence quotient (IQ) tests are administered in a structured one-to-one environment, but they do poorly in a school room setting, where they are easily distracted by extraneous stimuli, are unable to follow instructions, and lack the necessary persistence to complete assigned tasks.[1-3] These children are also unpopular with their peers. They are unable to play quietly by themselves, and often bully their way into the play of others. An inability to pay attention to the facial expressions and body language of other children leaves them unaware of their own inappropriate behavior and results in social failure.[4]

The nature of ADHD changes as the child reaches adolescence. At about this time, approximately 20 percent of children "outgrow" the disorder and become free of all symptoms. Another 20 percent continue to manifest a short attention-span, distractibility and impulsivity, but hyperactivity markedly declines. In junior high school and high school, learning tasks become more complex and these children are unable to concentrate and select relevant cues. Unable to ignore distractions and rapidly repeat learned responses they are overwhelmed, falling significantly behind in reading, mathematics, and spelling. The remaining 60 percent of adolescents continue to display one or more of the symptoms of ADHD, have the "learning disorder" noted above and develop a concomitant "conduct disorder" (e.g. start fights, lie, steal, run away).[5] This latter group of adolescents is at increased risk for abuse of alcohol

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and illicit drugs.[6,7] By age twenty-five, fewer young adults with ADHD manifest antisocial behaviors, but they remain behind their peers on measures of educational attainment, job satisfaction, social skills, and self-esteem.[8,9]

EPIDEMIOLOGY

The exact lifetime prevalence of ADHD is unknown, but it is estimated at 5 percent.[10] The disorder usually arises before age seven and boys are three to five times more likely to be affected than girls.[11] Family, genetic, and adoption studies suggest that ADHD is a genetically determined disorder. More than 25 percent of children with ADHD have at least one parent or other close family member with a similar childhood history.[12] Psychiatric disease is also common among the parents of these children with anxiety disorders, antisocial disorders, and major depression frequently encountered.[13]

ETIOLOGY

The etiology of ADHD remains unknown. Routine neurologic examination is often normal, but a plethora of minor physical anomalies (involving the head, eyes, mouth, fingers, and toes) seen in these children suggest fetal maldevelopment of these organs, during the first trimester.[14] Likewise, ADHD patients manifest "soft" neurological signs (clumsiness, poor coordination, minor sensory and reflex changes) suggesting abnormal central nervous system (CNS) development. Recent data have identified maternal alcohol abuse during pregnancy as the possible cause.[15] Inattention and impulsivity have been shown to be associated with a paucity of CNS norepinephrine and dopamine.[16,17] Data from neurophysiologic studies suggest underarousal and immaturity of the CNS.[18,19] Advanced brain imaging techniques [single photon emission computed tomography (SPECT) and positron emission tomography (PET)] have demonstrated diminished regional blood flow and reduced rates of glucose metabolism in those areas of the brain associated with attention and motor activity.[20,21]

MEDICAL MANAGEMENT

Children with ADHD experience difficulties in many areas of life. A multifaceted approach combining pharmacologic agents and school-based behavioral and cognitive therapies can effectively control the symptoms of ADHD and improve academic performance and social interactions. The Conners' Teacher and Parenting Rating Scale is frequently used to quantify pretreatment symptoms and the response to therapy.[22]

Methylphenidate (Ritalin) is the medication most often prescribed to treat the disorder.[23] The drug improves the child's ability to focus attention and concentration, decreases motor activity and aggressivity, relieves anxiety, and elevates the patient's mood.[24] This CNS stimulant medication produces these paradoxical responses by normalizing cerebral blood flow and glucose metabolic activity.[25] Long-term treatment of prepubertal children with methylphenidate reduces appetite and may be associated with growth suppression manifested as weight loss and limited height growth.[26] Treatment interruption ("drug holiday") on weekends and when school is not in session (e.g., summer) leads to "catch-up" growth. Other adverse side effects include, insomnia, stomachaches and headache.[27]

More than 25 percent of children with ADHD have at least one parent or other close family member with a similar childhood history.

Ensuring compliance with the medication regimen is a difficult problem.[28] Denial of the severity of the illness by the patient's family is often the major factor for nonadherence to therapy, but adverse side effects (real or imagined) to the drug are the reason most often cited for discontinuing the medication.[29] In addition, the family frequently has philosophical concerns about "drugging a child", and "changing the child's character with calming pills". This ethical issue has been muddled by the Church of Scientology and its Citizens Commission on Human Rights falsely asserts that use of this medication leads to murder, suicide or substance abuse.[30]

Behavior therapy and cognitive training are often employed simultaneously to improve academic performance. Younger children benefit from behavior systems that reward proper organization of school work and getting started on time. Older children are taught to self-monitor their level of attentiveness. Those easily distracted by auditory stimuli are provided ear phones with white sound and those distracted by visual stimuli are given individual study carrels. Social-skills training and impulse control techniques ("wait my turn", "do not shout out answers") tend to improve peer interaction in the classroom. Proper school placement enhances academic success and self-confidence, but unfortunately, in most areas of the United States, these special services are unavailable.[31]

Dietary restriction of food additives, artificial colors and flavors, an approach popular with the lay public for treatment of ADHD is helpful in only 1 to 2 percent of children.[32] Results of sugar challenge studies clearly demonstrate that refined sugars do not play an important role in hyperactivity.[33]

OROFACIAL FINDINGS

Minor physical anomalies of the orofacial region are the most frequently reported biological abnormality in ADHD. These anomalies are termed "minor", because they rarely present a cosmetic concern. Prevalence rates have not been determined, but an enlarged head circumference, epicanthic folds (vertical skin folds covering the tear ducts), hypertelorism (wide spacing of the eyes) and abnormal position or configuration of the ears are common.[34] A recent study comparing the facial proportions of children with ADHD with those in the general population noted a longer lower face, more pointed chin, shorter upper lip, and wider mouth.[35] Frequently encountered anomalies of the oral cavity include a steep palatal vault, fissured tongue, geographic tongue, aberrant frenula and irregular, crowded or malformed teeth.[36-40] In addition, the primary teeth of some of these children have a wide neonatal line and very porous prenatal enamel.[41] The teeth and the central nervous system both originate from the same germinal layer and may have been subject to the same insult that gave rise to ADHD.[42] First-degree relatives of children with ADHD manifest similar minor physical anomalies to a significantly greater extent than the general population.[43]

Preschool-age children with ADHD are uniquely prone to develop halitosis and chronic rhinitis.[44] Experimental diets that eliminate artificial colors and flavors, chocolate, monosodium glutamate, preservatives, caffeine, dairy products, and are low in simple sugars have been found marginally effective in reducing halitosis and chronic rhinitis, but the mechanism remains elusive.[45]

Behavior therapy and cognitive training are often employed simultaneously to improve academic performance.

Unlike other psychiatric disorders, ADHD does not appear to alter the volume or constituents of parotid gland secretions in unmedicated children.[46] Methylphenidate when administered, concentrates in saliva at a level four times that found in blood, but this is not associated with changes in salivary flow rates or altered taste sensation.[47]

School-age children with ADHD are uniquely prone to develop ear infections and earaches and these at times have been confused with pain of dental origin.[48] Orofacial injury is common because children with the disorder are forever running, climbing, and occasionally falling.[49] Injury of children with ADHD is unfortunately not always accidental. A hyperactive child is five to seven times more likely to suffer physical abuse from a parent than a child in the general population.[50]

Emphasis should be on brushing the teeth rather than on technique of brushing.

DENTAL MANAGEMENT

Provision of comprehensive dental treatment to youngsters suffering from ADHD requires certain modifications in the standard treatment plan. Dental appointments should be scheduled in the morning when these children are least fatigued, most attentive, and best able to remain seated in the dental chair[51,52] Morning appointments are also appropriate because most medication regimens target maximal drug effect (enhanced cognition and behavior) to occur during the early part of the school day.[53] Dental treatment is best avoided during the summer months, if the patient is on a "drug holiday."

Compliance with an age-appropriate, home-care regimen is difficult for these children. Understanding and adherence are enhanced, when colorful or highly stimulating educational materials are employed and instructions are simplified and repeated numerous times, during the dental treatment visit.[54,-56] Emphasis should be placed upon the brushing of teeth rather than the specifics of a brushing technique. Undo emphasis on technique is likely to result in cessation of all tooth brushing activities. Compliance may be enhanced by having the parents reward (small amounts of money) the child each time he or she initiates and completes a tooth-brushing episode.[57]

Methylphenidate therapy is associated with a number or adverse side-effects of concern to dentists. Elevation in both systolic and diastolic blood pressure and an increased heart rate are common.[58,59] Prudent care necessitates obtaining profound local anesthesia, thus limiting pain and the endogenous production of epinephrine, which may exacerbate these findings. An aspirating syringe must be used in order to avoid an intravascular injection and the possibility of an adverse interaction between the pressor agents (epinephrine, levonordefrin) used with local anesthetic and methylphenidate.[60]

Dental disease and neuropsychiatric disease are the most prevalent health problems in the United States and frequently they are seen in the same individual. ADHD presenting as motor restlessness and inattention in the dental office and as inability to complete home care tasks may be misconstrued as noncompliance. Assistance by a neurologist, psychiatrist, or pediatrician in management of these patients can alleviate much of the doubt and anxiety associated with providing dental care.

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CHILD CARE AND SELF-ESTEEM IN SCHOOL-AGE CHILDREN

Children in after-school self-care and sibling care remain a large and concerning population despite a variety of care options available to families. As suggested by this and other studies, they may be at risk for adverse effects on their psychosocial development. Our findings of lower self-esteem among children in sibling care and increased social isolation of those in self-care add to the growing body of literature describing the life experience of these children. The possible causality of these results must be interpreted with caution, however, directing future research to investigate through prospective design the relationship between older sibling care and developmental endpoints. Based on results of this study, it may be important for pediatric health care providers to foster careful consideration among parents in their selection of an appropriate after-school-care arrangement for their children, much as has been our role in assisting families in choice of day care. Factors including age and developmental capability, relationship between older and younger sibling, and number of hours and days per week spent in this form of care may all be important to consider in deciding on appropriate care. Pediatric care providers are in a unique position to investigate further how these and other factors may modify the consequences of older sibling care and to define guidelines for after-school care. As with day care, we may also want to monitor the physical and emotional health of school-age children and to advocate for suitable alternative forms of care when undesirable outcomes appear.

Berman, B.D. *et al*: After-school child care and self-esteem in school-age children. Pediatrics, 89:654-659, April 1992.

Dental management considerations in children who stutter

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Stuttering (synonymous with stammering) is a disorder in the rhythm of speech in which the child knows precisely what he or she wishes to say, but at the same time may have difficulty saying it because of an involuntary repetition, prolongation, or cessation of sound.[1] Facial tics and grimaces frequently accompany the stutter and make it appear as if the child is struggling to speak. Humanistic, comprehensive dental treatment can best be provided when the dentist is familiar with the symptoms and psychosocial implications of the disorder.

Many children in the process of acquiring communicative skills experience periods of "normal nonfluency" that are characterized by easy and unforced repetition of sounds, syllables, and words. When nonfluency increases in magnitude, it is termed (developmental) stuttering. Stuttering often evokes negative reactions from parents and friends that cause affected children to become overly aware of their speech pattern. Awareness develops into embarrassment, public speaking is avoided and social interactions diminish.

Children frequently manifest one or more variants of stuttering. Those most commonly encountered are:

- ☐ Sound/syllable repetition (e.g. "He is run-ruh-running.").
- ☐ Sound prolongation (e.g. "Mmmmmmore cake please.").
- ☐ Whole-word repetition ("He-he-he is a big boy.").

Motor movements (facial contortions, tremors of the lips, jaw jerks, tongue protrusions, irregularity of breathing) and changes in body position may accompany the speech dysfluencies, and give the impression that the child is struggling to speak and is frightened by the problem. Averting the eyes, blinking or closing the lids, and turning of the head away from the listener are common and often used as a method of interrupting eye contact. Emotional stress and the speaking situation influence the magnitude of the problem. When excited, tired, or in a hurry, and when asking questions, the young child's stuttering (verbal and nonverbal behaviors) often worsens.[2]

The rate of language development among stuttering children is slower than that of their fluent peers. They are more likely to manifest "immature speech" and other unrelated articulation disorders.[3] As a group they also lag an average of six months behind their peers in ed-

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ucational achievement, reflecting problems with school-based learning skills and reading. Compared to fluent children at age ten, stutterers score significantly lower on tests of intellectual function. This deficit is evident on both verbal and nonverbal items and does not appear to be the result of difficulties in communication.[4]

Stuttering is classified as a psychiatric condition, although children who stutter are no more likely to show symptoms of other emotional disorders than fluent children.[5] Sadly, they are often teased and ridiculed at school, have a negative attitude toward speech, and are fearful of speaking in front of the class.[6,7] Impairment of social functioning may result from associated anxiety, frustration, and low self-esteem.[8]

EPIDEMIOLOGY

Approximately 5 percent of males and 2 percent of females stutter for at least six months during childhood. The vast majority begin stuttering between the ages of three and five years. Almost 80 percent of these children will recover fluency spontaneously or with the aid of speech therapy by age sixteen.[9,10] A minority of dysfluent children who exhibit facial tics will develop Tourette's syndrome in late life.[11]

Stuttering appears to congregate in families, but it does not follow simple patterns of inheritance, presumably because of the interplay between genetic and environmental factors.[12] The risk of stuttering varies as a function of the sex of the affected parent and child. Adult male stutterers confer a 9 percent risk to their daughters and a 22 percent risk to their sons. Adult female stutters confer a 17 percent risk to their daughters and 36 percent risk to their sons.[13] If both parents stutter, more than two thirds of the offspring are likely to be stutterers as well.[14,15]

ETIOLOGY

The exact cause of the onset of stuttering in childhood remains unknown although psychogenic, environmental, and neurogenic origins have been proposed.[6] During the first forty years of this century, psychogenic theories prevailed. Stuttering movements of the tongue, lip, and jaw were thought to substitute for the oral gratification lost by the infant, when nursing was interrupted by weaning.[17] Stuttering was also interpreted as the manifestation of an aggressive drive in an unhappy child whose home environment was overly critical, perfectionistic and nonsupportive.[18-20] These theories have been replaced as newer evaluative methods have shown stutterers to have no greater evidence of specific neurotic conflicts than fluent children.

Some contemporary speech and language pathologists view the child's environment and interpersonal relationships within the family as fundamental to the development of stuttering. A very competitive communications environment, in which the parents talk rapidly and with complex vocabulary and linguistic structures, may exacerbate and perpetuate the problem.[21]

In the last decade, valuable clues to the neurogenic origins of childhood stuttering have been uncovered by studying "chronic adult stutterers." These individuals had childhood onset of the disorder, which did not undergo spontaneous regression and was not remediated by speech therapy. In most fluent individuals, the left hemisphere of the brain is dominant for verbal language and neuromotor coordination for speech production. Chronic adult stutterers tend toward right and left hemispheric equality so that the refined timing and coordination required for speech is disturbed.[22-24] Most recently, regional cerebral blood flow studies of these

Stuttering appears to congregate in families, but does not follow simple patterns of inheritance.

individuals have demonstrated hypoperfusion and low metabolic activity in areas of the brain (left temporal and frontal lobes) known to be associated with speech-motor control.[25]

Noting that dysfluencies usually worsen during times of stress or anxiety, some investigators have attempted to synthesize the psychogenic and neurogenic theories. The limbic system of the brain processes emotions and assists in timing and coordinating cortical neuromotor impulses. Stress and anxiety impair the limbic system's coordination of impulses to the speech-motor centers, and in susceptible individuals this may result in stuttering.[26]

OROFACIAL CONSIDERATIONS

Electromyographic (EMG) studies of stuttering have been conducted on the muscles controlling movements of the lips, jaw, tongue, and larynx. These muscles are hyperactive and tremulous, and their movements are slow and uncoordinated, because of cocontraction of antagonist muscle-groups.[27-29] These findings may explain the slower sensory-motor reaction times and incoordination of the perioral musculature noted among dysfluent children, even when they are not stuttering. Some of these children have difficulty or are unable to touch the tip of their tongue to either the middle of their upper lip or the middle of their chin. Others, have difficulty in moving their tongue rapidly from side to side. Still others, are unable to keep their mandibles stationary as they move their tongues from side to side. Stutterers also suffer tactile and proprioceptive defects of the tongue, and require more time to open and close the jaws.[30-32]

SPEECH THERAPY

Evaluation and treatment of stuttering is usually within the purview of the speech and language pathologist. The latter assesses the patient's condition using auditory (listening, audiotape recordings) and visual information (clinical examination and video recordings), in an attempt to identify the specific conditions that promote stuttering.

Almost all therapeutic approaches to stuttering attempt to decrease the rate of speech. An indirect approach is often taken with a very young child. The speech clinician does not directly try to modify the way the child talks, but rather through play, game and modeling encourages the child to speak with more appropriate levels of physical tension and rates of production. Children older than seven years are actively taught "timed syllabic speech." They are encouraged to speak syllable by syllable, with each syllable stressed evenly, said in time to a regular, even rhythm, and separated equidistantly from the next syllable.[33] This technique affords the child time to adjust their level of physical and psychological tension and that of their speech musculature so that speech becomes smooth and easy.[34]

Parental education is also critical. Parental attitudes and styles of communication with the child must be addressed. Parents are encouraged to talk to their child slowly, and in a relaxed manner. They are advised that family conversations should be structured so that each child feels that he or she may talk at their own pace. They are also advised neither to criticize the child nor to tell him to speak more slowly; or to repeat words that are said indistinctly. Parents are counseled to reduce the number of frustrations experienced by the

In stutterers, muscles that control movements of the lips, jaw, tongue, and larynx are hyperactive, tremulous, slow in movement, and uncoordinated.

Parental attitudes and styles of communication must be addressed.

child and to provide an opportunity, through play or creative dramatics, to express feelings. Bedtime reading is encouraged as a method of allowing the parent to provide a model of slow, calm speech, while fostering closeness and intimacy.

DENTAL CONSIDERATIONS

On occasion, the dentist may notice that a young patient appears to be stuttering. If the child has five or more speech breaks per hundred words this is cause for clinical concern. While there is little empiric evidence, some experts warn that talking to the child about their speaking pattern, even in nonprejorative terms, may be counterproductive. After discussing the problem with the parents, a referral for evaluation by a speech and language pathologist may be warranted. This is especially true, if the child is over the age of four years and has been stuttering for more than three months or demonstrates tension or struggle behavior.[35]

During the provision of dental treatment the office environment should be calm and quiet. Procedures must be adequately explained so that anxiety and stress are minimized. Speak slowly, naturally, and in a relaxed fashion. Appear genuinely interested in what the child is thinking and feeling.

Listen to the child's response in a gentle and accepting manner, rather than focusing upon the stutter. Provide nonverbal reassurance to the content of the child's message with head nods and "uh-huhs." The child should be allowed to complete his thoughts and ideas without interruption. Even if the child appears to have difficulty speaking, the dentist should not gratify the urge to finish words or sentences. Instead, pause a second or so before responding to the child's questions or comments while keeping natural eye contact.[36]

Intense auditory stimulation (e.g. dental handpiece) should also be minimized, because of the unique sensitivity of these children to sound.[37] Impaired oral-motor coordination and tactile-proprioceptive deficits mandate protection of the child's airway, tongue, and cheek by the professional staff during treatment. These deficits frequently increase the length of dental appointments and operator fatigue.

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MIDAZOLAM VERSUS FENTANYL AS PREMEDICATION FOR PAINFUL PROCEDURES

This study evaluated the use of midazolam and fentanyl as premedication for painful procedures when combined with local anesthetic. Midazolam and fentanyl were both effective as premedication. A majority of children and parents preferred midazolam. Although potentially significant side effects occurred, these effects were minimized by the use of appropriate monitoring and intervention.

Prior to this study, patients at the University of Florida would receive premedication by physician choice but the majority of patients received local anesthesia only. Common criticisms of the routine use of premedication were as follows: it may not be effective, it may be slow to take effect, deep long-lasting sedation is common, and it may not be safe. These criticisms have been largely addressed in the current study, in which the value of premedication has been clearly shown. Most of our patients said they would refuse future procedures without premedication.

Midazolam is a short-acting benzodiazepine with rapid onset of action and sedative, anxiolytic, and marked anterograde amnestic effects. Because of its water solubility it can be administered painlessly through the intravenous route. As with many other sedative medications, it is not approved by the Food and Drug Administration for use in children, but is commonly used for conscious sedation for procedures such as fracture reduction, endoscopy, and laceration repair. In a previous study comparing midazolam to placebo in a similar group of patients, midazolam was clearly shown to be effective as premedication for BM. Fentanyl is a narcotic analgesic with a rapid onset of action and a very short half-life. It is effective in children for many short surgical procedures. The rapidity of onset and short half-life of both drugs make them ideal for the short procedures tested here. The dosage of both drugs was derived based on our initial experience with these drugs and on doses that have been previously reported in the literature to be safe and effective.

Sandler, E.S. *et al.*: Midazolam versus fentanyl as premedication for painful procedures in children with cancer.
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DEVELOPMENT

Midline correction by extraction of the remaining mandibular canine: Myth or reality

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Malocclusions often begin to exhibit themselves before the patient's first dental visit. Other times, a patient may transfer to a dental office where a different interceptive philosophy prevails. In either of these circumstances, it must be determined whether treatment of the existing problem should begin now, or be delayed in the hope that the normal developmental forces will correct the problem.

During the mixed dentition stage, teeth may exfoliate earlier than the average sequence of eruption dictates, possibly creating a problem recognizable only by a dentist.

When a child's mandibular arch is constricted, there may not be enough space to accommodate the developing permanent incisors mesiodistally. The erupting lateral incisors may be impeded by the primary canines, thereby initiating the resorption of the canines. The primary canines are lost, and the permanent lateral incisors drift distally into the spaces vacated by the primary canines; if only one canine is lost, a shift in the midline will occur.

The purpose of this article is to describe the various procedures the dentist may implement to alleviate potential problems, as well as to demonstrate that earlier standards of practice may not be in the best interest of the patient.

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REVIEW OF THE LITERATURE

Mandibular crowding

The mixed dentition phase begins with the loss of the mandibular central incisors. Crowding may be observed as soon as the permanent incisors begin to emerge. Moorees and Chadha described a sudden change occurring during the emergence of the central and lateral incisors, resulting in 1.6 mm crowding in the mandibular dentition of males, and 1.8 mm crowding for females.[1] It can be assumed, therefore, that some crowding in the permanent mandibular incisors is a completely normal phenomenon, occurring more commonly than perfectly aligned teeth.

Loss of the canine

McDonald and Avery explain that the primary canine is frequently lost prematurely at the time of the eruption of the permanent lateral incisor.[2] This premature loss would probably be seen only in children with some degree of arch-length discrepancy.

McDonald and Avery state that if the unilateral loss is accompanied by a severe crowding of the incisors and a shift in the midline toward the area of the loss is evident, the canine on the opposite side of the arch should be extracted.

Although this standard of care is still being taught to many of today's dental students, as in fact it has been taught for many years, no data exist to confirm that the

Complications may occur, if the antimere canine is extracted.

midline will resolve automatically with the extraction of the antimere, leaving the stability of incisor symmetry in question.[3] Furthermore, several complications may appear, if in fact the remaining canine is removed.

Intercanine width

The first evidence that growth of the mandibular arch may depend on existing primary teeth was first introduced by Moorees, more than twenty years ago.[4] Since a midline suture does not exist in the mandible as in the maxilla, growth must occur at other points and in other ways.

The study by Moorees *et al* found that, initially, a difference between the combined mesiodistal diameters of the crowns of the four primary incisors and the permanent mandibular incisors averaged 5.1 mm, resulting in 1.6 mm. of crowding, when the permanent incisors emerge. This lack of space is largely compensated for after these teeth erupt fully, following the increase in arch-breadth that coincides with the transition to the permanent incisors.

The process of an increase in intercanine width has been described as occurring in a variety of ways. Lee believes that the primary canines act as proprioceptors to the forces of mesial migration and the labially moving forces of the lateral incisors, thus stimulating growth in the region of the canines.[5] As the erupting lateral incisors move labially, the mandibular canines will be made to move laterally. The canine movement, checked by the mesial migration of the posterior teeth, causes the primary canines to move obliquely (Figure 1).

Another theory, proposed by van der Linden, described the growth to begin as the permanent lateral incisors were beginning to erupt. As they made their ascent into the oral cavity, they came in contact with the roots of the primary canines, expanding the alveolar bone as they did so.[6]

CASE REPORTS

The University of Iowa began a facial growth study in the 1940's, in which eligible patients had impressions made every six months from three years of age to adulthood. While in the study, the patients were not allowed to have any orthodontic treatment. This way, the maturing occlusion developed without any outside influence.

Of approximately 200 patients in this population, twenty-six patients had a primary canine exfoliate prematurely, caused by the erupting permanent lateral incisor. A midline shift occurred in each of these patients, and records revealed that the antimere of the exfoliated canine was extracted, in all but one of the cases. Of the remaining twenty-five cases, a midline shift remained in adulthood, in nine of the patients (or 35 percent). Though not meant to be a scientific finding, this illustrates, nevertheless, that the midline will not always correct itself (Figures 2-5).

TREATMENT

If a patient shows radiographic evidence of premature resorption of a primary canine before the eruption of the permanent lateral incisor (Figure 6), treatment can be devised to prevent a midline shift. This shift can be prevented by fabricating a lower lingual holding arch with a spur placed on the distal aspect of the fully

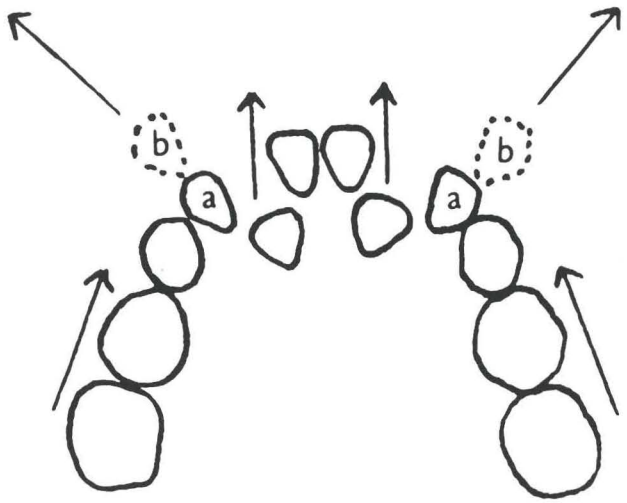
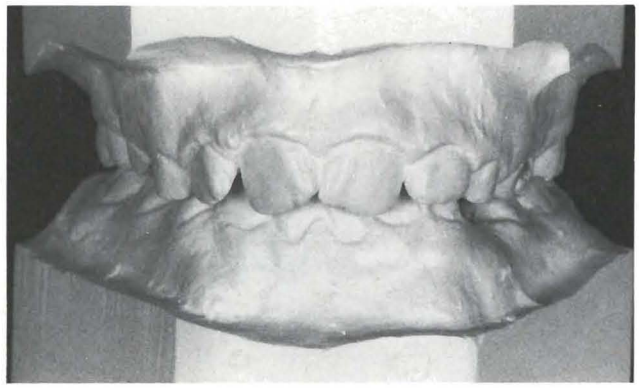
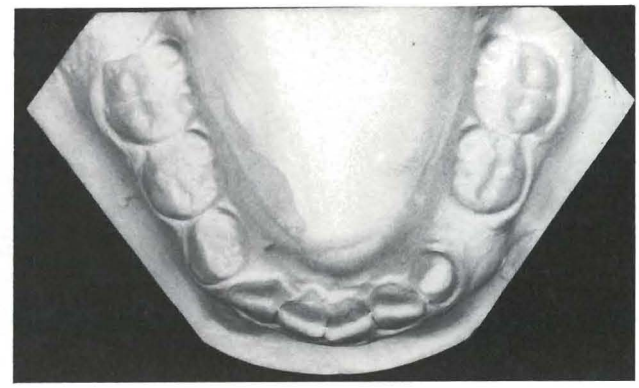
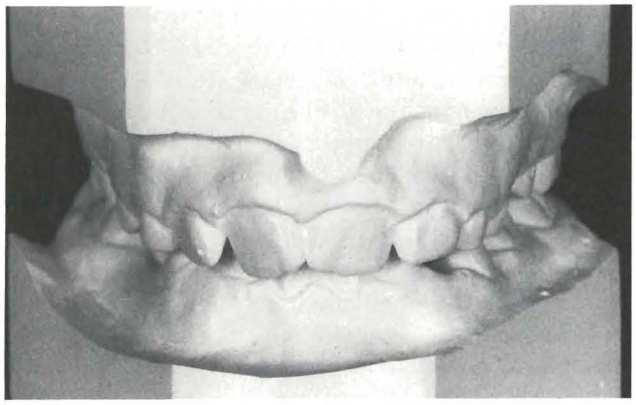


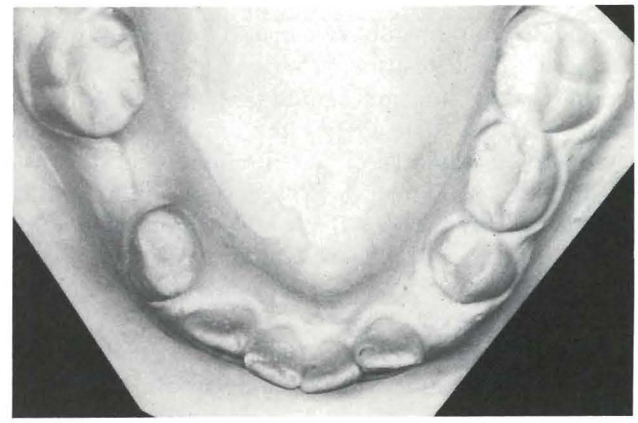
Figure 1. Courtesy of Dr. K. Paul Lee and the Journal of Clinical Orthodontics.



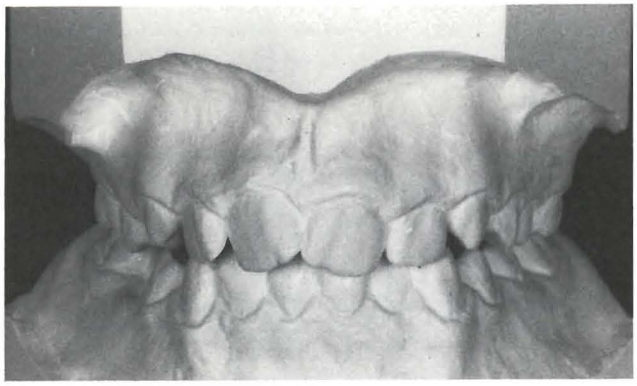


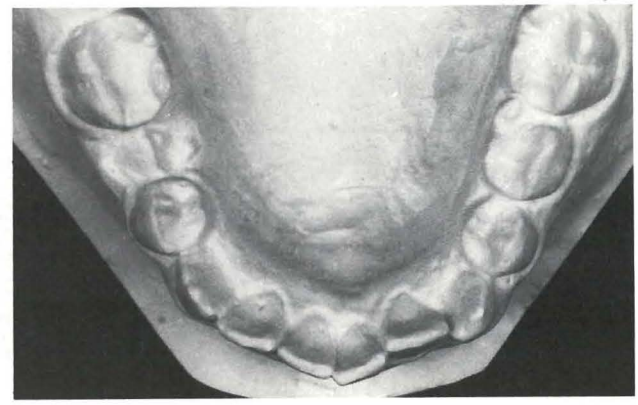
Figures 2a. and 2b. Eight-year-old female with early loss of mandibular right canine.



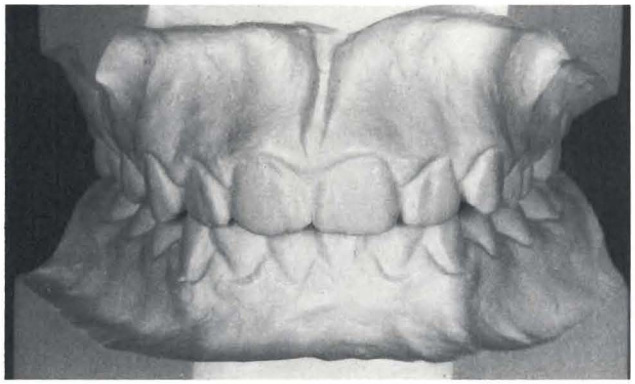


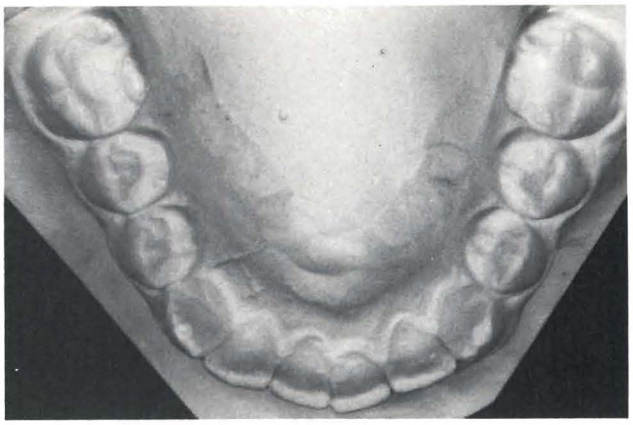
Figures 3a. and 3b. Left primary canine has been extracted.





Figures 4a. and 4b. The midline has shifted to the left, due to the eruption of the permanent canines.





Figures 5a. and 5b. Complete permanent dentition with no midline correction.

erupted lateral, provided it is placed immediately after the canine exfoliates.

A lingual holding arch should be placed, if the dentist is determined to extract the antimere. This will eliminate the potential of mesial migration of the posterior teeth into the leeway space, and help to inhibit the mandibular anterior teeth from tipping lingually, though Foster and Wylie found that a lower lingual arch could not be guaranteed to prohibit lingual tipping of the permanent incisors.[7]

In those patients where a canine has been lost prematurely and a shift in the midline has also occurred, it would be in the patient's best interest to leave the remaining canine intact. Gellin described the presence of the primary incisors and canines as necessary to alleviate crowding through the increase of intercanine width, as well as the process of alveolar growth.[8] The same philosophy pertains to this situation.

Since we cannot predict whether the midline will actually correct itself, it would be more beneficial to leave the antimere intact. Not only would we avoid an extraction and a potentially traumatic experience for a six- or seven-year-old child, but we would be allowing mandibular growth to reach its full potential. Once the patient has a complete permanent dentition, orthodontics, if needed, will correct any remaining problems.

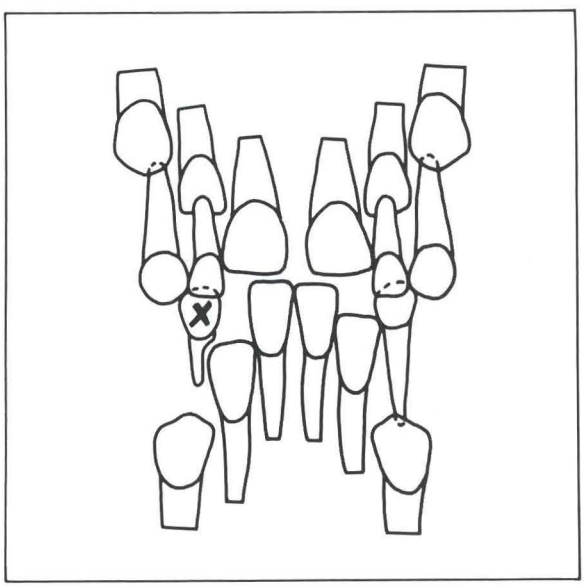


Figure 6. Courtesy of Dr. Frans van der Linden and Harper and Row Publishers, Inc.

SUMMARY

Standard of practice does not always equal standard of care. When faced with a problematic situation, the

Increase in intercanine width can occur in a variety of ways.

dentist will either treat from experience, or else depend on what has been suggested by others. In some cases, anecdotal information may not be applicable. Recommended clinical procedures have not always been supported by adequate research.

Although midline correction has been expressed as a certainty, it does not always occur. Patience on the part of the practitioner will allow the child to be observed periodically, and at the same time allow the dentition to develop naturally. Orthodontic treatment can always be used, once the permanent canines erupt.

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PROGRESS AGAINST CHILDHOOD CANCER

Bailar and Smith suggested that progress in the war on cancer has been minimal, although they acknowledged pediatric cancer, which involves only a small percentage of all patients with cancer, as a possible exception. The apparent progress in pediatric cancer far exceeds that which we have observed through the comparison of individual therapies within given randomized protocols. In fact, the fortunate limitation of numbers of patients with pediatric cancer greatly limits the number of randomized questions that can be asked. Only by pooling experience and by making observations in a systematic fashion can we learn how to control the disease or at least to limit the side effects of therapy. The utilization of central reference laboratories, which few single institutions can afford, enables physicians to have a better understanding of the biology of their patients' disease process. The cooperative group mechanism offers a review process in decisions involving whether or not new technological advances should be implemented. Institutional review and audits offer constructive ways for improvement of protocol compliance, record keeping, and overall patient care. All of these factors, while not directly related to a randomized therapeutic question, provide rationale for improved outcome of children with cancer.

Pediatric oncology group: Progress against childhood cancer: The pediatric oncology group experience.
Pediatrics, 89:597-600, April 1992.

COMMUNITY SERVICE

Pediatric dental education and community service: A combined approach

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Paulette Spencer, DDS, MS
John I. Haynes, DDS, MA

Over the past decade, a decrease in the caries experience of children has resulted in a concurrent shortage of procedural techniques in undergraduate dental clinics[1-4] According to Brunelle and Carlos, by 1980, 37 percent of American children were caries-free, probably as a result of fluoridated drinking water, fluoridated dentifrices, and topical fluoride applications.[5,6] In 1969, a survey by Meskin reported that 23 percent of undergraduate pediatric dental programs were having difficulty in obtaining child dental patients.[4] A more recent study by McTigue and Lee suggests that 66 percent of dental schools surveyed are currently encountering difficulty in providing undergraduate dental students adequate opportunities in clinical pediatric dentistry.[7] Because the majority of children nationwide are treated by general dentists, dental educators must strive to provide clinical experiences and opportunities that will ensure the competence of graduating dental students in the treatment of the child patient.[8]

Along with the need to provide dental students with experience in pediatric dentistry, there are many children from low-income households who are in need of dental care but who are not receiving such care.[9] Waldman, for example, reports that states have indicated a decrease ln the number of children receiving Medicaid dental services.[10] Studies indicate that federally funded dental programs are limited due to inadequate and short-term funding, and state funding for dental services varies widely and is often inadequate.[11,12] In efforts to overcome these inadequacies, a few communities have implemented programs to address the problem of inadequate dental care for indigent children. For example, in Chattanooga, Tennessee, a combined dental and medical health care facility was established to provide comprehensive health services to indigent children at no cost to the family.[13] There are few reports, however, of dental schools that have successfully organized and financed a long-term program that provides dental care for indigent school children. The University of Missouri-Kansas City School of Dentistry has established and maintained, for over fifty-eight years, such a community service program. This program, known as the Lowry Clinic provides dental care for first and second grade children from five urban elementary schools annually.

At this time, when the pool of pediatric patients who are seeking care in our dental schools is declining, the Lowry Clinic serves a two-fold purpose. It addresses the dental needs of indigent children and it augments the child-patient pool for dental students. The purpose of this paper is to examine the effectiveness of the Lowry Clinic program in supplementing undergraduate clinical experience and education. Dental procedures completed by fourth-year dental students on Lowry Clinic patients will be compared to treatment completed on

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non-Lowry pediatric patients during the years 1986 through 1990.

METHODS

Performance records of treatment completed by undergraduate dental students in the pediatric clinic during the following academic years: 1986, 1987, 1988, 1989 and 1990, were examined. Clinical procedural data were categorized in two groups. Group 1 included procedures performed on patients obtained through the Lowry Clinic, and group 2 included procedures performed on non-Lowry patients. Data were compiled for fourth-year undergraduate dental students who treated both Lowry and non-Lowry clinic patients. Data were collapsed into the following six types of clinical procedures:

- ☐ Examination, prophylaxis, and topical fluoride application.
- ☐ Placement of occlusal dental sealants.
- ☐ Placement of composite restorations.
- ☐ Placement of amalgam restorations.
- ☐ Placement of stainless steel crown restorations.
- ☐ Placement of various types of space maintainers.

In each of the six treatment categories the mean number of procedures completed by each fourth-year dental student was calculated for treatment done on both Lowry Clinic patients and non-Lowry patients. Data pertaining to overall differences in clinical procedural performance on Lowry versus non-Lowry patients were analyzed using a chi-square analysis, where differences were significant at $p < 0.05$. Differences between specific procedures were analyzed using a matched-pair Student's t-test and tested for significance at $p < 0.05$.

RESULTS

An average of ninety-five fourth-year dental students treated both Lowry and non-Lowry clinic patients during each of the five years examined. The average number of Lowry patients treated per year was 210, and the average number of non-Lowry patients treated per year was 814. The data pertaining to numbers of students and patients participating in the undergraduate clinic are presented in Table 1. These data indicate that there are significantly fewer Lowry patients treated per year compared to the number of non-Lowry patients.

Table 2 presents data that compare the mean num-

Table 1 ☐ Distribution of fourth-year undergraduate students and pediatric dental patients.

Year	Number of fourth-year students	Number of Lowry Clinic patients	Number of *non-*Lowry Clinic patients
1986	96	175	809
1987	96	208	857
1988	98	233	792
1989	84	225	815
1990	99	211	795
Mean	95	210	814

Table 2 ☐ Mean number of procedures completed per student per patient per year in Lowry Clinic versus non-Lowry clinic.

	Lowry	non-Lowry
Examinations	1.0	1.0
Sealants	1.5	1.5
Composite restorations	0.06	0.1
Amalgam restorations	2.3*	1.3
Stainless steel crowns	0.27*	0.12
Space maintainers	0.05	0.03

* Results are significant at $p<0.05$

Many children need dental care, while many dental schools seriously lack pediatric patients for teaching purposes.

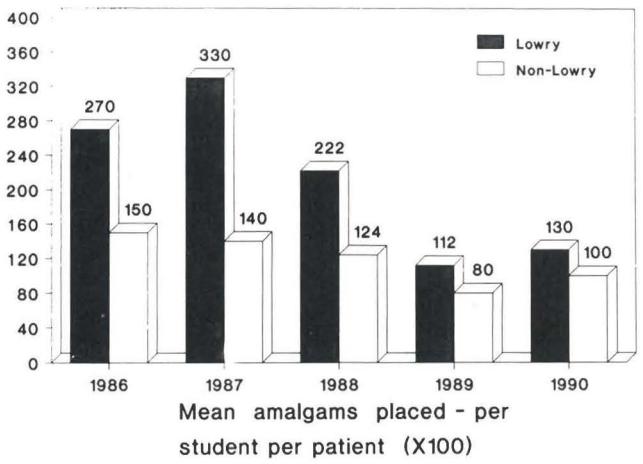

Figure 1. Mean amalgams placed per student per Lowry patient vs amalgams placed per non-Lowry patient per year.

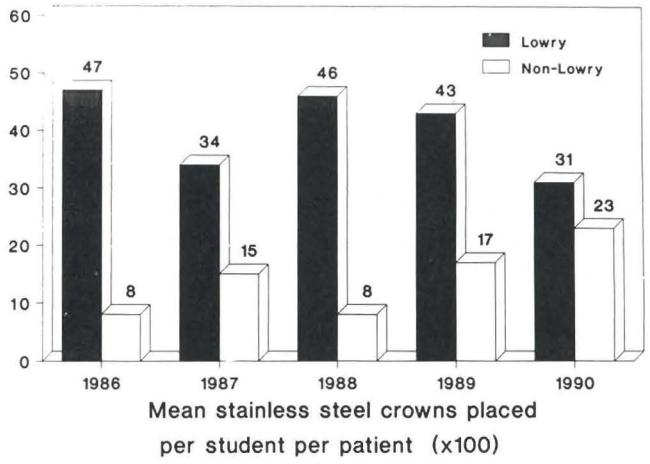

Figure 2. Mean stainless steel crowns placed per student per Lowry patient versus crowns placed per non-Lowry patient per year.

bers of categorized procedures completed by fourth-year dental students per year per Lowry Clinic patient to the procedures that the same student completed per non-Lowry clinic patient. When overall performance was compared using a chi square analysis, there was a significant difference in the number of restorative procedures completed per student per patient in Lowry clinic versus non-Lowry clinic. In order to determine where specific statistically significant differences occurred, a matched pair student's t-test was performed on data that examined the number of amalgam and stainless steel crown restorations completed each year. These data are presented in Table 3. The significance value used in the analysis was 0.05. Results from years 1986-1989 had p values of 0.02 or less, however, in both the amalgam and stainless steel crown categories. These results are illustrated in Figures 1 and 2, respectively. The data indicate that there is a statistically significant greater number of amalgam and stainless steel crown restorations completed per student per patient, when comparing Lowry clinic versus non-Lowry clinic patient data for four of the five years analyzed.

DISCUSSION

The data presented here indicate that the Lowry Clinic provide undergraduate dental students with valuable clinical experience. Significant difference in the number of amalgam and stainless steel crown restorations performed on children treated in the Lowry Clinic versus non-Lowry clinic patients, suggests that although students generally treat fewer patients in the Lowry Clinic, the amount of clinical experience they receive in pediatric restorative dentistry is significantly greater. It is interesting to note that the overall data (Table 3) do suggest that the children treated in the Lowry clinic are requiring less extensive restorations. Further, the data pertaining to the number of stainless steel crowns completed per patient in 1990 indicate that there was no statistically significant difference between Lowry vs. non-Lowry patients. This may be due to several different factors including water fluoridation and improved dental awareness. The trend demonstrated by data pertaining to restorations completed during the past five years supports various studies suggesting that, in general, children are requiring less restorative dentistry.[8,14] Although the general dental health of children appears to be improving, studies by Ripa, and Spencer *et al*, have indicated that there is still a segment of the pediatric population that continues to re-

Table 3. ☐ Mean number of amalgam and stainless steel crown restorations completed per student per patient per year.

	Amalgams		Crowns	
	Lowry	Non-Lowry	Lowry	Non-Lowry
1986				
Mean	*2.7	1.5	*0.5	0.08
S.D.	2.6	1.0	0.7	0.2
1987				
Mean	*3.3	1.4	$0.3	0.2
S.D.	4.3	1.0	0.7	0.3
1988				
Mean	*2.2	1.2	*0.5	0.08
S.D.	2.1	0.8	0.9	0.1
1989				
Mean	*1.1	0.8	*0.4	0.2
S.D.	0.9	0.6	0.5	0.2
1990				
Mean	*1.3	1.0	0.3	0.2
S.D.	1.0	0.7	0.4	0.3

* Results significant at $p<0.05$

quire extensive treatment as a result of dental caries.[16,17] In view of these statistics, it is the responsibility of dental educators to provide undergraduate dental students with adequate experience in restorative dentistry for pediatric patients. Community service programs such as the Lowry Clinic, designed to serve indigent children can enhance undergraduate dental education and clinical experience.

Children with lower family incomes demonstrate poorer dental health in general.[10] These children benefit greatly from dental programs that provide comprehensive dental care at minimal or no cost to the patient. The University of Missouri has made a commitment to community service by underwriting the funding for the Lowry Clinic. The University donates approximately $20,000 ($200.00 per fourth-year dental student) worth of free dental care to the indigent children participating in the Lowry Clinic. Although many dental schools would be unable to underwrite this type of project alone, Schuman *et al*, report that there are federal, state and local agencies that may aid in supporting such programs.[18] As dental educators, we must seek the extramural support necessary to initiate and sustain a program that not only provides dental students with valuable clinical experience but also provides children with dental care that they would not ordinarily receive.

In conclusion, the data indicate that this community service program does provide undergraduate dental students with valuable clinical experience in treating pediatric patients. During four of the five academic years surveyed, dental students completed significantly more amalgam and stainless steel crown restorations per patient in the Lowry clinic versus non-Lowry clinic. This community service program continues to be a viable alternative for meeting the needs of both our undergraduate dental students and indigent pediatric patients.

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AVOID BEING A HISTORIAN

Leave bad behavior to history and don't keep bringing it up. If a child makes an error, constantly reminding him of his error will only lead to resentment and increase the likelihood of bad behavior. What is done is done. Working toward a better future makes more sense than dwelling on history. Reminding your children of the errors they make only holds their errors as examples of what not to do, but doesn't show them what to do. If reminding children about their errors does anything, it acts as practice in making errors.

Youngs, B.B.: *The 6 vital ingredients of self-esteem.*
New York: Rawson Associates, 1991, p 46.

DEMOGRAPHY

"Rediscovering" the health status of Native Americans

H. Barry Waldman, BA, DDS, MPH, PhD

This is the 500th anniversary of the supposed "discovery" of the New World (if we may omit the fact that there had been a previous "discovery" approximately a thousand years ago by the Norseman and that the entire continent was peopled by a resident population for in excess of ten thousand years). It would seem appropriate, from the perspective of the health professions, to "discover" the general and dental health status of Native Americans—particularly at a time when educators are being encouraged to teach a more realistic historical presentation on the contributions of the many minorities to the development of our nation.[1]

POPULATION DEMOGRAPHICS

In 1990, the Bureau of the Census reported that there were two million Native Americans (0.8 percent of the total U.S. population), an increase of 37.9 percent since 1980. During the same period, the overall population of the nation increased by 9.8 percent.[2] In federal fiscal year (FY) 1990, the Indian Health Service (IHS) identified more than 1.1 million American Indians and Eskimos (or Aleuts) in its service population. This population was increasing at a rate of 2.7 percent per year.[3,4] Ninety percent of the Indian Health Service population lives in eleven states: Alaska, Arizona, Minnesota, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, Utah, Washington, and Wisconsin.[5] While the States of Alaska and New Mexico have the highest concentration of native Americans, between 1980 and 1990, the population of Native Americans increased by 117 percent and 96 percent, respectively, in the States of Alabama and Tennessee (Tables 1 and 2).

There are numerous differences between the population demographics of Native Americans and those of the general population. For example, in 1980:

- ☐ Thirty-two percent of the Native American population was younger than fifteen years (23 percent for the general population).
- ☐ Five percent of the Native American population was older than sixty-four years (11 percent of the general population).

Table 1. ☐ States with the highest Native American population concentration: 1990.[2]

State	1990 population	Change from 1980	Percent of state population
	(000s)		
Alaska	85.7	33.7%	15.6%
New Mexico	134.4	26.6	8.9
Oklahoma	252.4	49.0	8.0
S. Dakota	50.6	12.5	7.3
Montana	47.7	27.9	6.0

Table 2. ☐ States with the largest increase in Native American population: 1990.[2]

State	1990 population	Change from 1980	Percent of state population
	(000s)		
Alabama	16.5	117.7%	0.4%
Tennessee	10.0	96.7	0.2
Florida	36.3	88.7	0.3
Hawaii	5.1	84.2	0.5
New Jersey	14.9	78.3	0.2

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Ninety percent of the Indian Health Service population lives in eleven states.

- ☐ Twenty-eight and two tenths percent of the Native American population was below the poverty level (12.4 percent for the general population).[4]
- ☐ The average family income for Native Americans was $16,500 ($23,100 for the general population).[5]
- ☐ A smaller percentage of the Native American population completed high school and college than the general population (Table 3).
- ☐ Forty-two percent of Native American mothers were under twenty years of age when they had their first child, compared to 24 percent for the general population.[4]
- ☐ The life expectancy at birth for Native Americans was 3.3 years less than that for the white population (Table 4).
- ☐ In 1984, 40 percent of the births of Native Americans were to unmarried women; compared to 59 percent for blacks and 13 percent for whites (Table 5).

INDIAN HEALTH SERVICE

The Indian Health Service (IHS) is a component of the Public Health Service and functions within the Department of Health and Human Services. The IHS comprises eleven regional area offices with a headquarters office located in Tucson, Arizona, which is responsible for administering the delivery of health services. The IHS operates forty-three hospitals, sixty-seven health centers, five school health centers and fifty-five health stations; while tribes operate a comparable series of health delivery facilities. In addition, there are thirty-four urban projects providing community services.[4] Almost three quarters of Native American children receive their medical services from Indian Health Service and tribal facilities.[6]

The number of direct and contract dental services provided by the IHS, tribal and urban programs doubled between FY 1970 and FY 1989. In FY 1989, approximately 2.2 million dental services were provided. Nevertheless, untreated dental caries rates are almost three times that of the general population. (See below).

DEMOGRAPHICS OF HEALTH

There are many marked differences between Native American and general population levels of health. For example, in the mid-1980s:

- ☐ American Indian, age-adjusted, mortality rates for the following diseases were much greater than the rates for the general population:
  - ☐Tuberculosis: 400 percent greater.
  - ☐Alcoholism: 332 percent greater.
  - ☐Diabetes mellitus: 139 percent greater.
  - ☐Accidents: 139 percent greater.
  - ☐Homicide: 54 percent greater.

Table 3 ☐ Social and economic characteristics of American Indians in 33 reservation states(*): 1980.[4,5]

	American Indians, Eskimos & Aleuts	U.S. All race
Median age	22.6	30.0
Average number of persons per family	4.6	3.8
Median family income	$13,700	$19,900
Average family income	$16,500	$23,100
Per capita income	$3,600	$7,300
Percent of all persons below poverty level	28.2%	12.4%
Percent high school graduates	55.4%	66.5%
Percent college graduates	7.4%	16.2%

*A reservation state is one in which the IHS has responsibilities for providing health care to American Indians or Alaska Natives. In 1990, there were 33 reservation states.[4]

Table 4 ☐ Life expectancy at birth by race and gender for American Indians and Alaskan Natives and total U.S. white population: 1980.[5]

	Male	Female
American Indian & Alaskan Natives	67.1 yrs.	75.1 yrs.
U.S. white population	70.7	78.1

Table 5 ☐ Birth characteristics by race: 1984.[5]

	Native American	Black	White
Births to unmarried mothers(*)	39.8%	59.2%	13.4%
Birth of low birthweight	6.2	5.6	12.4
Preterm births	11.0	16.8	7.9

*Per 1,000 total live births

- ☐Pneumonia and influenza: 44 percent greater.
- ☐Suicide: 28 percent greater.
- ☐ The maternal death rate for Native Americans was 22 percent higher than that of the general population.
- ☐ The two leading causes of death for Native Americans, ages fifteen to twenty-five years were accidents and suicide; for the general population the leading causes of death were accidents and homicide.
- ☐ The two leading causes of death for native Americans, ages twenty-five to forty-four years were accidents, chronic liver disease, and cirrhosis; for general population the leading causes of death were accidents and malignant neoplasms.
- ☐ Thirty-three percent of all Native Americans who died were under forty-five years of age, compared to 11 percent for the general population.[4]

DENTAL HEALTH

While both the prevalence and severity of dental caries have decreased markedly among the general population of children, "...dental caries remains a serious problem for large numbers of AI/AN (American Indian and Alaskan Native) youngsters." (Niendorff, W.J. and Collins, R.J. unpublished observations, 1986).[7] For example, the results from a 1983-84 study of dental patients conducted in dental clinics of the Indian Health Service* (compared to the results from the National Caries Prevalence Study conducted in 1986-1987) indicate that:

- ☐ Nineteen percent of Native American dental patients, five to nineteen years of age, were caries-free, compared to 49.9 percent of the subjects, ages five to seventeen years, in the general national study.[2,7]
- ☐ Native Americans have a decayed-missing-filled teeth (DMFT) count that is three times that of the general population. The (d) decayed component rate of the DMFT for Native Americans (44 percent) is almost three times that of the general population (15.3 percent) (Table 6, Figure 1).**

A series of reports by the Indian Health Service document the prevalence of baby bottle tooth decay in various regions at from 17 percent to 52 and 70 percent. In addition, 87 percent of those affected by the disease displayed the most severe manifestations of the disease (i.e. two or more maxillary anterior tooth surfaces with caries, plus one or more teeth with pulpal

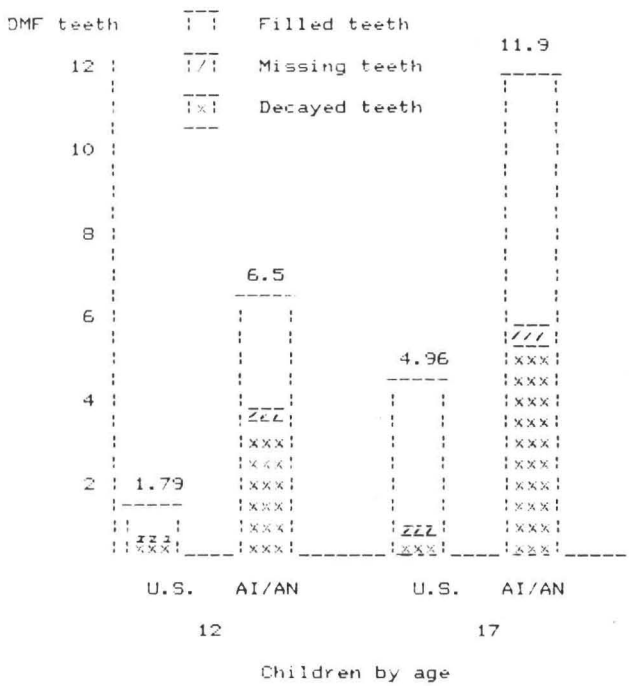

Figure. Mean decayed mission and filled teeth (DMFT) status and percent DMFT due to decayed, missing and filled teeth for American Indian/Alaskan Native children (1983-1984) and all U.S. children (1986-1987)—age 12 and 17 years.[9,10]

Table 6. ☐ Mean decayed, missing and filled teeth (DMFT) scores and percent DMFT due to decayed, missing and filled teeth for Native American children (ages 5-19) in Indian Health Service (IHS) clinics in 11 IHS geographic areas (1983-1984) as compared to all U.S. children (age 5-17) (1986-1987).[3,10]

		Percent of DMFT		
	DMF Teeth	Decayed	Missing	Filled
Native Americans (IHS)	5.9	44%	2.2%	53%
All U.S. children				
Total	1.97	15.3	1.3	83.4
Urban (SMSA)*	1.95	14.6	1.3	84.1
Rural (nonSMSA)	2.04	17.1	1.4	81.5

*Standard Metropolitan Statistical Area

*The results from this study of clinic patients represents the latest available information on the oral status of Native Americans.[8]

**There were major differences in the sampling method, making direct comparisons of the IHS data with the national survey data difficult. However, "...the higher incidence of tooth decay in AI/AN (American Indian and Alaskan Native) children cannot be explained by these differences."[8] In addition, because the IHS data were collected from a sample of dental patients, they necessarily do not represent the actual dental caries prevalence among all AI/AN children.[8]

involvement or mandibular anterior decay, or both).[7] "The majority of recent reports of nursing caries in Western-type cultures, including the United States and numbers of other countries, indicate the prevalence to be approximately 5 percent or less."[11]

Surveys of Native American school children have reported prevalence of regular smokeless tobacco use ranging from 24 to 64 percent. In addition, there are indications that there is "...a greater prevalence of smokeless tobacco use in Indian adolescents than in Indian adults."[12] Smokeless tobacco use has been linked with oral cancer and other oral conditions and can produce nicotine addiction similar to that of cigarette smoking.[12]

In the past, because of limited numbers of native Americans identified in national sampling frames, the information on the dental status of this population has been reported in the "black and other races" and "other races" categories or included in the general totals, but not otherwise identified. The published or unpublished data on the dental status of Native Americans (unpublished data find their way into the literature by citations in subsequent articles) often are limited to observations on those individuals who have sought services in a dental facility. Service need information for those not seeking care generally is not available.

DENTAL PERSONNEL

Between academic years 1980-81 and 1990-91, the number of Native Americans enrolled in entering classes of dental schools ranged between nine and twenty-one students per year. A total of 50 female and 126 male native Americans entered dental school during this period: a total of a half percent or less of the respective classes (Table 7).

In 1990-91, forty-five female Native Americans entered dental assisting education programs; fourteen female Native Americans entered dental hygiene programs; four male and two female Native Americans entered dental laboratory technology programs.[15]

WHY NATIVE AMERICANS?

In 1990, "...nearly one in every four Americans (was of) African, Asian, Hispanic or American Indian ancestry."[2] The need to know about the burgeoning diversification of the population in our country should transcend our attention to the growth of the numerically larger minority groups.[16,17] In the past, most practitioners (except in specific locales) have had limited contact with Native American populations. Government agencies and tribal programs have provided most services.

But we are an inquisitive and concerned profession. We are unsatisfied when information is inadequate and when individuals do not receive needed services. While members of the dental profession do provide services

Table 7 ☐ Number of Native Americans in first year dental school classes by gender: 1980-81 through 1990-91.[13,14]

Year	Male	Female	Total	Percent of entering class
1980-81	11	1	12	.2%
1981-82	15	6	21	.4
1982-83	13	3	16	.3
1983-84	16	3	19	.4
1984-85	13	4	17	.3
1985-86	10	6	16	.3
1986-87	5	4	9	.2
1987-88	11	9	20	.5
1988-89	16	5	21	.5
1989-90	11	4	15	.4
1990-91	5	5	10	.2
Totals	126	50	176	

Only 19 percent of Native American dental patients, 5 to 19 years of age were caries-free.

under the auspices of government agencies and tribal programs, the reality is that we are unsure of the health status of the Native American population. (Note: the American Indian and Alaska native component of the 1987 national Medical Expenditure Survey does provide some general data on the status of these populations.[6]) If general health status data and the "sketchy" available dental information are any indication, however, one may hypothesize that the need for dental services in the North American population is greater than that in the general population. If the dental profession does not seek to increase and improve services for the Native American population, who will?

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DELEADING THE ENVIRONMENT

The Centers for Disease Control Strategic Plan contains an econometric analysis of the costs and benefits of lead prevention. The Plan estimates the costs for deleading homes and the benefits that accrue from reduced need for medical care, for special education and the increase in wages that goes with having a higher IQ. The model does not include other potentially related benefits such as increased tax returns, reduced spending for delinquency, and reduced medical costs for hypertension and cardiovascular disease. The conclusion of the analysis, described as conservative by Centers for Disease Control, is that the net return to our society for deleading the housing stock in the United States would be $28 billion more than the costs of the abatement.

It should not be necessary to place a price tag on the eradication of a serious childhood illness; the presence of the disease and owning the means to eliminate it should be enough. But this is the era of self-satisfied pragmatism, and metrics are often required to justify undertaking moral actions. The eradication of lead, this blunter of children's cognition and silent thief of their futures, meets the pragmatic test. The numbers are clear; it makes unequivocal fiscal sense to make this investment in human capital, and in achieving this end, we might learn something important about our ability to control our personal destinies.

Needleman, H.L. *et al*: Lead toxicity in the 21st century. Pediatrics, 89:678-680 April 1992.

Hispanic children: An increasing reality in pediatric dental practice

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"...are we so certain of the economic viability of pediatric dentistry that we may overlook minority children?"[1]

The changing population demographics (in particular the growth of minority groups) and its potential impact on pediatric dental practice have been emphasized repeatedly in a series of reports in the Journal of Dentistry for Children.[1-3] Unfortunately, despite the great variety that exists in the country's minority population, in the past the tendency has been to dichotomize most reported data into a "white population" and "black population" format, indicating that "other groups" are included in the overall "total" category. Government agencies increasingly are recognizing, however, the limitations of such a reporting system and have begun to emphasize the variety and significance of the "other groups", in particular, the population of Hispanic origin.*

The following presentation will provide available estimates on Hispanic children: a population which will be an increasing reality in the future of pediatric dental practice.

POPULATION SIZE

In 1990, almost two thirds of the 20.8 million persons of Hispanic ancestry in the United States were of Mexican origin (Table 1). By the end of the decade, the 11.5 million Hispanic children (i.e. less than eighteen years of age) will represent the largest population of minority children. While the number of Hispanic children will continue to increase during the early years of the next century, the number of white children will decrease and the number of black children will stabilize (Table 2). Note: The Centers for Disease Control reported that, in 1988, babies born to single women represent 26 percent of all American newborns. Infants born to single women represented 63 percent of all black babies, 34 percent of Hispanic babies, and 18 percent of white babies.)[6]

ECONOMICS

"(Except for)...families with incomes slightly above Medicaid income limits...there was a direct relationship between increasing income and the number of pediatric dental visits per child."[2]

In 1989, 15.2 percent of non-Hispanic and 21.5 percent of Hispanic households† had incomes of less than $10,000. Almost one third of Puerto Rican households had incomes below $10,000 (Table 3). More than dou-

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*Hispanic origin data are based upon a self-identification process. Persons of Spanish/Hispanic origin or descent (who may be of any race) are those who classify themselves of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish origin.[4]

†A household consists of all the persons who occupy a housing unit (a house, an apartment or other group of rooms or a single room).[4]

Table 1 ☐ Estimate of the Hispanic population in the United States: March 1990.[4]

Hispanic population	Percent
Mexican	64.0
Puerto Rican	10.5
Cuban	4.9
Central & S. American	13.7
Other	6.9
Totals	100.0 (20.8 million)

Table 2 ☐ Projections of the number of children (less than 18 years of age) by race and Hispanic origin.[5]

	1990	2000	2010
		(in millions)	
White	51.4	52.7	48.3
Black	9.9	10.6	10.6
Hispanic	9.5	11.5	13.3
Totals	64.0	65.7	62.6

Table 3 ☐ Percent of households with incomes of less than $10,000: 1989.[4]

Not Hispanic	15.2%	
Hispanic	21.5	
Mexican		21.0
Puerto Rican		31.3
Cuban		20.7
Central & S. American		15.1
Other Hispanic		20.9

Table 4 ☐ Estimate percent below poverty line by age and ethnic origin: 1989.[4]

	Non-Hispanic	Hispanic
	(Percent of total below poverty line)	
Less than 18 yrs	38.3	47.9
18–64 yrs	49.6	48.2
65 yrs and over	12.1	3.9
Totals	100.0%	100.0%
	(Percent in each age-group)	
Less than 18 yrs	17.5%	36.2%
18–64 yrs	9.3	20.9
65 yrs and over	11.1	20.6

Table 5 ☐ Selected characteristics of Hispanic persons, households and families: 1983, 1990.[4]

	1990	1983	Percent change
Educational attainment (25 yrs & over)			
Less than 5 yrs of school	12.3%	15.6%	−21.2
4 yrs high school or more	50.8	45.6	11.2
4 yrs of college or more	9.2	8.0	15.0
Median household income (1989 constant dollars)	$21,922	$19,503	12.4
Families below poverty level	23.4%	27.2%	−14.0

Table 6 ☐ Percent of households with incomes of $50,000 or more: 1989.[4]

Not Hispanic	24.1%	
Hispanic	13.8	
Mexican		11.9
Puerto Rican		14.5
Cuban		20.7
Central & S. American		17.1
Other Hispanic		15.5

ble the proportion of Hispanic than non-Hispanic families‡ lived in poverty (23.4 percent vs. 9.2 percent).[4] But most important, almost 48 percent of all Hispanic persons living in poverty were children. (Note: 4 percent of the Hispanic population living in poverty were age 65 and over.)[4] In addition, more than a third (36.2 percent) of Hispanic children, compared to 17.5 of non-Hispanic children, lived below the poverty line (Table 4).

But there have been improvements. The poverty rate of Hispanic families in 1989 (23.4 percent) was lower than it was in 1982 (27.2 percent). Although the median income of Hispanic families in 1989 was lower than that of non-Hispanic families ($21,900 vs. $29,500) the median income of Hispanic households in 1989 was about 13 percent higher than in 1982 (after taking into account changes in the cost of living) (Table 5). Among the Hispanic subgroups, Puerto Ricans had the lowest median household income ($18,900).[4] (Note: during the 1980s, there were marked increases in the educational attainments of Hispanic persons [Table 5]).

In addition, Hispanic unemployment in 1990 was about a half of what it was in 1983. In 1989, almost 14 percent of Hispanic households had incomes of $50,000 or more (compared to 24 percent for non-Hispanic households). Among the Hispanic subgroups, Cubans had the highest percent of households with incomes of $50,000 or more (20.7 percent) and Mexicans had the lowest (11.5 percent) (Table 6).

‡A family is a group of two persons or more related by birth, marriage or adoption and residing together.[4]

DENTISTRY FOR HISPANIC CHILDREN

"Despite the increasing number of Hispanics in the United States, little information on their oral health status is available."[7]

Some recent studies of the oral health status of immigrants and migrants have documented a significantly higher prevalence of dental caries and unmet restorative treatment needs in children of these Hispanic families, compared with the general population.[8-10] But for economic, social, and political reasons, new immigrants and migrants tend to seek less treatment than the general population.

The only recent study that collected data information on the oral health status of Hispanics is the Hispanic

Table 7 □ Percent distribution of Decayed, Missing, and Filled permanent teeth, total DMF rate for Mexican Americans, Cuban Americans, Puerto Ricans, and white population: ages 5–17: 1982–1984, 1986–1987.[13,14]

	Percent			
	Decayed	Missing	Filled	DMF rate
Mexican-American*	32.8	1.9	65.2	2.13
Cuban American*	24.6	6.2	69.1	2.07
Puerto Rican*	25.6	3.7	70.6	2.96
White population**	11.7	0.8	87.5	1.97

*1982–1984
**1986–1987

Health and Nutrition Examination Survey (HHANES) conducted by the National Center for Health Statistics between 1982 and 1984.[11,12] The HHANES report represents the results of a cross-sectional analysis of the prevalence of dental caries and periodontal disease, as well as the frequency and type of dental services. The study included Mexican-Americans in Arizona, California, Colorado, New Mexico, and Texas; Puerto Ricans in the New York City area; and Cuban Americans in Dade County, Florida.[13]

The results from the 1982-84 HHANES report were compared with the 1986-87 National Survey of Dental Caries in U.S. School Children.[14] (Note: care should be exercised in comparing the data from these two studies because of the differing periods of time and the regional nature of the HHANES study and the national scope of the survey representing all U.S. school children.)

Mexican-American and Cuban-American children DMF teeth rates were comparable to that of white children. Puerto Rican children DMF teeth rates were almost 50 percent higher than those of the other groups. But most significant were the differences in the decayed (D) component of the DMF rates. The D component of the DMF rate for white children was 11.7 percent. The D component for Cuban-American and Puerto Rican children was more than double the rate; for Mexican-American children it was almost triple the rate (Table 7).

An additional analysis of data from the Southwestern states in the HHANES report was carried out for dentate Mexican-Americans, aged twelve to seventy-four years, who 1) were born in Mexico, 2) spoke and wrote in Spanish only, and 3) they and their parents identified themselves as Mexicans. This group (identified as having "low acculturation status") was compared with other groups of Mexican-Americans who reported themselves as being Americans, spoke and wrote in Spanish and/or English, etc. These latter groups were identified as having "higher acculturation status").[7]

The results from the study indicated that Mexican-American adolescents with low accultural status 1) had higher mean number of decayed and missing teeth, 2) had poorer oral hygiene, 3) had higher prevalence of gingivitis and periodontal disease, 4) were less likely to have dental insurance, and 5) visited a dentist less frequently, than their counterparts with high accultural status. "The Mexican-Americans with low accultural status had minimal access to the health care system... despite their obvious need for care."[7]

THE REALITIES OF ECONOMICS

The economic realities of dental practice demand a reasonable financial return for services rendered. The economic realities of dentistry for Hispanic children have been the disparity in the incomes of non-Hispanic and Hispanic families. The economic realities of Medicaid dentistry have been that the service reimbursement rates in most states have not maintained any semblance

The poverty rate of Hispanic children was lower in 1989 (23.4 percent) than it was in 1982 (27.2 percent).

of parity with ongoing charges in the general community (or for that matter, with the overhead costs of practice). And yet, those states that elect to participate in the Medicaid program are mandated to provide dental services to children.[15]

Developments in the State of New Hampshire highlighted the inadequate fee schedules and the resultant difficulties faced by Medicaid eligible individuals in their attempt to secure services. In 1990, a class action suit was filed in the U.S. District Court in New Hampshire alleging that, as a result of limited reimbursement rates, state officials "failed to ensure sufficient 'participating by dentists in the state Medicaid programs' so that children under age 21 from low-income families can obtain adequate dental care."[16] (Children are the only population group eligible for regular dental care through Medicaid's early periodic screening, diagnosis and treatment programs.) The suit alleges that the Medicaid reimbursement rates for dentistry have not been increased since 1972.

But limitation in access to health care by Hispanics is not confined to dental services. As with dental services, the ability of Hispanics to obtain general medical care is hampered by relatively low incomes, lack of health insurance coverage and ties to a particular health provider.[17]

POTENTIAL IMPACT ON PEDIATRIC DENTAL PRACTICE

The continuing need to develop patient populations as former patients "age out" of pediatric practice increasingly will draw pediatric dentists to provide service to "non-traditional" groups. The forecasted decrease in the numbers of white children will be offset by an increase in the numbers of Hispanic children. In many instances, rising educational and employment opportunities, with associated improvements in economic standards for Hispanic families will require minimal changes in practice procedures. Other cases will require practitioner advocacy to enhance government financial contribution for dental services for Hispanic children.

But beyond problems of numbers and economics, pediatric dentists will be providing services for children whose language, culture, and heritage may be quite different from that of many past patients. Yes, the majority of Hispanic pediatric dental patients can be managed successfully using the standard behavior techniques.[18] Rather, the need will be to transcend the few directions that many dental students learned in dealing with Spanish language patients, *Abre la boca, Cierra la boca,* and *Escupe.* While the increasing numbers of Hispanic students in dental schools and pediatric dentistry programs could prove to be an important factor in the development of services for Hispanic children, the reality is that many (most?) practitioners will provide services for Hispanic children.[19] How ready are you and your staff for this eventuality?

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REVIEW

Root canal filling materials for primary teeth: A review of the literature

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It is important to maintain the primary dentition in a non-pathologic and healthy condition for space maintenance, proper mastication, esthetics, and prevention of aberrant habits such as tongue thrust and phonetics.[1,2] Pulp therapy has been suggested since at least 1932 as a method for maintaining primary teeth, which would otherwise be lost.[3] Still, primary tooth pulp therapy has remained controversial for a number of reasons. The perceived difficulty of behavior management in the pediatric population and difficulties with root canal filling materials have surely added to the reluctance among dentists to use this procedure. This literature review is intended to clarify the state of material science in regard to pulpal filling materials for primary teeth.

Root canal filling materials for primary and permanent teeth have different criteria: Differences in the morphology of primary and permanent teeth, desired timely root resorption of primary teeth, and the difficulty in obtaining a good radiographic view of the apex of a primary tooth.[4-7] The criteria for an ideal root-canal filling material for primary teeth have been named by several authors. The material should resorb as the primary tooth root resorbs, be harmless to the periapical tissues and permanent tooth germ, readily resorb if pressed beyond the apex, be antiseptic, easily fill the root canals, adhere to the walls of the canal, not shrink, be easily removed if necessary, be radiopaque, and not discolor the tooth.[7-9] At the present time no material meets all ten of these criteria.

The four most commonly used materials for filling primary pulp canals are zinc oxide and eugenol, calcium hydroxide, iodoform, and gutta percha. These materials will be reviewed individually. At various times each of these materials has been suggested for one or more types of pulp therapy, including pulpotomy and pulpectomies on vital, as well as, necrotic teeth. For the purpose of clarity, this paper assumes a material is to be used for all of these procedures, unless otherwise specified.

ZINC OXIDE AND EUGENOL MIXTURE

Zinc oxide-eugenol paste is probably the most commonly used root canal filling material for primary teeth in the United States, and most textbooks include this material as a root canal material for primary teeth. Several researchers have reported on this subject.[10-14] Camp stated that once the patient is free of all clinical signs and symptoms of infection, the canals are filled with a resorbable paste of ZOE.[2] Cullen stated that the ma-

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Particles of zinc oxide may remain in the alveolar bone as the root is resorbed.

terials can be carried to the pulp chamber and canals by a lentulo spiral; placed in bulk and pushed into the canals with endodontic pluggers; or pushed into the canals with a wet cotton pellet.[5] There are several disadvantages associated with ZOE including underfilling of the root canals. Camp introduced the use of the endodontic pressure syringe to correct this problem.[2] Overfilling, on the other hand, causes a mild foreign-body reaction according to Barker.[16] Another disadvantage of ZOE, as Allen stated, is the difference between the resorption rate of the zinc oxide paste and the tooth root. Consequently, particles of zinc oxide paste may remain in alveolar bone as the root is resorbed.[17] Further, as reported by Jerell and Ronk, the long-term effect of ZOE when mixed with formocresol is not fully understood, particularly in the event of root-canal overfilling.[18]

CALCIUM HYDROXIDE

Hermann in 1930 showed that calcium hydroxide stimulated the formation of new dentin, when placed in contact with pulp tissue.[19] Currently, in the United States, the use of calcium hydroxide in pulpectomies has been limited to nonvital apexification techniques in permanent teeth.[1,20,21] This technique, termed the Frank technique, uses calcium hydroxide and camphorated monochloroparaphenol. Among the many articles reporting its use is one by Hendry who reported treating nonvital primary teeth in dogs, using zinc oxide eugenol as a control. The calcium hydroxide produced favorable results.[20] Calcium hydroxide is generally not used in pulp therapy for primary teeth, due to the frequent occurrence of internal root resorption.

In Japan, several clinical and histopathologic investigations of a calcium hydroxide and iodoform mixture (VITAPEX - New Dental Chemical Products Co. Ltd., Tokyo, Japan) have been published.[6,7,22-24] It comes as premixed paste and is enclosed in a syringe with an application nozzle. Fuchino in 1978 states that in most cases, physiological root resorption and resorption of this filling material occurred simultaneously.[23] These authors have reported favorable results with this mixture for root canal filling of primary teeth. Machida found this calcium hydroxide-iodoform mixture to resorb at a little faster rate than the rate of root resorption.[8] He found the mixture to be easily applied, to have no toxic effects on the permanent successors, and to be radio-opaque. Machida considers the calcium hydroxide-iodoform mixture to be a nearly ideal pulpal filling material for primary teeth.[8]

IODOFORMl

Walkhoff in 1928 introduced a material which consists of sterilized iodoform paste as the vehicle for a carefully blended mixture of parachlorophenol-camphor-menthol for root canal therapy in primary teeth.[25] Castagnola used Walkhoff paste and reported 68 percent of his cases to be a perfect result and nearly 78 percent as an "improvement".[8]

Barker *et al* in 1971 used KRI Paste (Pharmachemie AG, Swaziland), (a mixture of iodoform, 80.8 percent; camphor, 4.9 percent; p-chlorophenol, 2.0 percent, in dogs' teeth. They observed that paste that extruded into periapical tissue was rapidly replaced with normal tissue.[16]

Rifkin also used KRI paste in forty-five nonvital primary teeth. He reported that it would be desirable when treating nonvital infected primary teeth to use an antibacterial drug capable of penetrating tissue and controlling infection.[9] Orlay found that KRI Paste has a 1.7 to 2.2 cm ring of inhibition against staphylococci, streptococci, and mixed aerobes grown on agar.[26] Rifkin also reported on the effect of the succedaneous teeth when abscessed primary teeth had been treated by KRI Paste.[27]

Recently Maisto's paste (Buenos Aires, Argentina), which consists of a sterilized iodoform mixture of paracholorophenol-camphor-menthol and, in addition, zinc-oxide, thymol and lanolin, was reported to have been used successfully for the treatment of infected primary teeth.[28]

Table ☐ Comparison of root canal filling materials for primary teeth.

Criteria	ZOE	Ca $(OH)_2$ with lodoform*	Kri paste lodoform	Gutta percha
1. Resorbs at same rate as root				
2. Harmless	x	x	x	x
3. Overfill resorbs		x	x	
4. Antiseptic	x	x	x	
5. Easily applied		x		
6. Adheres to the wall	x	x	x	
7. Easily removed		x	x	
8. Radiopaque	x	x	x	x
9. No discoloration	x	x	x	x

* Vitapex - Neo Dental Chemical Products Co. Ltd., Tokyo, Japan.

GUTTA PERCHA

Because gutta percha is not resorbable, it does not satisfy the criteria for an ideal root canal filling for primary teeth.[7-10] Nevertheless, Gerlach in 1932 suggested gutta percha for primary teeth.[3] Ogihara reported sixty-nine cases using gutta percha with root canal sealer and judged 85.6 percent to be apparently successful.[29] Further, Ishikawa used gutta percha for 111 cases of which 94 cases were judged to be successful. Seven cases were extracted, because they were judged to be unsuccessful. There were no cases observed that interrupted the eruption or caused an enamel defect in the succeeding permanent teeth.[30]

The table summarizes the evaluation of these materials.

SUMMARY

In summary, there is no known ideal root canal filling material for primary teeth. The closest to the ideal appears to be a calcium hydroxide-iodoform mixture. More histopathologic studies as well as long-term clinical studies are needed on this material.

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REPORTS

Ectopic eruption of a mandibular first permanent molar: Report of an unusual case

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Ectopic eruption of the first permanent molar is an abnormal positioning of this tooth, causing a premature resorption of the distal surface of the second primary molar.[1-5] Two types of ectopic eruption are recognized, reversible and irreversible (also referred to as "jump" and "hold" cases).[1,6] If the permanent molar spontaneously frees itself and erupts to occlusion, the reversible (hold) type is present. If the permanent molar remains in the locked position until treatment is provided or premature exfoliation of the primary molar occurs spontaneously, the irreversible (hold) type is present.

Irreversible ectopic eruption, where the second primary molar is lost, often causes mesial tipping and rotation of the permanent molar, unfavorable occlusion, and spacing deficiency for the second premolar. Usually some type of treatment is indicated.[3-6]

The literature is replete with the description of the ectopic eruption of the maxillary first permanent molar, but very little is written about the ectopically erupted mandibular first permanent molar, because it is quite rare.[5] In fact, Young reported that only three of 789 ectopic eruptions diagnosed among 1,619 school children were mandibular.[6]

The most thorough review of the literature regarding ectopic eruption of the mandibular first permanent molar was done by Duncan and Ashrafi in 1981.[7] They quoted several authors, all of whom stated that the cause of ectopic eruption is a lack of growth of the jaws.[3,8,9] Sicher was one of those authors cited. According to Sicher, "...normally, the teeth erupt upward and forward, becoming more vertical in position as resorption along the anterior border of the ramus provides space for them. A lack of growth of the mandible in relation to the eruption of the first permanent molar can cause continued mesial inclination of the molar and its eventual entrapment against the distal surface of the second primary molar."

Duncan and Ashrafi's article also stated that ectopic eruption can be a sign of inadequate arch-length, which could result in a crowded permanent dentition and which would require subsequent orthodontic treatment.[3,6,8]

CASE REPORT

The patient, an 8.5-year-old, white male, in the early, mixed dentition stage, was examined in a private dental office. His health history was within normal limits. A clinical examination revealed no hard or soft tissue morbidity. It was observed further that three permanent first molars had erupted, whereas the mandibular left first permanent molar (number 19) was unerupted. Examination disclosed a normal midline, a class II molar relationship with excessive overbite and overjet, and lower permanent incisors that were erupted, but slightly rotated.

Radiographic examination showed:

- ☐ Number 19 to be in a mesioangular position and unerupted.

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Only three of 789 reported ectopic eruptions in children were in the mandible.

- ☐ The mesial half of number 19 caused a definite resorption of the distal root of the mandibular left second primary molar (number k).
- ☐ The mandibular right and left permanent second premolars were congenitally missing.
- ☐ There was a radiolucent area distal and inferior to number 19 (Figure 1).

The treatment plan for this patient consisted of either uncovering the first molar and then repositioning the tooth distally by use of an appliance or extracting the second primary molar and allowing the permanent molar to erupt. Upon consultation with an orthodontist, extraction of the primary molar was recommended because:

- ☐ There was a definite resorption of it's distal root.
- ☐ There was no succedaneous tooth beneath it.
- ☐ In all probability full orthodontics would be instituted.

The patient was examined at six-month intervals. Approximately six months after the primary molar was extracted, the permanent molar was fully erupted. In spite of mesial drifting of the permanent molar, there was still a space (3-5mm) between the first permanent molar and the distal surface of the lower first primary molar (number 1). There was a slight mesiolingual rotation of the permanent molar. On the subsequent six-month oral examination, it was found that the following had occurred:

- ☐ The normal exfoliation of the first primary molar.
- ☐ The mandibular left and right first permanent premolars had erupted.
- ☐ The maxillary left first permanent molar (number 14) had supraerupted, because there was only minimal occlusion with the distal surface of the mandibular permanent molar (Figure 2).

New radiographs were taken and compared to those taken earlier. On an occlusal radiograph, a radiolucent area was noted distal and labial to the mandibular left first permanent molar (number 19); the mandibular left second permanent molar (number 18) was nearly horizontal (Figure 3). The patient was referred to an oral surgeon, who biopsied the radiolucent area. The biopsy revealed an inflamed epithelial cyst, which was excised.

Regarding the treatment of the second permanent molar, the oral surgeon, upon consultation with his colleagues, was left with two choices:

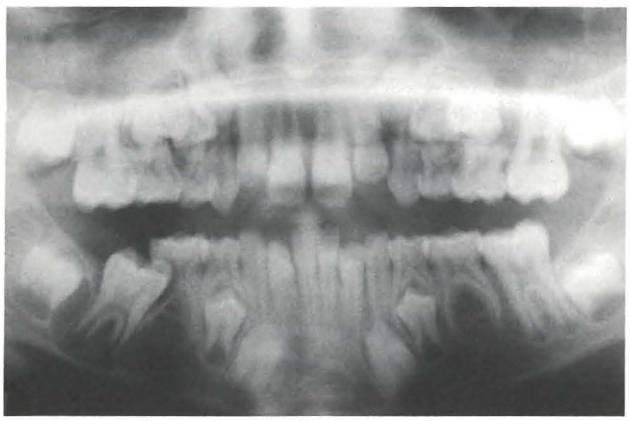

Figure 1. Panoramic radiograph (12/87) showing: (1) ectopic eruption of the lower left first permanent molar; (2) congenitally missing lower left and right second premolars; and (3) radiolucent area distal and inferior to the lower left first permanent molar.

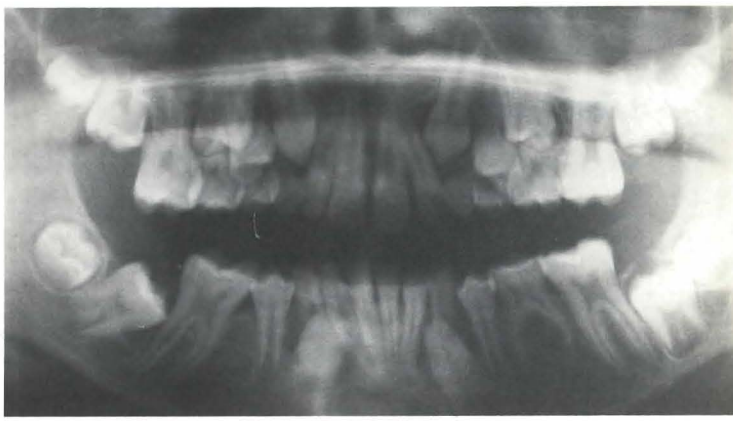

Figure 2. Panoramic radiograph (1/90) showing: (1) tooth number k previously extracted; (2) lower left and right first premolars erupted; (3) tooth number 19 drifted mesially; and (4) tooth number 18 nearly horizontal.

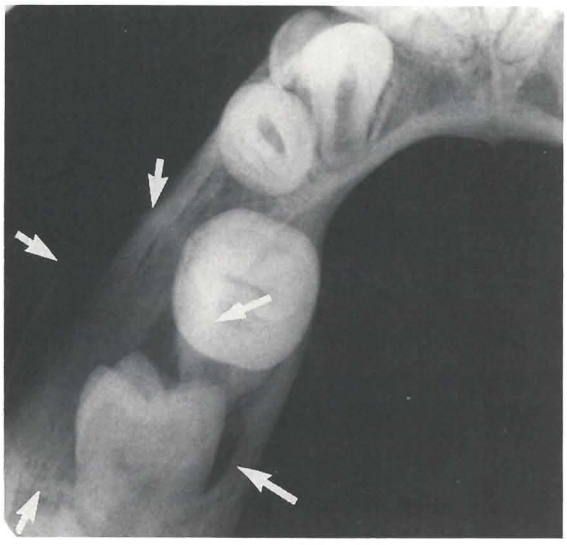

Figure 3. Occlusal radiograph (7/90) showing: margins of the inflamed epithelial cyst, labial and distal to teeth numbers 18 and 19 (arrows).

- ☐ Remove the second molar (number 18) and allow the mandibular left third permanent molar (number 17) to drift and erupt into the space previously occupied by the second molar.
- ☐ Upright the second molar.

The oral surgeon chose to upright the tooth because of his success rate with repositioning. Unfortunately, he had to remove the third molar, because he needed the space distally to upright the second molar superiorly. After six months postoperative, it was found the second molar had not become stabilized by tissues and bony attachments. As a result, it was necessary to remove the tooth. Subsequently, the patient was fully banded (Figure 4).

DISCUSSION

The case presented is unique, because it shows three abnormalities not usually associated with ectopic eruption of a mandibular first permanent molar, namely:

- ☐ A missing second premolar on the affected side.
- ☐ An epithelial cyst on the affected side.
- ☐ A horizontally impacted mandibular second permanent molar on the affected side.

Ectopic eruption is always associated with the resorption of an adjacent primary tooth, which is frequently

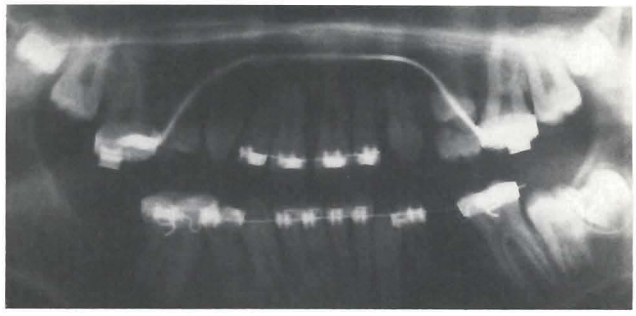

Figure 4. Panoramic radiograph (7/91) showing: (1) excision of inflamed epithelial cyst; (2) teeth numbers 18 and 19 extracted; and (3) patient banded orthodontically.

impacted. The ectopically erupted mandibular left first molar described in this report had all of these signs. The fact that the tooth erupted successfully after the blocked tooth was removed was evidence enough that the eruption potential was not lost and that the tooth would continue to erupt. Hindsight showed that the decision to upright the mandibular second permanent molar, however, was incorrect. Had a similar case been reported in the literature and had this author been aware of that case, perhaps one or both of the extracted molars might have been spared.

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Dentocraniofacial structure with complete anodontia of permanent teeth: Report of case

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Sachiko Ueno, DDS
Tadamichi Takehara, DDS, PhD

The agenesis of numerous teeth, defined as oligodontia, is commonly associated with specific syndromes or systemic abnormalities, and particularly related to ectodermal dysplasia.[1,2] The congenitally missing teeth could be the initial clue to a diagnosis of systemic lesions, and, therefore, of special significance for dental clinical practice.[3,4] At the same time, hypodontia, in which the missing teeth are limited to one or several teeth, is common and is considered a variant of the normal.[5] Indeed the reduction in number of teeth is concomitant with the reduction in the size of the jaw in human evolution, and believed to be a continuing evolutionary trend.

Nevertheless, cases of missing teeth, particularly anodontia— an extreme expression of oligodontia—are most suitable for evaluating the role of teeth in dentocraniofacial development. Among the many anodontia case reports, there are a few reports that include such a consideration, although the importance of the teeth in the development of the jaws and craniofacial structures has yet to be elucidated.[6-17] In this paper, we will evaluate the dentocraniofacial structure where complete anodontia of the permanent teeth exists, and discuss the role of dental growth in the development of the jaws and craniofacial structures.

CASE REPORT

An eight-year-old Japanese girl visited our hospital, because no permanent teeth had erupted. All the primary teeth were present in the oral cavity, except the maxillary lateral incisors. There was no history of tooth extraction or trauma and all of the mandibular incisors

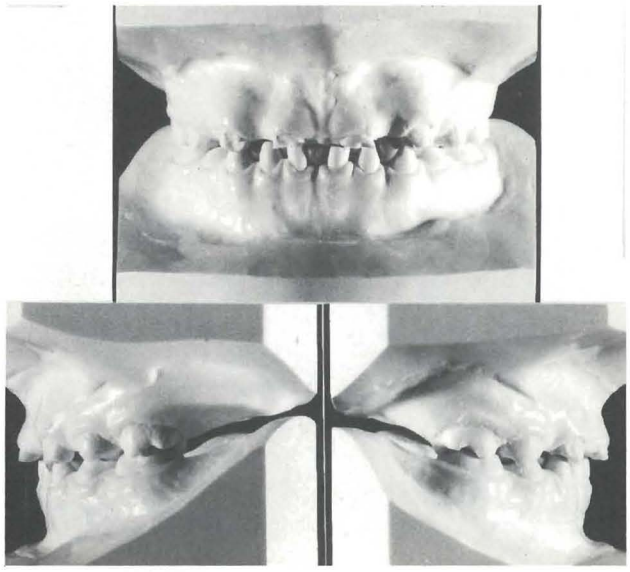

Figure 1. Anterior and lateral views of model of the patient.

and canines were the typically tapered teeth caused by enamel dysplasia (Figures 1 and 2). A radiographic examination found no tooth buds in either jaw (Figure 3). Although her hair and nails appeared to be normal, a decrease of sweat-pore count was diagnosed in the Department of Pediatrics, the Center of Developmental Medicine and Education in Kitakyushu City. No other signs of ectodermal dysplasia were observed and the family's history showed no record of hypodontia or anodontia.

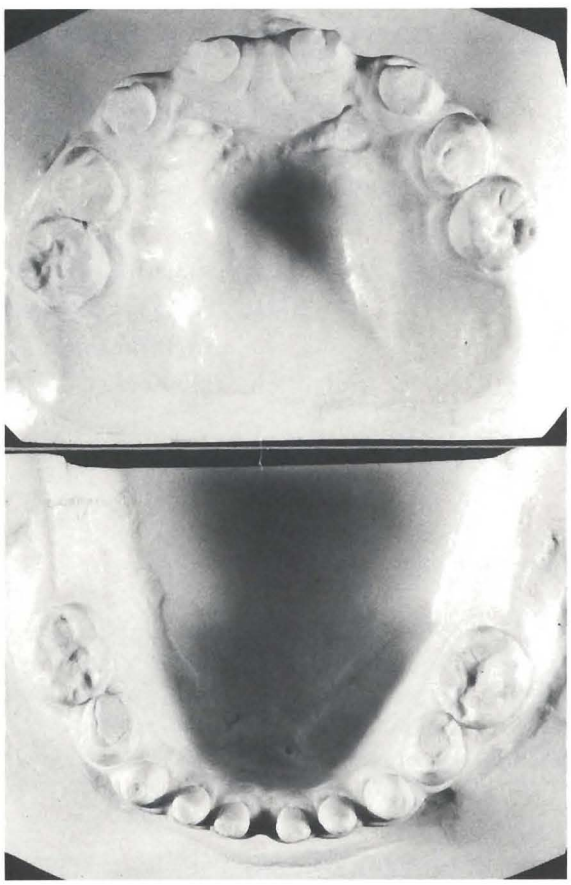

Figure 2. Occlusal views of model of the patient. Note the missing upper lateral incisors and the tapered teeth in the lower anterior region.

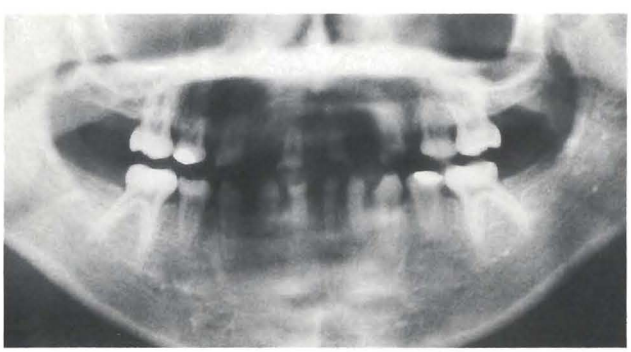

Figure 3. Orthopantomogram of the patient. Note that all permanent tooth buds are absent.

Craniofacial structure

Figure 4 shows cephalometric tracing and Table lists the measurements from the cephalometric analyses. Even though abnormalities in the FH to SN angle are considered, the facial angle and Y-axis clearly suggest a normal horizontal growth of the mandible. While other angular measurements, except for SNA, SNB, and ANB, are almost normal, points A and B as the alveolar fronts, especially point A, are found to be retracted on the basis of the SNA, SNB, and ANB values. The linear measurements reveal an extreme limitation of maxil-

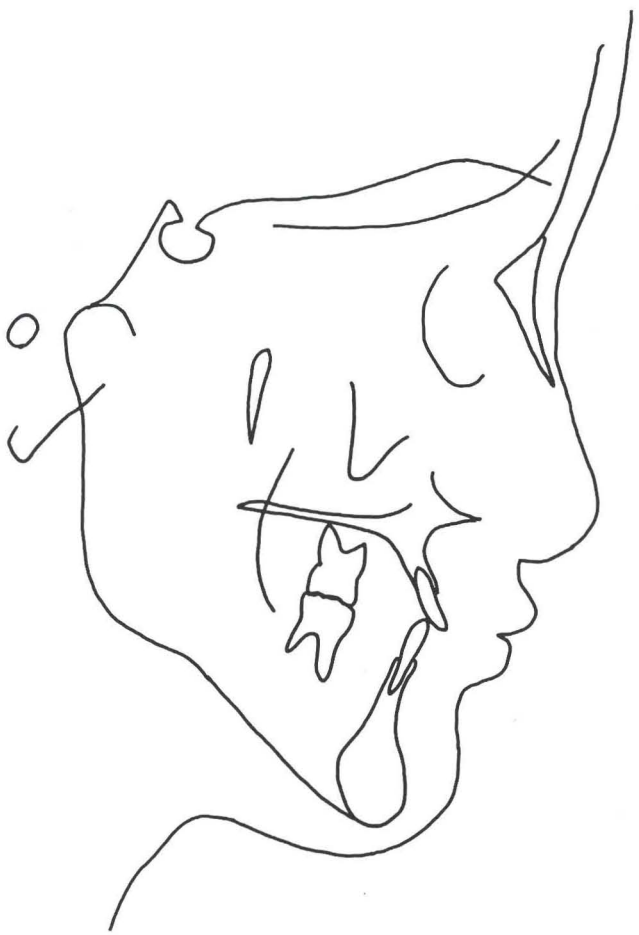

Figure 4. Cephalometric tracing. Note that profile of soft tissue does not appear to be abnormal.

Table □ Cephalometric analysis.

Angular measurements	Measurement (°)	Control** Mean ± S.D. (°)
Facial angle	85.2	82.4 ± 2.10
Y-axis	61.0	65.4 ± 2.47
SNA	67.5	80.7 ± 2.87
SNB	71.5	76.9 ± 2.36
ANB	−4.0	3.7 ± 1.97
Gonial Angle	130.0	126.9 ± 5.18
Ramus pl. to SN	89.8	90.7 ± 4.83
FMA (MP to FH)	29.2	32.2 ± 3.69
FH to SN	10.0	6.8 ± 1.92
Linear measurements	**(mm)**	**Mean ± S.D. (mm)**
S-N	62.0	64.2 ± 2.38
N-Me	104.0	109.1 ± 3.94
Go-Me	60.5	61.7 ± 3.64
Ar-Me	85.5	91.9 ± 4.19
A-Ptm/NF*	30.8	43.9 ± 1.93
N to NF	50.0	47.9 ± 2.40
S to NF	45.0	39.1 ± 2.59
Me to NF	51.8	59.3 ± 2.84
Go to NF	16.0	26.5 ± 3.54

*Distance between the respective points projected on the nasal floor (NF).

**Control values are standard values for 8-year-old girls, established at Department of Orthodontics, School of Dentistry, Osaka University.[19]

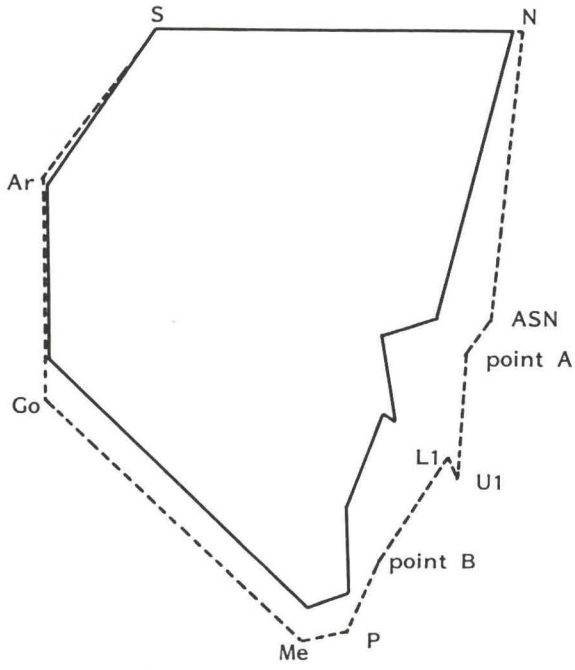

Figure 5. Cephalometric template using a profilogram. The profilogram of the control is framed by using the control values shown in Table.

lary growth and vertical growth of both anterior and posterior lower facial height. Figure 5 shows cephalometric template using the profilogram devised by Sakamoto.[18] The cephalometric template summarizes the results of the cephalometric analyses described above. In addition, as shown in Figure 6, the dental arch widths (D.A.W.) of both jaws are within the ranges of standard deviation in the control group; while the dental arch lengths (D.A.L.) are much smaller than the values of the control and are outside of the ranges of standard deviation.

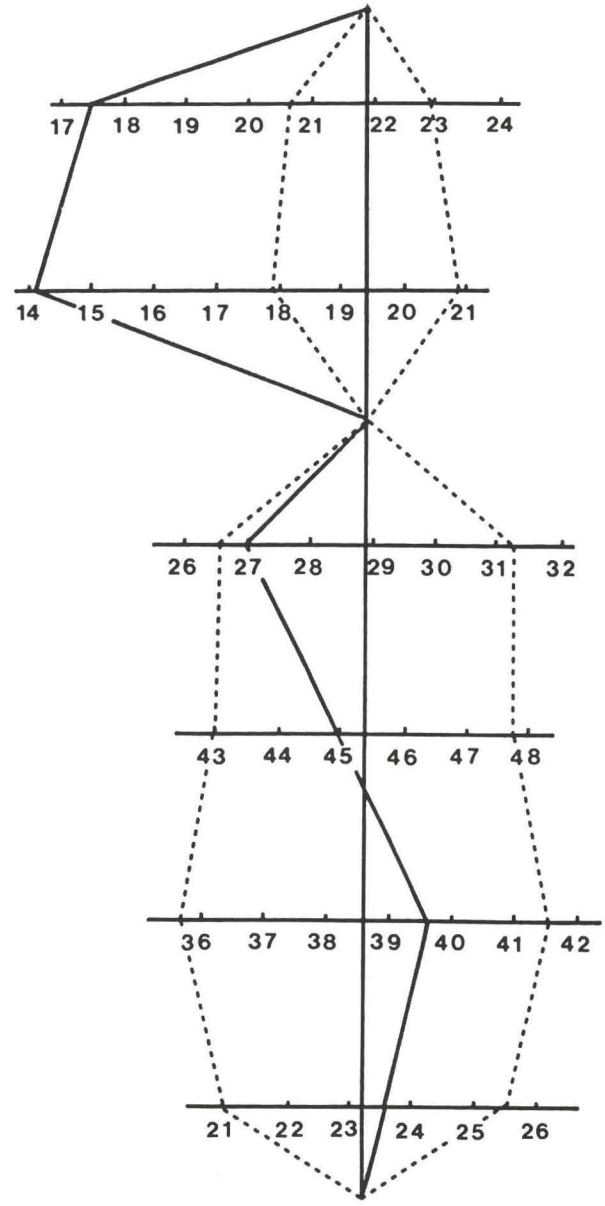

Figure 6. Measurements of the model and comparisons with the control values. D.A.L. is defined as the distance from the labial surface of primary incisor to the line between the central pits of primary second molars. Anterior D.A.W. is defined as the distance between the cuspal tips of the primary canines and posterior D.A.W. as the distance between central pits of primary second molars. The control values were obtained from twenty-eight three to five-year-old girls who were healthy and living in Kitakyushu city, and who had a complete primary occlusion.

DISCUSSION

Ectodermal dysplasia could be characterized by some or many of the following features: absence (anhidrotic) or decrease (hypohidrotic) of sweat glands; kinky hair (pili torti); defective formation of the nails; sparse eyebrows and lashes; odontoplasia including hypodontia

and hypoplastic enamel; iris, and other ectodermal defective formations. The patient was diagnosed as having anhidrotic ectodermal dysplasia, which is mainly characterized by odontoplasia (anodontia and hypoplastic enamel). Ectodermal dysplasia does not necessarily cause the limitation of jaw growth and, furthermore, the patient showed no feature other than odontoplasia, except for a slight decrease of the sweat-pore count. For these reasons, this case is thought to be suitable for evaluating the role of tooth-growth in the development of the jaws and craniofacial structures.

In the present case, the extreme limitation of maxillary and vertical growth of the lower facial height, and a retracted mandibular alveolus front were observed. While Saranat, Brodie, and Kobacki reported that jaw and facial growth in ectodermal dysplasia with complete anodontia lay within the lower range of normal, Tocchini, West, and Bartlett found that the anterior growth of the maxilla was reduced in the case of complete anodontia.[17]

In a former report, however, evaluation of the jaw and facial structures compared with the control was very obscure and our examination of the case found a negative ANB value and a shorter maxillary length than in the control. The conclusions of Tocchini, West, and Bartlett regarding jaws and facial structures with anodontia agreed with ours. They stated that it was unclear whether the lack of growth was due to the absence of teeth or was an effect of the prosthetic replacement. The present case received no treatment in either jaw, however, and the limited growth observed in the maxilla was believed to have been caused by anodontia. It is said that the growth center of the mandible is in the condylar cartilage, and not thought to be affected by dental growth. Indeed, in our case, the growth of the mandibular base was almost normal and the dental effect was limited to the alveolar bone. Tooth growth appeared to exert a substantial influence, however, on maxillary growth in this case. We concluded, therefore, that the role of dental growth was significant in the development of maxillary and alveolar bone, but not in the development of the mandible.

An extreme limitation of maxillary and vertical growth was evident.

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Primary maxillary bilateral birooted canines: Report of two cases

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Curt S. Ralstrom, DDS, MS

The frequency of birooted primary maxillary canines is very low; in fact, since 1975 this anomaly has been reported in the dental literature only six times.[1-6]

The etiology of this condition is unknown. Kelly demonstrated though that twinning of the root can be related to an ingrowth of Hartwig's epithelial root sheath.[2] It is Hartwig's epithelial root sheath that helps to form the shape of the roots as well as initiate dentin formation. The following is a report of two cases of the anomaly.

CASE 1

A four-year-old, black male was brought to the Children's Hospital of Michigan dental clinic with a chief complaint of a toothache in the upper left quadrant. The patient had been experiencing intermittent pain for the past several days. A moderate swelling existed in the buccal vestibule above the carious primary maxillary left second molar. Other carious teeth were noted and generalized mile gingivitis was present. Occlusion was a Class I canine relationship with a distal step molar occlusion. Overbite and overjet were 2 mm.

The patient had a medical history of hyperactivity that was controlled with 10 mg methylphenidate hydrochloride b.i.d. The patient was restrained on a papoose board while radiographs were obtained with moderate difficulty. One of the radiographs (Figure 1) shows a primary maxillary bilateral birooted canine. The patient was treated, using a local anesthetic and healing was uneventful.

CASE 2

A twenty-month-old, black male presented to Children's Hospital of Michigan emergency room with a chief complaint of oral trauma. Medical evaluation of

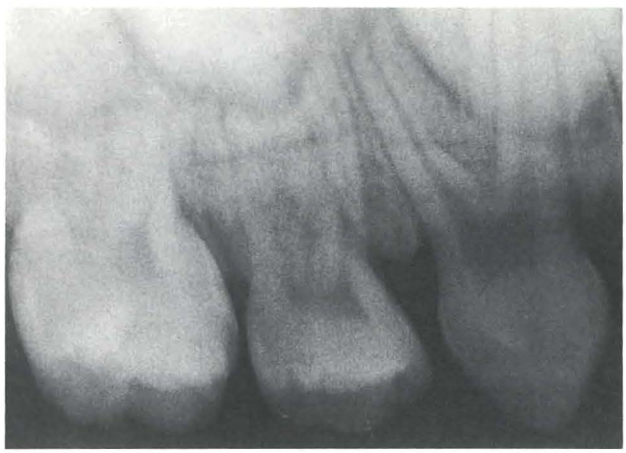

Figure 1. Periapical radiographs showing primary maxillary bilateral birooted cuspids.

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this toddler revealed only oral trauma sustained in a fall when he jumped off his bed striking his sister's crib. The patient was referred to our dental clinic for evaluation and treatment.

The patient's medical history was nonremarkable, except for being a dizygotic twin. Oral examination showed avulsion of the primary maxillary right central incisor with a maxillary alveolar fracture above the primary maxillary right central and lateral incisors. The primary maxillary right lateral incisor had a mobility of 2. The mucosa was denuded down to the alveolar plate and superiorly to the maxillary vestibule from primary maxillary right central incisor to right canine. The maxillary frenum was completely torn. There was slight to moderate bleeding in the area. An upper anterior occlusal radiograph was obtained. Review of this radiograph revealed a missing primary maxillary right central incisor, maxillary alveolar fracture, and a primary maxillary birooted canine (Figure 2).

The patient was treated using a local anesthetic, and healing was uneventful.

DISCUSSION

The review of these two cases further supports the dental literature that there is no sex predilection, but that there appears to be a tendency for this to occur more frequently in black children and in the maxillary arch (Table).

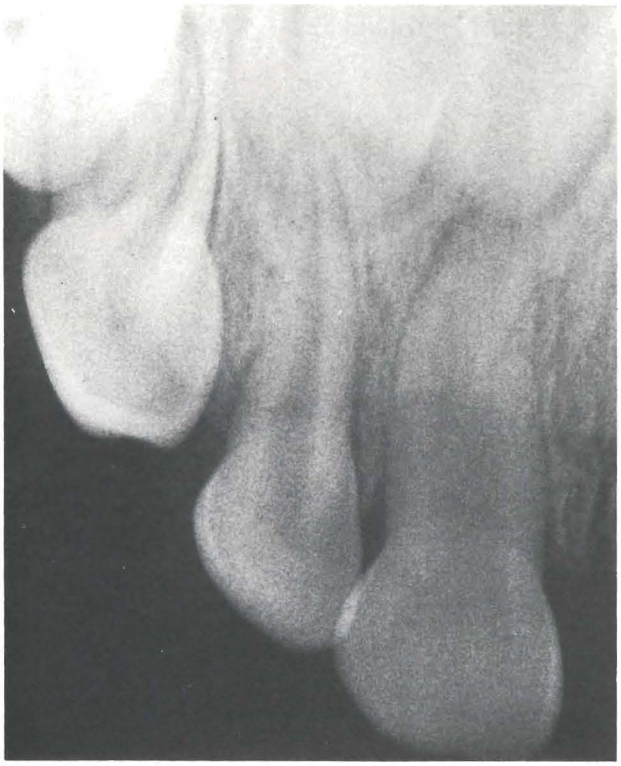

Figure 2. Upper anterior occlusal radiograph showing primary maxillary bilateral birooted cuspid.

Aside from these similarities, there are many differences in morphology associated with this dental anomaly. The dental anatomy of the primary birooted canine reported in the dental literature have the crown morphology of primary canines, and the root morphology of the primary mandibular molars, as can be demonstrated from our radiographs of cases 1 and 2. The normal morphology for the primary maxillary canine is that of a long, slender tapering root that is more than twice the length of the crown. The root is usually included distally, apical to the middle third. The crown of the primary maxillary birooted canine has approximately the same dimensions. The root orientation is like that of primary mandibular molars; primary birooted canines have a mesial and a distal root. This is very different from the maxillary first premolar which has buccal and lingual roots, or the maxillary second molars which normally have a mesiobuccal, distobuccal, and palatal roots. For normal exfoliation to occur, the permanent successor must resorb the roots evenly. The anatomy of the permanent canine may not lead to normal exfoliation of the primary canine or eruption of the permanent canine. This unusual root anatomy could lead to problems during exfoliation or extraction. These teeth may have to be sectioned during extraction. Observation of primary birooted canines during growth and development will help avoid problems during successive stages of development and eruption.

CONCLUSIONS

Primary birooted canines are rare, having been reported only six times previously. We believe that there may be a propensity for this dental anomaly in black children, six out of eight cases reported in the dental literature. At this time, there is no statistically signif-

Table ☐ Surveys of prevalence of birooted primary canines.

Case Authors	Year	Canines	Sex	Race
1 Brown[1]	1975	maxillary	F	not reported
2 Kelly[2]	1978	maxillary	F	black
3 Kroll and Donahue[3]	1980	maxillary	F	black
4 Bimstein and Bystrom[4]	1982	maxillary	M	black
5 Bryant and Bowers[5]	1982	max./mand.	M	caucasian
6 Jones and Hazelriggs[6]	1986	maxillary	M	black
7 Case 1	1988	maxillary	M	black
8 Case 2	1989	maxillary	M	black

icant sexual predilection for primary bilateral birooted cuspids. Males are reported 5:3 over females for this dental anomaly.

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COMMINUTION OF FOOD BY COMPLETE-DENTURE WEARERS

The ability of the denture-wearers to break down the test food particles was very poor as compared with that of the young adults with natural dentitions. The results confirm earlier results (*e.g.*, Kapur and Soman, 1964; Helkimo *et al.*, 1977, 1978; Haraldson *et al.*, 1979; Heath, 1982) and strengthen the impression that the complete denture is a poor substitute for the natural dentition. However, subjects wearing complete dentures and dentate subjects were not matched according to age in any of the above studies. In these studies, as well as in the present one, significant differences in age existed between the denture-wearers and the dentate subjects. Although it seems likely that the effects of the loss of teeth largely accounted for the marked decrease in masticatory performance found in this study in the complete-denture wearers as opposed to the dentate subjects (Carlsson, 1984), it cannot be excluded that effects of aging contributed to this difference as well.

Slagter, A.P. *et al*: Comminution of food by complete-denture wearers. J Dent Res, 71:380-386, February 1992.

ABSTRACTS

Conry, J.P.; Beyer, J.P.; Pintado, M.R. *et al*: Measurement of preventive resin restorations using computer profilometry. J Dent Child, 59:177-181, May-June 1992.

The amount of extracoronal material placed when a tooth is restored with a preventive resin restoration (PRR) was quantitatively measured together with the projected area of each cavity preparation. Thirty-three patients (mean age 11 yrs, 6 mos) requiring a PRR on a lower first permanent molar were selected. Impressions of the teeth were made with polyvinylsiloxane before and after cavity preparation and then restored with P-50 and Concise sealant. Following occlusal adjustment, a third impression was taken. Replicas were digitized using computer profilometry. Computer images of occlusal surfaces were superimposed using a "goodness of fit" method. The volume of extracoronal material placed on all molar teeth (n = 33) was X = 6.52 ± 2.9 mm^3. The mean depth applied was X = 222.52 ± 83.09 μ and the mean area of material applied over the entire tooth surface was X = 27.13 ± 5.72 mm^2. The cavity preparations occupied, on average 19.02 percent of the occlusal surface.

Restorations, preventive resin, measurement of; Computer profilometry

Taylor, Gregory; Taylor, Sharon; Abrams, Richard; Mueller, William: Dental erosion associated with asymptomatic gastroesophageal reflux. J Dent Child, 59:182-185, May-June 1992.

An eight-year-old girl presented with severe erosion of the primary dentition and early erosion of the erupted permanent teeth. Although the pattern of erosion was consistent with that seen with acid erosion, the diagnosis could not be elucidated from the patient's symptoms, or medical or dental history. A 24-hour pH probe study documented severe gastroesophageal acid reflux. Oral salivary pH tested during sleep nightly for one week revealed low oral pH. Treatment with metoclopramide and ranitidine was instituted to decrease acid availability for reflux. Custom-fitted, maxillary and mandibular trays were fashioned to deliver sodium fluoride gel twice daily, and fissure sealants were placed in the hopes of retarding erosion of existing permanent teeth, as well as preventing similar erosion of erupting permanent dentition.

Erosion, primary dentition; gastroesophageal acid reflux; Metoclopramide; Ranitidine; Sodium fluoride; Sealants

Huang, Wen-Hsi; Tsai, Tzong-Ping; Su, Huey-Li: Mesiodens in the primary dentition stage: A radiographic study. J Dent Child, 59:186-189, May-June 1992.

Five hundred and forty-three Chinese patients in the primary dentition stage were evaluated for mesiodens with maxillary, anterior occlusal films. Compared with other studies, a higher prevalence was found, using different age-groups and diagnostic methods. The distributions of mesiodens by sex, location, and direction were also studied. Because mesiodens could interfere with normal development of the occlusion, especially in the early mixed dentition stage, early diagnosis, using appropriate radiographs during the primary dentition stage, could lead to more comprehensive treatment planning.

Mesiodens, distribution; Diagnosis, early

Tang, Endarra, L.K.: Multispecialty team management of a case with impacted maxillary permanent canines. J Dent Child, 59:190-195, May-June 1992.

A fifteen-year-old Chinese girl presented with unerupted maxillary permanent canines impacted against the roots of the central incisors, causing malalignment of the maxillary incisors. The canines were fully formed and their apices closed. The potential path of eruption of the canines contraindicated surgical exposure, followed by orthodontic traction. It was decided to transplant the impacted canines to their normal positions, and then align the maxillary anterior teeth, using a fixed orthodontic appliance. The transplantations and the orthodontic treatment were successful, and neither transplant showed signs of root resorption, periodontal pockets, mobility, or pain, three years after surgery. Root canal therapy was performed on the canines after transplantation, because their apices were closed. They were stained by the amalgam in the access cavities, but both responded well to nonvital bleaching using 30 percent H_2O_2.

Canines, permanent, impacted; Transplantation, canine; Orthodontics; Therapy, root canal; Bleaching

Friedlander, Arthur H.; Friedlander, Ida Kreinik: Dental management considerations in children with attention-deficit hyperactivity disorder. J Dent Child, 59:196-201, May-June 1992.

Children suffering from attention-deficit hyperactivity disorder frequently have numerous orofacial anomalies of concern to the dentist. Behavioral manifestations of the disorder frequently impair the patient's ability to perform home care adequately, make dental treatment arduous, and place the patient at risk of physical abuse from family and peers. Familiarity with the symptoms and treatment of the disorder will better prepare the dentist to meet the needs of this unique group of patients.

Attention-deficit hyperactivity; Anomalies, orofacial; Abuse, physical

Friedlander, Arthur H.; Hanson, Wayne; Eth, Spencer: Dental management considerations in children who stutter. J Dent Child, 59:202-206, May-June 1992.

Stuttering is one of the most common speech disorders of childhood. It is characterized by involuntary pauses, reiteration and prolongation of sounds and syllables. Oral motor incoordination may make provision of dental treatment arduous. Familiarity with the verbal and nonverbal manifestations of the disorder and with the possible adverse psychosocial implications prepares the dentist best to meet the needs of this unique group of children.

Stuttering; Treatment; Manifestation of the disorder; Psychosocial implications

Hollander, Craig S.; Full, C.A.: Midline correction by extraction of the remaining mandibular canine: Myth or reality. J Dent Child, 59:207-211, May-June 1992.

Therapy when a primary mandibular canine is lost prematurely is explored. Though previous treatment included extraction of the remaining antimere, evidence is reported that the midline shift may not always correct itself. Leaving the remaining canine intact is suggested, to allow for maximum increase of intercanine width, as well as to avoid the extraction of a perfectly sound tooth in a young child. Modalities of treatment before the canine's root has been completely resorbed are also discussed.

Primary canine; Premature loss; Midline shift; Treatment

Bohaty, Brenda, S.; Spencer, Paulette; Haynes, John I.: Pediatric dental education and community service: A combined approach. J Dent Child, 59:212-215, May-June 1992.

Dental educators nationwide have expressed concern regarding the decreasing pediatric clinical experience available to undergraduate dental students. Some educators have suggested that dental programs should utilize extramural clinics and rotations to enhance current patient pools. This paper presents a successful clinical program that is designed to 1) augment the dental education of predoctoral dental students, and 2) provide dental care for an underserved pediatric dental population in an urban community.

Pediatric dentistry; Indigent pediatric dental care; Dental education

Waldman, H. Barry: "Rediscovering" the health status of Native Americans. J Dent Child, 59:216-220, May-June 1992.

The demographic and health characteristics of the Native American population differ from those of the general population. A review is provided for concerned pediatric dental practitioners.

Native Americans; Characteristics, demographic and health; General population

Waldman, H. Barry: Hispanic children: An increasing reality in pediatric dental practice. J Dent Child, 59:221-224, May-June 1992.

By the end of the current decade, the 11.5 million Hispanic children (less than eighteen years of age) in the United States will represent the largest population of minority children. Almost 48 percent of all Hispanic persons living in poverty were children (1989). Data show great need for dental care among these people, with only limited access to adequate care.

Hispanic children; Need for dental care; Limited access to care

Kubota, Kazumi; Golden, Bruce E.; Penugonda, Bapanaiah: Root canal filling materials for primary teeth: A review of the literature. J Dent Child, 59:225-227, May-June 1992.

Despite the fact that pulp therapy in the primary dentition has been reported for at least sixty years, there is still no known ideal root canal filling material available for primary teeth. Since the criteria for root canal filling material for the primary and permanent dentitions differ greatly this subject begs further investigation. The literature was reviewed with regard to root canal filling materials for the primary teeth. The four most commonly used materials, zinc oxide and eugenol, calcium hydroxide, iodoform, and gutta percha were compared. The closest to the ideal appears to be a calcium hydroxide-iodoform mixture.

Root canal filling materials, primary teeth; Zinc oxide and eugenol; Calcium hydroxide; Iodoform; Gutta percha

Groper, John N.: Ectopic eruption of a mandibular first permanent molar: Report of an unusual case. J Dent Child, 59:228-230, May-June 1992.

A case history of an ectopically erupting mandibular left first permanent molar is described. Most notable are the unusual findings of a missing mandibular left second premolar and an epithelial cyst and a horizontally impacted mandibular left second permanent molar. A unique treatment plan called for the extraction of the mandibular second primary molar, excision of the cyst, and removal of the mandibular left second and third molars. In hindsight, other procedures might have served the patient better.

Ectopic eruption; Mandibular first molar; Epithelial cyst; Impacted second molar; Treatment