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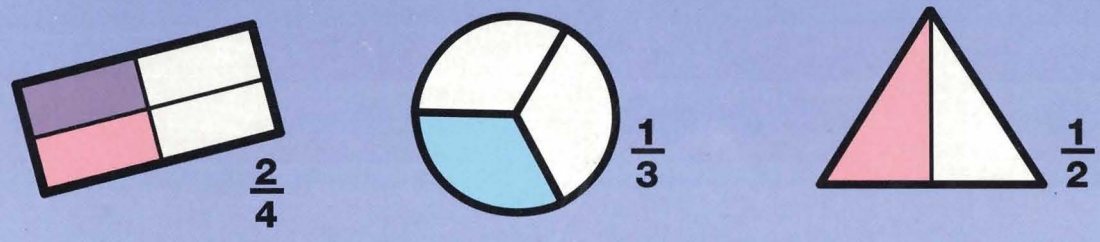
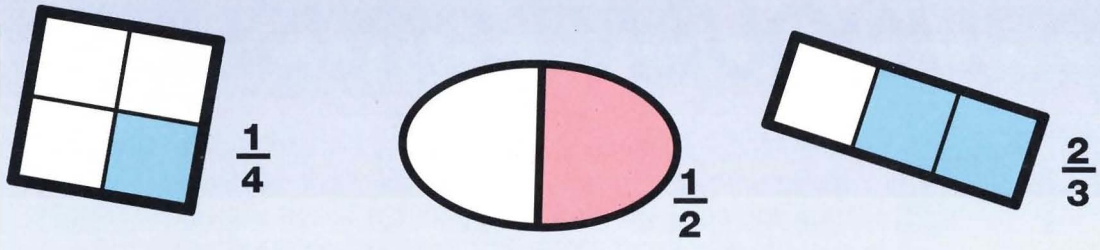


Self-motivation is the cardinal characteristic of the nine-year-old. It is the key to understanding him on his progress toward maturity. He has a growing capacity to put his mind to things, on his own initiative or on only slight cues from the environment. This typically gives him a preoccupied business-like air, both at home and at school. Indeed he is so busy that he seems to lack time for routine tasks and he does not relish interruptions.

Nine is an optimal age for perfecting proficiency in the tool ıbjects, in the fundamental operations of arithmetic and other skills.

hilosophers have not solved the mystery of human conscience. But the nine-year-old might teach them something of its origins. In him, conscience is clearly in the making.

Arnold Gesell, 1946



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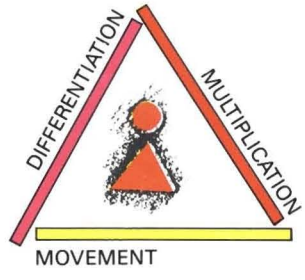
THE CHILD, NOT YET WHOLLY INDEPENDENT, BECOMES THE SEARCHER AS HE GROWS UP—AN UNCOMMITTED OBSERVER OF THE LIFE AROUND HIM.

—*Helen Kay*



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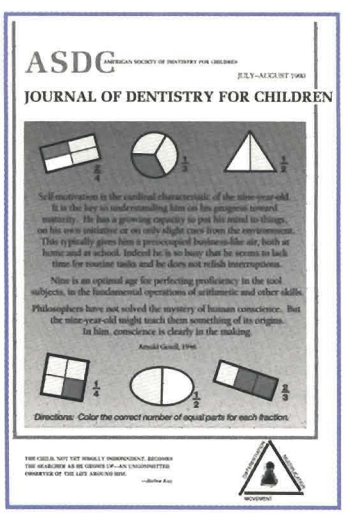
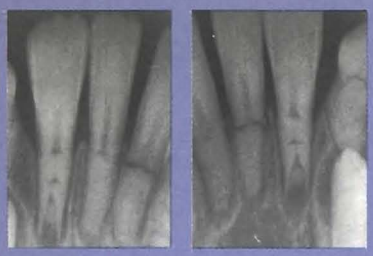


The nine-year-old typically shows an interest in learning the skills such as arithmetic that will help him achieve his many goals. Cover art and design by Sharlene Nowak-Stellmach.

CLINIC



EPIDEMIOLOGY

CASE REPORTS

For the busy reader

A clinical review of preventive resin restorations—page 257

Since the 1981-1982 academic year, the University of Iowa Department of Pediatric Dentistry had placed approximately 2000 composite/sealants or preventive resin restorations in children's molars. When these children appeared again for examination or treatment, their restorations were evaluated for retention, maintenance, and quality. Results were encouraging: more than 80 percent of the sealant material was "all present"; and more than 98 percent of the composite restorative material was rated quite satisfactory (the "Alfa" category).

Requests for reprints should be directed Dr. Jerry D. Walker, Department of Pediatric Dentistry, College of Dentistry, The University of Iowa, Iowa City, IA 52242.

Posterior composite resin: use for anterior restorations—page 260

Because of its low filler particle percentage, microfilled composite resins—traditionally recommended for anterior restorations—are extremely translucent. Function, especially in terms of shear-fracture-strength, has been another problem associated with the final restoration. Presented here is the concept of using posterior composite resin as an esthetic restorative material for anterior teeth.

Requests for reprints should be directed to Dr. Kevin J. Donly, University of Texas, Department of Pediatric Dentistry, 6516 John Freeman Avenue, Houston, TX 77030.

Efficacy and safety of intravenous ketamine for the severely handicapped—page 263

The severely and profoundly mentally and physically handicapped dental patient predominates in the institutional setting today. Many patients still require restorative dentistry, periodontal treatment, and an occasional tooth extraction. In terms of enabling treatment to be performed by the institutional dentist, intravenous agent can be effective but can be accompanied by substantial risks in this population. The anesthetic ketamine was evaluated as a sedative agent for dental treatment in this study.

Requests for reprints should be directed to Dr. Paul S. Casamassimo, Professor and Chief of Dentistry, Children's Hospital, 700 Children's Drive, Columbus, OH 43205.

Caries among children with cerebral palsy related to CP-diagnosis, mental and motor handicap—page 267

A total of 105 children with cerebral palsy, born in eastern Denmark in 1968 or 1969, comprised the group studied here. They were classified by CP-diagnosis, motor handicap, mental handicap, speech, caries, with dental data statistically analyzed. The caries rate of the combined CP-group was significantly lower than that of the control group.

Requests for reprints should be directed to Dr. Lis Almer Nielsen, Department of Pediatric Dentistry, Royal Dental College, Nørre Alle 20, 2200 Copenhagen N, Denmark.

Treatment selections for fissured grooves of permanent molar teeth—page 274

Twenty dentists from selected dental school departments were asked to examine thirteen areas of fissured grooves or pits in extracted molars, and select a treatment from a list of options for each designated groove area, as if each was on a separate tooth. There was a wide variation in initial treatment selections with (29 percent) amalgam and (25 percent) resin sealants being the most common. Pediatric dentists were significantly more conservative in both their original and later diagnoses than were the other dentists in this study.

Requests for reprints should be directed to Dr. James C. Setcos, Department of Dental Materials, School of Dentistry, Indiana University, 1121 West Michigan Street, Indianapolis, IN 46202.

Pulse rate and oxygen saturation in children during routine dental procedures—page 279

To understand the state of hypoxemia and how it occurs, one must first understand the concepts of blood oxygen tension, arterial oxygen saturation, and the

blood's methods for carrying oxygen and delivering it to body tissues. One device that allows detection of decreases in patients' oxygenation levels, before a dangerous situation is reached, is the pulse oximeter. It is easy to apply and remains secure, and will not interfere with dental procedures. The purpose of this study was to examine the effect routine dental procedures have on heart rate and SaO_2 in unsedated children, ranging in age from five to seven years old.

Requests for reprints should be directed to Dr. Ronald Johnson, Pediatric Dentistry, School of Dentistry, University of Southern California, 925 West Thirty-fourth Street, Los Angeles, CA 90007.

Decreases in dental caries do not mean that children no longer need dental services—page 284

The continuing decline in dental caries in children could give one the impression that there is a decreasing need for the services of pediatric dentists. However, the conclusion drawn from reading the annual reports from the National Health Interview Survey is that despite such a decline, there is a significant on-going need for the services of pediatric dentists.

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

Who provides what dental services for children? We need more information—page 289

Pediatric dentists provided 19 percent of dental services for children between 2 and 4 years of age, and 9 percent for those between 5 and 11 years. Children also receive dental services from general practitioners and other specialists. The difficulty is that there is limited available information on the type and extent of services provided by general practitioners and specialists.

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

Occlusion in the primary and early mixed dentitions in a group of Tanzanian and Finnish children—page 293

Two high and two low socioeconomic areas were selected for the Tanzanian portion of this study, with all nursery schools located in those areas included, for a subtotal of 580 children. The Finnish group was comprised of a total of 575 Caucasian children examined. The Tanzanian children (83 percent Black African, 10 percent Asian, 7 percent Arab) had fewer occlusal anomalies than the Finnish children did. Finnish children had a 13-percent incidence rate of lateral crossbite; among African children, 8 percent showed anterior crossbite; and among the combined Asian/Arab group of children, 10 percent had an anterior open bite. African children had significantly fewer prevalences of distal bite, lateral crossbite and crowding than Finnish children did.

Requests for reprints should be directed to Dr. Heidi Kerosuo, Vaiveronkatu 58, SF-05900 Hyvinkaa 90, Finland.

Dental dysplasia, type I: report of case—page 299

Requests for reprints should be directed to Dr. Dennis R. Miers, LSUSD Box 127, LSU School of Dentistry, 1100 Florida Avenue, New Orleans, LA 70119. 70119.

Idiopathic odontoma formation following avulsion of immature permanent incisors: two case reports—page 303

Requests for reprints should be directed to Dr. Raymond L. Braham, Department of Growth and Development, School of Dentistry, University of California San Francisco, San Francisco, CA 94143.

A clinical review of preventive resin restorations

Clinic

Jerry D. Walker, DDS, MA
Mark E. Jensen, BS, MS, DDS, PhD
Jimmy R. Pinkham, DDS, MS

INTRODUCTION AND LITERATURE REVIEW

Simonsen in 1979 reported three-year results of restoring permanent molars with preventive resin restorations.[1] These restorations consisted of removal of occlusal caries with subsequent placement of composite restorations in the preparations. Over these and throughout the pits and fissures were placed occlusal sealants.[2-5] The restorations had the advantage of minimal preparation and loss of tooth structure with the preventive benefits of the pit and fissure sealant. Houpt *et al* reported the results after five years of a conservative occlusal preparation using fissure sealant instead of "extension for prevention" in 139 teeth with 179 restorations.[6] In 72 percent of these, or 129 restorations, there was complete retention of the sealant. In another eleven instances there was complete loss of sealant observed and twelve teeth were carious. Walls *et al* in a two-year follow-up of paired restorations (occlusal amalgams and composites) demonstrated few differences in the restorations in the management of occlusal caries.[7] The amount of occlusal surface occupied by the amalgam amounted to 25 percent com-

The authors are with the Department of Pediatric Dentistry, University of Iowa School of Dentistry. Dr. Pinkham is Professor and Chairman of the Department.

Composite	Female	Male	Total	Percent
P-10	6	3	9	2.74
Fulfil	53	38	91	27.74
P-30	35	39	74	22.56
Unknown	82	72	154	49.96
Totals	176	152	328	100

Figure 1. Composite materials used for restorations.

Composite	Alfa	Bravo	Charlie
Anatomic/form	327 (99.70%)	1 (0.30%)	0 (0.00%)
Marginal adaptation	323 (98.48%)	4 (1.22%)	1 (0.30%)
Color match	322 (98.70%)	3 (0.91%)	3 (0.91%)
Totals	323 (98.48%)	3 (0.91%)	2 (0.61%)

Figure 2. Composite status.

pared to 5 percent with the normal composite. Hicks concluded that "the preventive resin restoration possessed an intimate enamel resin interface with no microscopic evidence that a microspace exists between the resin and the etched enamel cavity wall and that this restoration could serve as an alternative to an amalgam or restoration with an alloy or the sealing of a questionable occlusal surface."[8]

Since the 1981-82 academic year, the University of Iowa Department of Pediatric Dentistry had placed approximately 2000 composite/sealants or preventive resin restorations in primary and permanent molars of children seen in our Dental Science Building teaching/service clinic. It was the purpose of this investigation to identify retrospectively these children, when they appeared for treatment or examination in the clinic; and to evaluate these restorations according to a series of observations that judged their retention, maintenance, and quality.

METHODS AND MATERIALS

At the time of each recall examination, the patient's chronological records of treatment were reviewed. The teeth that had been restored with preventive resin were evaluated by the faculty member or resident in the clinic at that time.

An examiner (MEJ) experienced in clinical trials tested the clinical faculty to determine the reliability of their ratings. All subjects were examined with a front surface dental mirror and a sharp No. 23 explorer. The teeth were air dried and the operatory's high intensity dental light was used for illumination. The results of the evaluation were recorded on a data sheet provided in the operatory for this purpose.

Thirteen separate decisions were made, concerning both the status of the composite and also the sealant. Each restoration was rated using Ryge's criteria for the following observations:

1. Sealant all present.
2. Sealant all missing.
3. Sealant partly missing.
4. Occlusal alloy present.
5. Proximo-occlusal alloy present or indicated.
6. Tooth resealed.
7. Extracted or exfoliated.
8. Anatomic form - Alfa†, Bravo, Charlie, Delta.
9. Color match - Alfa, Bravo, Charlie, Delta.
10. Color match - Alfa, Bravo, Charlie, Delta.
11. Cavo surface marginal discoloration - Alfa, Bravo, Charlie, Delta.
12. Caries.
13. Status cannot be determined.[9]

RESULTS

The materials used in our clinic for posterior restorations from 1981-1982 until the date of the study consisted of P-10††, P-30†† and Fulfil‡ (Figure 1). The sealant was always Delton.‡‡ Unfortunately, in evaluating these previously placed restorations the material remained "unknown" in nearly half of the instances because it had not been adequately documented at the time of placement in the clinical record. Any attempt to determine the materials used during the time frame in which they were placed was uncertain except for P-10. Most of these restorations were simply referred to in the clinical chronological record of treatment as composite/sealant or preventive resin restoration.

The status of the composite restorations was outstanding as only two of the restorations fell in the completely unsatisfactory or Charlie range and three were clinically acceptable but some change in the anatomical form, marginal adaptation, or color match was noted (Figure 2). In Figure 3, it can be seen that the sealant status appeared to be the greatest factor in contributing to satisfaction or dissatisfaction with the preventive resin restoration. In nearly 82 percent of the cases, all the sealant was still present. In only 1+ percent was the sealant entirely missing and in the majority of the cases where the sealant was lost it was partially missing. Caries was detected in seventeen of the teeth restored with preventive resin restorations. It should be noted that these restorations had been placed over a time period that lasted from four months to 5.5 years with a weighted mean of 15.67 months.

DISCUSSION

It did not come as a surprise that the sealant portion of the restorations possessed the greatest predictor to success or failure of these preventive resin restorations.

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†Alfa—replacement unnecessary, Bravo-Replacement Questionable, Charlie—replace for preventive reasons, Delat—replace immediately.

††Dental Products Division/3M, St. Paul, MN 55144.

‡The L.D. Caulk Co., Division of Dentsply, International Inc., Milford, DE 19963.

‡‡Johnson & Johnson Company, 20 Lake Drive, East Windsor, NJ 08520

Sealants	Female	Male	Totals	%
All present	143	125	268	81.71
All missing	2	2	4	1.22
Partly missing	20	19	39	11.89
Caries	11	6	17	5.18
Totals	176	152	328	100

Figure 3. Sealant status and caries.

In many instances, these materials were placed under less than ideal circumstances. An example would be with a partially erupted tooth where access to the distal occlusal surface was nearly impossible due to the operculum still covering this surface of the tooth. In these instances, cotton roll isolation was required and may have predisposed the tooth to contamination during placement. These restorations were also placed in most instances by undergraduate, third-year students who did not have access to a dental assistant at the time of placement of the composite and sealant. The outcome in this study using preventive resin restorations is quite satisfactory considering the status of the composite restorations was rated "Alfa" greater than 98 percent for all three evaluation categories.

Loss of the sealant did not necessarily mean failure of the restoration, because of the 43 instances where sealant was all or partially missing, only 17 of these teeth upon evaluation were found to be carious. In most of these instances, these lost preventive resin restorations were replaced with the preventive-restoration approach, with minimal removal of tooth structure and placement of sealants over the remaining susceptible occlusal areas. It would appear that these restorations still served the primary purpose for which they were intended, which was to conserve tooth structure while removing morbid tissue.

The preventive resin restorations evaluated in this study may not have been entirely representative of the greater than 2000 placed in our clinic, because they were not randomly selected. The results of this study were encouraging, however, since over 80 percent of the sealant material was "all present" and over 98 percent of the composite restorative material was rated "Alfa" in all categories of evaluation. The missing sealant material and caries in 5 percent of the teeth have led us to place an increased emphasis on isolation of the tooth during placement of the restorations in our teaching program. Furthermore, it is critical that partially erupted teeth in which preventive resin restorations are placed continue to be carefully examined at recalls for treatment or addition of material, when the tooth can be more adequately isolated. Finally it would appear that more dentists would need to accept sealants as a primary preventive measure for widespread acceptability of this restoration. The NIDR findings that sealants were placed in approximately 7 percent of children was not encouraging.[10]

CONCLUSION

In conclusion, it would appear that further investigation must be made of the appropriateness of the use of composite/sealant to restore primary and permanent molar and premolar teeth, when caries occurs early. A critical examination of a sample of these restorations placed in our teaching clinic has confirmed our reason for choosing this restorative approach. A small portion of the restorations, however, required retreatment. The primary reason for their failure is loss of the sealant material, which can be explained by the fact that these restorations were placed in partially erupted teeth and thus predictably subject to contamination by moisture. Preventive resin restorations are still the treatment of choice for small pit and fissure caries in our clinics, but the need for adequate isolation must be emphasized in a teaching environment.

The authors' philosophy for noncarious fissures is to seal and reseal as needed.

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Posterior composite resin: use for anterior restorations

Kevin J. Donly, DDS, MS

Composite resin has become a widely accepted and utilized material since its introduction in 1956.[1] The use of composite resin with the acid-etch technique, initially described by Buonocore, has made composite an excellent restorative material.[2] Advantages of esthetics, strong acid-etched enamel margins, low-thermal conductivity, and preservation of tooth structure during preparation has caused a dramatic increase in the use of composite resin for contemporary restorative dentistry.

Microfilled composite resin has traditionally been recommended for anterior restorations. These microfilled composite resins had the unique quality of being polished to a high luster.[3] Unfortunately, several problems were associated with the final restoration; esthetics and function, the two most important factors in a restoration, were compromised. Because of the low filler particle percentage, microfilled composite resins are extremely translucent.[4] Upon completion of an anterior restoration, the outline of the preparation can become quite evident. To aid in camouflaging this effect, opaquers were developed. The opaquers provided a "whiting out" appearance to intrinsic stains and made it difficult to distinguish restorations from natural tooth structure; nevertheless, the natural tooth appearance was difficult to obtain. The translucency of the microfilled composite resin, overlying the opaquer, seemed to create an artificial opaque image.

Dr. Donly is Assistant Professor, Department of Pediatric Dentistry, Dental Branch, University of Texas Health Science Center at Houston, 6516 John Freeman, Houston, TX 77030.

Function, the other pertinent factor to consider during the placement of an anterior restoration, should be evaluated. When the shear-fracture-strength of composite resin to acid-etched enamel was studied, it was found that the fracture occurred within the composite resin itself.[5,6] The acid-etched enamel bond was stronger than the composite resin cohesiveness. Because of this factor and the previous esthetic problem, a new approach for anterior restorations might be more clinically practical.

Contemporary posterior composite resins, in general, have greater than 75 percent particle filler loading by weight, compared to the anterior microfilled composite resins that contain close to 50 percent particle filler by weight.[4,7] This increase in particle filler increases the strength of the material and decreases the translucency.[8,9] The purpose of this article is to present the concept of posterior composite resin as an esthetic restorative material for anterior teeth.

CASE REPORT

A twelve-year-old, white female was referred to the University of Texas Dental Branch for comprehensive dental care. The patient and parent related "ugly" teeth as their chief complaint. Review of the medical history revealed no pertinent disease or abnormality. The dental history stated that the patient received intermittent routine dental care since she was five years of age. The patient's maxillary right central incisor was traumatized at age ten. The trauma was caused by a blow to the mouth while the patient was playing basketball. The maxillary right central incisor was subluxated by the

Figure 1. Facial appearance of the patient at the initial examination.

Figure 2. Intraoral appearance of the patient at the initial examination.

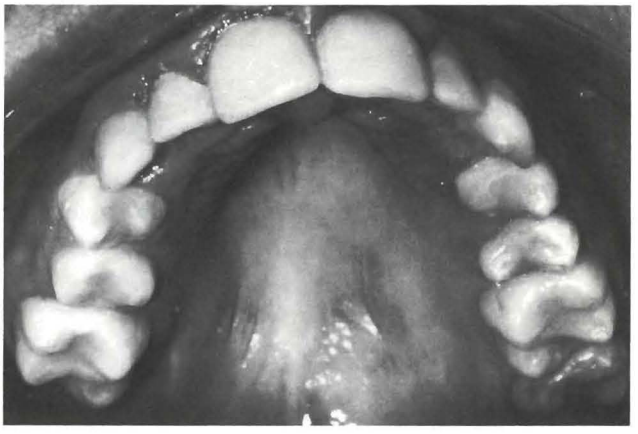

Figure 3. Intraoral appearance of the patient at the two-year recall appointment.

blow and was treated, therefore, by repositioning and splinting with an orthodontic arch-wire extending from the right lateral incisor (#7) to the left central incisor (#9), anchored with composite resin. The arch-wire was removed after two weeks, the tooth remained vital, and no further complications occurred.

The first clinical examination showed an erupted permanent dentition expected for an adolescent, twelve years of age. All oral soft tissues appeared normal and clear. The dentition was in a bilateral Class I molar and canine relationship; a 90-percent overbite and two-millimeter overjet. Enamel hypoplasia of unknown etiology was present on the maxillary and mandibular canines, premolars, and second molars. The maxillary lateral incisors also presented with enamel hypoplasia (Figures 1,2). A history did not reveal an etiologic diagnosis. The clinical examination noted that the maxillary central incisors and right lateral incisor had facial composite resin restorations. It was learned by questioning the patient and parent that these incisors had appeared similar to the other hypoplastic teeth until she traumatized the maxillary right central incisor. Following the removal of the stabilizing arch-wire, post-trauma, composite resin had been left as a partial veneer.

Limited finances were a major consideration during treatment planning. The first treatment plan, therefore, included a regimen for caries control and the restoration of all carious and hypoplastic lesions with composite resin. Modifications of the treatment plan were explained to the patient and parent, including the unknown prognosis and need for follow-up care.

Posterior carious lesions were restored with posterior composite resin* restorations. There was little need for extension from the occlusal surface; conservative esthetic restorative care was completed, therefore, without complications.

The restoration of the anterior teeth posed the problem of severe enamel hypoplasia, caries secondary to enamel hypoplasia, and intrinsic discoloration. The translucency and strength of anterior composite resin was a concern due to the intrinsic staining, severe loss of tooth structure, and the presence of a deep overbite; posterior composite resin was chosen, therefore, to be the restorative material.

All caries was removed and a glass ionomer liner† was placed over all exposed dentin. A conservative chamfer margin was placed on the maxillary anterior teeth at the free gingival margin, as Jordan *et al* have previously recommended.[10] Approximately 0.5 mm of enamel was removed on the facial surface of these teeth to provide the opportunity to place posterior composite resin veneers, without producing an unnatural labial

*P-30 - 3M Dental Products: St. Paul, MN.
†Ketac-Bond, ESPE-Premier, Norristown, PA.

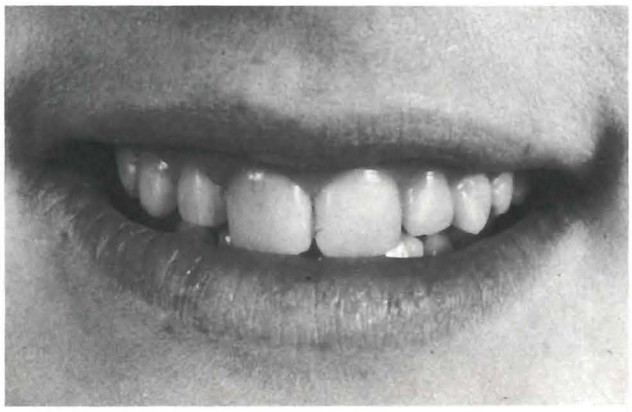

Figure 4. The natural smiling appearance of the patient at the two-year recall appointment.

Figure 5. Facial appearance of the patient at the two-year recall appointment.

contour. The incisors and canines were built to their natural contour, finished and polished with carbide finishing burs and polishing discs.

The patient was instructed thoroughly in oral hygiene maintenance, which included brushing with a soft toothbrush, concentrating on the free gingival margin area. Flossing was demonstrated and its daily use stressed. The patient was placed on a three-month recall.

Figures 3,4, and 5 show the patient's appearance two years later. The patient had maintained excellent oral hygiene and was very satisfied with the appearance of her teeth. No discoloration was noted and all composite resin margins remained intact.

This case report presents an alternative restorative procedure for "special patients" in "special circumstances". The two-year success in this particular case demonstrates that dental treatment should be planned on an individual need basis, the concern for children remaining an integral part of pediatric care.

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Efficacy and safety of intravenous ketamine for the severely handicapped

Connie L. Seiler, DDS
W. Craig Shellhart, DDS, MS
Paul S. Casamassimo, DDS, MS

The severely and profoundly mentally and physically handicapped dental patient predominates in today's institutions. While most facilities have seen a decreasing caries rate, many patients still require minor restorative dentistry, periodontal treatment and an occasional tooth extraction. General anesthesia in a hospital or outpatient setting is more difficult to justify for these minor but necessary procedures, especially in this period of declining resources. The use of physical restraints, once common and tolerated, is now more rigidly controlled and limited in benefit. The dilemma of the institutional dentist is further compounded by the ineffectiveness of oral and safety limitations of intravenous sedative agents in this largely adult population, many of whom take several medications.

Intravenous agents can be effective, but are often accompanied by risk of cardiorespiratory depression, especially when used in patients who routinely take one or more centrally acting seizure or behavioral medications. Ketamine, a dissociative nonbarbiturate anesthetic, provides an alternative to other intravenous agents in its minimal cardiorespiratory depression, low-dose anesthesia and low hypersensitivity.[1,2] A drawback to ketamine anesthesia is its tendency to create emergence reactions.[3] In addition, the drug has an eliptogenic potential and can cause exaggerated cardiovascular response.[4] In practice, the eliptogenic potential seldom appears to be a clinical problem. The cardiovascular changes that result in hypertension and the emergence reactions can be controlled with administration of other drugs, most notably the benzodiazepines.[5]

The purpose of this study was to evaluate the safety and effectiveness of intravenous ketamine as a sedative agent for dental treatment in a population of severely handicapped patients.

METHODS AND MATERIALS

Subjects for the study were clients at a public residential facility for the physically and mentally handicapped. All clients met the following criteria for inclusion in addition to consent for treatment:

- ☐ Needed oral surgery or restorative dentistry, in depth examination, or periodontal scaling.
- ☐ Had a diagnosis of mental retardation or a serious physical disability or both.
- ☐ Were found by a physician to be able to undergo the procedure.
- ☐ Had at least one unsuccessful attempt at dental treatment using oral, intramuscular or a combination of sedative medications.

Dr. Seiler is Dental Director, Wheatridge Regional Center and is in private practice in Denver, Colorado.

Dr. Shellhart is Assistant Professor, Department of Oral Health Practice, Section of Orthodontics, College of Dentistry, University of Kentucky, Lexington, Kentucky.

Dr. Casamassimo is Professor and Chief of Dentistry, College of Dentistry, The Ohio State University and Columbus Children's Hospital, Columbus, Ohio.

Patients were NPO for at least six hours before the procedure and were placed in a reclined position to have an intravenous line established. Restraints were used initially, if needed, to establish the IV line. Each patient received an initial dose of 0.1 mg/lb over three to five minutes. Anesthesia was maintained by titration.

All dental treatment was provided by one of three dentists using conventional dental therapies. A physician-anesthetist delivered the ketamine and additional supportive medications, if needed to manage side effects. Vital signs, including preanesthetic baseline measurements, were made for cardiac rate, respiration and systolic and diastolic blood pressure by the physician-anesthetist, and recorded on a standard anesthetic record. Side effects of emesis and seizures were noted during the procedure, early in the postoperative period (within six hours), and later, from six to twelve hours postoperatively. Patients were kept initially in the dental clinic until stable and then moved to the institution's intensive care unit for observation. Side effects were managed using conventional medical therapy in the operative and postoperative periods.

Efficacy was defined as the drug's ability to provide sufficient anesthesia to permit completion of planned treatment, without subjecting the patient to unnecessary risk as determined by the physician. Abortion of the procedure was at the discretion of the physician, who determined when side effects required it for the safety of the patient.

Data were entered and analyzed by computer, using the Statistical Package for Social Science.

Table 1 □ Characteristics of subjects receiving ketamine.

Characteristics	No.	Mean ± SD	Sample range
Age (yrs)	38	27 ± 7	15 – 54
Weight (lbs)	38	116 ± 32	60 – 180

CNS medications	Total	1 Drug	2 Drug	3 Drug	4 Drug
	35	8	18	4	5
Seizures	22				
Cerebral palsy	4				
Mental retardation	37				

Table 2 □ Mean baseline, maximum, minimum and procedural mean heart rate and blood pressure measurements.

Vital sign	No.	Baseline	Maximum	Minimum	Mean
Systolic BP (mmHg)	37	117 ± 18	153 ± 28	110 ± 15	130 ± 19
Diastolic BP (mmHg)	37	80 ± 14	103 ± 25	74 ± 12	87 ± 12
Heart rate (Beats/m)	33	81 ± 15	102 ± 19	75 ± 12	89 ± 13

Ketamine anesthesia has a tendency to create emergence reactions.

RESULTS

Thirty-eight subjects contributed to thirty-nine recorded ketamine procedures with one subject undergoing two separate procedures, due to the extent of treatment required. Table 1 profiles the characteristics of the clients who were treated with ketamine. Six subjects were female and thirty-two male. The mean age was twenty-seven years, with a low of fifteen and high of fifty-four. The average subject was 116 pounds, with the smallest weighing sixty and the heaviest 180 pounds. Thirty-seven subjects were mentally retarded, four had cerebral palsy, twenty-two had a seizure disorder, and all but three were taking at least one centrally acting medication.

Vital signs

Heart rate and systolic and diastolic blood pressures were recorded at baseline before the administration of ketamine, and then periodically throughout the procedure. Table 2 shows the baseline, minimum, maximum and mean readings for vital signs. The baseline data for heart rate and systolic and diastolic blood pressures are within normal ranges at 81, 117 and 80, respectively. Subjects experienced both a rise and depression of rates within the operative period. For all three factors, an average increase was noted.

Characteristics of the procedure

The characteristics of the procedure that might affect morbidity or efficacy, including the total ketamine dose

for the procedure, dose per pound of body weight, and quarter-hour ketamine dosage, were evaluated. The type of treatment provided and the duration of surgery were also evaluated (Table 3). The mean total dose of ketamine for the procedure was 66 mg with a minimum of 10 mg and a maximum of 180 mg for the procedure. Milligrams of ketamine per pound of body weight were 0.55 but ranged from .13 and 1.4. The mean quarter-hour dose was 11.3 mg and ranged from 1.5 to 30.0 mg for the sample. Fourteen patients had a combination of surgery and restorative dentistry, fourteen had restorative only and eight, surgery only. Two procedures did not require either and one was terminated before delivery of treatment. The average procedure lasted 102 minutes, with the shortest one lasting 15 and the longest, 230 minutes.

Efficacy and morbidity

Efficacy was assessed according to whether the procedure was completed. The physician-anesthetist had the option to terminate the procedure at any time. Additional medications were administered as needed to control side effects, and this was evaluated as a secondary measure of efficacy. Of the thirty-nine procedures started, thirty-seven were completed, one was partially completed, and one was terminated prematurely due to an uncontrollable side effect.

Table 4 shows the variety of additional medications provided patients to complete the procedure. The most commonly provided medications were Vistaril and Valium, followed by Demerol and atropine.

The morbidity was evaluated in the operative, early postoperative and late postoperative periods using episodes of emesis and seizures as primary measures. In addition, isolated side effects that required treatment were recorded.

Table 5 depicts the postoperative side effects for the thirty-nine procedures, with the most common being emesis in the early postoperative period. Seizures were quite common side effects in the operative and early postoperative periods, as well.

Finally, postoperative vital signs were observed and measured during recovery as an indirect indication of morbidity (Table 6). Blood pressure stabilized to below baseline levels at 112/75 at six hours postoperative and 114/75 at 12 hours postoperative. Heart rate was immediately at baseline levels at 87 and then rose to 91 at twelve hours.

Correlations

In an attempt to identify factors that might predict efficacy and morbidity, variables were analyzed statistically for significant relationships.

Table 3 ☐ Characteristics of procedure, including ketamine dose, length and type of procedure.

Characteristics		
Dose	Mean	Range
Ketamine/procedure (mg)	66	(10–180)
Ketamine/pound body weight (mg)	0.55	(.13–1.4)
Quarter hour dose (mg)	11.3	(1.5–30)
Length of procedure (min)	102	(15–230)
Type of procedure	No.	
Restorative	14	
Combination	14	
Surgery	8	
Neither	2	
Aborted	1	

Table 4 ☐ Additional supportive medications provided to subjects during or subsequent to procedure.

Medication administered	No. of Subjects	Percent*
Vistaril	14	36
Valium	9	23
Demerol	5	13
Atropine	4	10
Benadryl	1	3
Epinephrine	1	3

*Does not total to 100 percent because some subjects received multiple medications.

Table 5 ☐ Occurrence of side effects of emesis, seizures and others during, within six and within twelve hours of the termination of the procedure.

Side effects	During procedure	Within 6 hrs	Within 12 hrs	During 12 hrs
Emesis	0	11	3	0
Seizures	7	3	0	0
Hypertension	3	0	0	0
Other[1,2]				6

[1]Occurred at some time during procedure or the 12-hour postoperative period.
[2]Includes one each of the following: diabetic reaction, cyanosis, allergic reaction, sinus arrhythmia, apnea and gagging.

Table 6 ☐ Mean postoperative vital signs of systolic and diastolic blood pressure and heart rate within six and twelve hours of the termination of the procedure.

Vital sign	n*	Within 6 hrs	n*	Within 12 hrs
Systolic BP (mmHg)	38	112 ± 14	14	114 ± 6
Diastolic BP (mmHg)	38	75 ± 10	14	75 ± 8
Heart Rate (Beats/m)	37	87 ± 13	10	91 ± 16

*n reflects all subjects for whom readings were available.

KETAMINE DOSE

No statistically significant relationships were found for total ketamine, when correlated with weight and maximum vital signs of systolic and diastolic blood pressure and heart rate.

On the other hand, a statistically significant relationship at $p \leq 0.05$ emerged between mean ketamine dose and weight. Mean ketamine dose had a significant relationship with mean systolic blood pressure and mean diastolic blood pressure, as well ($p \leq 0.05$).

SIDE EFFECTS AND PROCEDURAL AND PATIENT CHARACTERISTICS

Patient characteristics of CNS medications and seizure history and procedural characteristics of duration, total dose and mean ketamine dose were correlated with intraoperative, immediate postoperative, and late postoperative side effects of emesis and seizures. A logistic regression analysis showed no significant relationship at $p \leq 0.05$ between CNS medications taken and procedurally related seizures or emesis, nor between seizure history and procedurally related seizures or emesis. The duration of the procedure, total dose of ketamine given, and the mean dose failed to show any significant relationship with procedurally related seizures or emesis ($p \leq 0.05$).

DISCUSSION AND CONCLUSIONS

The purpose of this study was to evaluate the safety and efficacy of ketamine in dental treatment of the severely and profoundly handicapped patient. Deinstitutionalization of centers has distilled this population into a higher risk group with considerable medical problems and medications.[6]

Emergence reactions, the most troublesome side effects in the general population, were not evaluated directly in this study because of the difficulty in obtaining accurate data.[7] Observation by nurses who were familiar with patients was contemplated, but disregarded, because of the ambiguity of signs of emergence reactions in the severely handicapped and their inability to communicate consistently.

The safety of ketamine was affirmed in this study. Vital signs were not greatly altered during administration and quickly returned to normal postoperatively. The number of seizures and emetic episodes is of concern. Ten patients encountered seizures during or immediately after the procedure. Fourteen also experienced postoperative emesis. The etiology of these side effects is not clear. Only three of ten of those with procedure-related seizures received more than the mean procedural dose. Eight of ten, however, had a diagnosed seizure disorder. Ketamine may not be indicated in these patients. Those patients who experienced emesis had no distinguishing characteristics as a group that would suggest a reason for their emetic experiences.

The drug is effective. Only one procedure of thirty-nine was aborted and that was due to a difficult-to-control hypertensive event. Planned treatment was completed in all but this case.

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Caries among children with cerebral palsy: relation to CP-diagnosis, mental and motor handicap

Lis Almer Nielsen, DDS

The chance for patients with cerebral palsy (CP) to be integrated successfully in society depends on the specific diagnosis of cerebral palsy and the severity of motor and mental handicaps.[1-3] As regards dental care, a recent Danish study showed that of 396 CP-children, age seven to thirteen years, about 90 percent were treated by the public dental health care system, while the remaining children were treated at special clinics.[4] The study did not include the multihandicapped cerebral palsy children who reside at the regional institutions for the handicapped. The study showed that the rate of caries, expressed by the DMFS-score, was lower in CP-children than in normal children. In contrast, a Swedish study found slightly higher DMFS-scores in CP-children than in normal children, whereas most other studies showed the same caries rate in CP-children and in normal children.[5-8]

It is commonly known that dental treatment of CP-children can be difficult.[9] CP-patients represent a very heterogeneous group, however, and it is essential, therefore, for the dental health care system to plan prevention, treatment, and the intervals between dental visits, according to the individual child's needs. To date, no Danish studies have correlated specific CP-diagnoses, the mental and the motor handicaps with the occurrence of caries. Only two previous studies, Swedish and American, have dealt with this problem.[5,7] Both studies were carried out before the dramatic lowering of the caries rate in western countries. Furthermore, sample sizes were small and the ages studied were markedly varied. Consequently, results were difficult to interpret. In the Swedish study, it was found that of forty-two CP-children, ages eight to fourteen years, hemiplegic children had slightly higher DMFT-scores than tetraplegic children.[5] Furthermore, CP-children with mild motor handicaps had higher DMFT-scores than CP-children with more severe motor handicap; and CPchildren with mild mental handicaps had higher DM-FT-scores than more severely retarded CP-children. In the age-group of three to eight years (n = 26), however, the deft-score was slightly higher among children with tetraplegia than among children with hemiplegia. CP-children with severe motor handicap had higher deft-scores than the CP-children with mild motor handicap; and severely mentally handicapped CP-children had higher deft-scores than CP-children with mild mental handicap. In the American study of eighty-one CP-children, ages four to fifteen years, it was found that DMFT-scores in specific diagnostic groups showed only small variation when compared to the total CP-group; whereas CP-children with severe mental handicap had higher DMFT-scores than slightly mentally handicapped CP-children.[7] None of the described differences in the two studies was statistically significant.

Dr. Nielsen is with the Department of Pediatric Dentistry, Royal Dental College, Copenhagen, Denmark and the Department of Prospektiv Paediatri, University Hospital (Rigshospitalet), Copenhagen, Denmark.

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Table 1 ☐ Distribution of CP-samples according to specific diagnosis.

Diagnosis	N
Spasticity	87
Athetosis	4
Ataxia	2
Mixed diagnosis	12
	105

PURPOSE

The purpose of the present study is:

- ☐ To study the occurrence of caries in fourteen- and fifteen-year-old Danish CP-children included in the public children's dental health care system, and compare it to normative data.
- ☐ To determine whether the occurrence of caries among CP-children is related to the specific CP-diagnosis, namely, the mental and/or the motor handicap.
- ☐ To suggest improved planning of the dental care for these children.

MATERIAL AND METHODS

The study population

Names, addresses, and birth dates of all CP-children in the eastern half of Denmark born in 1968 and 1969 were taken from the CP-Registry.[10] At the time of the study (1983-1984), these children were fourteen and fifteen years old, and thus belonged to the two oldest age-groups in the public dental health care system at that time. The initial patient contact totaled 184 children; of those, 105 were included in this study.

Twenty-six (14.1 percent) lived at a regional institution for the handicapped, and because their dental care was not administered by the public dental health care system, they were not included in the study. Another nineteen children (10 percent) were not included in this study, because they could not be identified (n = 7) or because the CP-diagnosis was not specified (n = 3). In seven cases, the CP-symptoms were very slight, and two children were not contacted because of special family situations.

The remaining 139 children's parents were contacted by telephone (n = 101) when possible or otherwise by letter. Letters were necessary because many families had unlisted telephone numbers.

The parents of thirty-three children (24 percent) did not want their children to take part in the study. The parents of ten claimed that their child was not handicapped, and seven did not reply. There were fifteen (15 percent) negative responses to written requests. One child could not be included in the study, because of lack of cooperation.

Of the 105 children included in the study, fifty-four (51 percent) were born in 1968 and fifty-one (49 percent) were born in 1969. There were sixty-one boys (58 percent) and forty-four girls (42 percent). The age-range was fourteen years nine months to fifteen years eleven months.

For controls, fourteen- and fifteen-year-old children from the same geographical area registered in the Public Health Department's Odontological Register (SCOR) were used.[11]

METHODS

All children in the study group were examined by the author. Clinical examination was performed with dental mirror, probe, cotton rolls, and fiber light. The children were examined at their schools (n = 79), in their homes (n = 21), or at the Royal Dental College of Copenhagen (n = 5).

The following registrations were made on all children:

- ☐ *CP-diagnosis* These were taken from the CP-Registry, which also specified whether the onset of cerebral palsy was postnatal and whether the child suffered from epilepsy.
- ☐ *Motor handicap** Patients were classified in three groups, according to the system of Kristensen: patients who need no help (mild); patients who need some help (moderate), and patients who are totally dependent (severe).[1]
- ☐ *Mental handicap** Children were classified in three groups: no mental handicap, slightly retarded, and severely retarded.
- ☐ *Speech** Patients were classified in four groups: normal speech, unclear speech, few words or short sentences, and absence of speech.
- ☐ *Caries** Registration included present teeth, primary and secondary caries, restorations, and extracted teeth resulting from caries, and extracted teeth to accommodate orthodontic treatment. Data in relation to the frequency of plaque and gingivitis, occlusion and oral function were also recorded. Finally, the parents' and the child's dentist filled out a questionnaire about problems encountered in maintaining good oral hygiene, the number of dental visits, and the type of dental treatment. These data were not included, however, in the present study.
- ☐ *Data processing and statistical analysis* Each child was given a DMFS-score.[12] In addition, children were classified in three groups, according to caries type on the basis of the collected data: (1) caries-

*Classified by the author, who has had ten years of experience with CP-patients.

Table 2 □ Distribution of CP-children with spasticity according to subdiagnosis.

Diagnosis	N
Hemiplegia	20
Monoplegia	3
Diplegia	16
Paraplegia	17
Triplegia	1
Tetraplegia	30
Total	87

Table 3 □ Distribution of CP-children according to degree of mental and motor handicap.

	Mental handicap			
Motor handicap	none	slight	severe	N
mild	47	18	6	71
moderate	2	7	5	14
severe	2	6	12	20
Total	51	31	23	105

free, (2) pit and fissure caries only and (3) proximal and smooth surface caries. The results were analyzed using the Statistical Analysis System (SAS) Soft-Ware Package. SCOR's age tables for caries were used as controls.[13]

The average caries rate, recorded as DMFS-average (M), was tested using Student's t-test. The frequencies of the three caries types were tested by the Chi-square test. The whole CP-group, the specific diagnostic groups, the mental handicap groups, the motor handicap groups, and the combination of mental and motor handicap groups were tested against the control group. The diagnostic groups were then tested against each other, and the mental and motor handicap groups were tested against each other internally.

Using the same method, the combination of motor and mental handicap groups was tested internally, one group against the other.

In addition, bivariate regression analyses were performed that tested DMFS-score against CP-diagnosis, motor handicap, and mental handicap, respectively. DMFS-score was tested at the same time against CP-diagnosis, motor and mental handicap using multivariate analysis (SAS Soft-Ware Package).

RESULTS

There were eighty-six children (82 percent) who cooperated without problems. The remaining children were difficult to examine, due to little or no cooperation. In one child, it was only possible to examine the incisors due to lack of cooperation. For this child, the dental status was requested from the patient's own dentist.

Diagnoses

Table 1 shows the subgrouping of the separate CP-diagnoses among the 105 children examined. There were eighty-seven children (83 percent) who suffered from spasticity, four (4 percent) with athetosis, two (2 percent) with ataxia, and twelve (11 percent) with various combinations of these diagnoses. Among the spastic children, the diagnoses tetraplegia (29 percent) and hemiplegia (19 percent) were most prevalent (Table 2). There were twelve postnatal cases (11 percent), and nineteen children (18 percent) had epilepsy. There were fifteen children (14 percent) with no speech, twenty-six (25 percent) with difficulty expressing themselves, and sixty-four (61 percent) with no speech problems. Table 3 shows that half of the CP-group was evaluated as retarded (n = 54) while the remaining fifty-one children showed no mental handicap. Twenty-three children (22 percent) were evaluated as severely retarded. There were twenty children (19 percent) who were almost totally dependent, seventy-one (68 percent) who needed no help, while the remaining could manage with some help. Table 3 also shows that twelve children (11 percent) were both severely mentally and severely physically handicapped, while forty-seven of the children (45 percent) functioned normally except for a mild motor handicap. The table also shows that among the retarded (n = 54), there was a slightly higher prevalence of severe motor handicap (n = 30), while among children without mental handicap (n = 51), only four (8 percent) had severe physical handicap.

Table 4 shows the prevalence of mental and motor handicap in the six largest CP-diagnosis groups. The groups athetosis and ataxia also include children with

Table 4 □ Six CP-diagnostic groups according to degree of mental and motor handicap. The athetosis group and ataxia group include CP-children with mixed diagnosis. The number of children in the other diagnostic groups was less than 7 and are, therefore, not included in the table.

	Mental handicap				Motor handicap			
Diagnosis	none	slight	severe	Total	mild	moderate	severe	Total
	N	N	N		N	N	N	
Monoplegia	3			3	3			3
Hemiplegia	12	3	5	20	18	1	1	20
Diplegia	6	9	1	16	12	4	0	16
Tetraplegia	11	10	9	30	15	7	8	30
Triplegia	1			1	1			1
Paraplegia	12	1	4	17	14	0	3	17
Athetosis	4	5	2	11	3	1	7	11
Ataxia	2	3	2	7	5	1	1	7
Total	51	31	23	105	71	14	20	105

a combination diagnosis. Children with paraplegia and hemiplegia were most often without mental handicap, while children with diplegia were most often retarded. Tetraplegic children were equally divided among the three mental handicap groups. The group with athetosis (73 percent) and tetraplegia (50 percent) included the most children with severe motor handicap. More than half of the children with paraplegia (71 percent) and hemiplegia (60 percent) were evaluated as independent and without mental handicap, while not quite half of the tetraplegic children (42 percent) were evaluated as severely physically and mentally handicapped.

Table 5 □ DMFS-scores for controls, total CP-group and six CP-diagnostic groups (mean (M) and standard deviation (SD) and number (N)).

	DMFS-Score		
	M	SD	N
Controls	8.2	6.0	49116
CP-Total	6.0	5.4	105
Hemiplegia	5.8	5.8	20
Diplegia	6.4	6.3	16
Tetraplegia	4.3	4.9	30
Paraplegia	7.6	6.1	17
Athetosis	5.0	3.6	11
Ataxia	8.6	6.1	7

Caries

Table 5 shows that the average DMFS-score for the whole CP-group was 6.0. Compared to controls, this DMFS-score was significantly lower ($p < 0.001$). When comparing the separate diagnostic groups with each other, there were no significant differences. Tetraplegic children and children with athetosis had the lowest DMFS-scores, whereas the highest DMFS-scores were observed in children with paraplegia and ataxia. Children with ataxia had slightly higher DMFS-scores than controls. The tetraplegic group was the only diagnostic group that differed significantly from the controls ($p < 0.001$).

If the frequency of caries was evaluated in terms of caries type (Table 6), the combined CP-group had 2.5 times as many children without caries and a third fewer children with proximal and smooth surface caries than the controls. The difference between the two groups was highly significant ($p < 0.001$).

When individual diagnostic groups and controls were compared according to caries type, the tetraplegic and athetotic groups differed significantly from controls ($p < 0.05$). Among the tetraplegic children, there were almost six times as many caries-free children as in the controls. In the group with ataxia there were no caries-free children. The number of children with proximal and smooth surface caries was less in all CP-groups, when compared with the control group, except in the group with ataxia. There were no children with proximal and smooth surface caries in the athetotic group.

Table 7 shows that the DMFS-scores were highest for CP-children without mental handicap and lowest for severely retarded CP-children. The difference was significant ($p < 0.05$). The difference between severely and mildly retarded children was also significant ($p < 0.05$). In relation to the controls, the CP-children with slight mental retardation or without mental handicap had slightly lower DMFS-scores, but the difference was not significant. Severely mentally handicapped children had significantly lower DMFS-scores than controls ($p < 0.001$).

Table 7 also shows that the frequency of children with pit-andfissure caries was almost the same in all three handicap groups. The frequency of caries-free children was three times higher among the severely retarded than in the group without mental handicap; the frequency of children with proximal and smooth surface caries was the exact opposite in the two groups.

When evaluating the frequency of caries in relation to motor handicap, Table 8 shows variation similar to that observed in the individual mental handicap groups.

Table 6 □ Distribution of caries types in controls, total CP-group and six CP-diagnostic groups.

	Caries-free		Pit and fissure caries		Proximal and smooth surface caries		
	Percent	(N)	Percent	(N)	Percent	(N)	N
Controls	6.6		52.6		40.8		49116
CP-total	16.1	(17)	55.2	(58)	28.5	(30)	105
Hemiplegia	5.0	(1)	65.0	(13)	30.0	(6)	20
Diplegia	18.8	(3)	56.3	(9)	25.0	(4)	16
Tetraplegia	36.7	(11)	43.3	(13)	20.0	(6)	30
Paraplegia	6.3	(1)	56.2	(9)	36.7	(7)	17
Athetosis	9.1	(1)	90.9	(10)	0.0	(0)	11
Ataxia	0.0	(0)	42.8	(3)	57.1	(4)	7

DMFS-scores were twice as high in the physically independent group as in the physically dependent group. The difference was significant for both handicap groups ($p < 0.01$). Compared to controls, the group with mild motor handicap had lower DMFS-scores, but the difference was not significant. For the motor handicapped, however, the difference was significant for both the moderately motor handicapped ($p < 0.01$) and the severely motor handicapped ($p < 0.01$). The distribution of caries types in relation to the degree of motor handicap showed that there was almost the same frequency of children with pit-and-fissure caries in all three groups, whereas the frequency of children without caries or with proximal and smooth surface caries varied. There were four times as many children without caries among the severely motor handicapped as among the children with mild motor handicap, whereas the number of children with proximal and smooth surface caries was very low, 5 percent ($n = 1$) among the severely motor handicapped, as opposed to 38 percent ($n = 27$) among the mildly motor handicapped. When comparing the caries type distribution to the control group, the division among the independent was very similar to that seen in the controls, except for a slightly higher frequency of caries-free children in the CP-group.

Motor and mental handicaps are negatively related to DMFS-scores

Table 9 shows that mildly motor handicapped CP-

Table 7 □ DMFS-scores (mean ($\overline{M}$) and standard deviation (SD)) and distribution of caries types according to CP-total grouped by degree of mental handicap.

	DMFS-score		Caries-free		Pit and fissure caries		Proximal and smooth surface caries		Total
Mental handicap	$\overline{M}$	SD	Percent	(N)	Percent	(N)	Percent	(N)	N
None	6.8	5.5	9.8	(5)	54.9	(28)	35.2	(18)	51
Mild	6.5	5.9	16.1	(5)	54.8	(17)	29.0	(9)	31
Severe	3.5	3.7	30.4	(7)	56.9	(13)	13.0	(3)	23

Table 8 □ DMFS-scores (mean ($\overline{M}$) and standard deviation (SD)) and distribution of caries types according to CP-total grouped by degree of motor handicap.

	DMFS-score		Caries-free		Pit and fissure caries		Proximal and smooth surface caries		Total
Motor handicap	$\overline{M}$	SD	Percent	(N)	Percent	(N)	Percent	(N)	N
Mild	7.3	5.7	8.5	(6)	53.5	(38)	38.8	(27)	71
Moderate	3.5	3.4	28.6	(4)	57.1	(8)	14.3	(14)	14
Severe	3.3	3.7	35.0	(7)	60.0	(12)	5.0	(1)	20

Table 9 □ 3 groups of CP-children grouped by degree of mental and motor handicap according to DMFS-scores (mean (M) and standard deviation (SD) and type of caries.

Handicap		DMFS-score		Caries-free		Pit and fissure caries		Proximal and smooth surface caries		Total
Mental	Motor	$\overline{M}$	SD	Percent	(N)	Percent	(N)	Percent	(N)	N
None	Mild	7.2	5.5	6.4	(3)	55.3	(26)	38.0	(18)	47
Slight	Mild	7.7	6.8	16.7	(3)	50.0	(9)	33.3	(6)	18
Severe	Severe	2.8	3.6	41.7	(5)	50.0	(6)	8.3	(1)	12

children without mental handicap had the same caries type distribution as the controls, while the two other handicap groups had more caries-free children and fewer with proximal and smooth surface caries. DMFS-scores for severely mentally and motor handicapped were significantly lower than for the two previous groups ($p < 0.01$). Only the severely mentally and motor handicapped children had significantly lower DMFS-scores than the controls ($p < 0.01$). The frequency of children with pit-and-fissure caries was, for the most part, the same in all three groups and did not differ from controls. Only three handicap combinations are listed in Table 9, since there were very few children in the other groups of combined handicaps. Bivariate regression analyses showed that motor handicap ($p = 0.002$) and mental handicap ($p = 0.04$) were significantly negatively related to the DMFS-scores, whereas no significant relations were found for the different (CP-diagnoses ($p = 0.20$) and DMFS-scores. Multivariate analysis showed that the motor handicap was the best predictor ($p = 0.05$) in relation to DMFS-score.

DISCUSSION

Population

The study population included almost two-thirds of all registered CP-children in the age-group in the chosen geographical area. In the study, 76 percent of the contacted children participated, which was quite impressive in light of the CP-children's strain with respect to contact with the general health care system. The number of children in individual groups was not large, but larger than in previous studies.[5,7] In contrast to these studies, the present study used only two ages, which reduces the effect of agerelated factors on the results.

Diagnoses

A detailed comparison with Glenting's Danish material with respect to grouping of children by diagnosis, intelligence, and motor handicap is not possible, since the most severely mentally handicapped children were not included in this study.[14] In addition, some mildly handicapped children did not wish to participate. The gender division is in agreement with Glenting's findings.[14]

Caries

This study showed that fourteen- and fifteen-year-old CP-children as a group had lower DMFS-scores than normal children. This finding is in agreement with the findings in younger age-groups.[4] Difference in DMFS-scores could be explained by the fact that there were more children without caries in the CP-group than in the control group. This may result from the delayed eruption of the permanent teeth in CP-children.[14] In the present study, there were fewer CP-children with proximal and smooth surface caries than among controls, whereas it has been shown that there are an equal number of children with proximal and smooth surface caries in the younger CP-children and controls.[4] The present study showed that the frequency of pit-and-fissure caries was the same in the CP-group as in the control group. In contrast, among younger CP-children, pit-and-fissure caries is less common than in controls.[4]

The difference in the two studies with respect to frequency of pit-and-fissure caries and proximal and smooth surface caries can be explained by the difference in the age-grouping in the two studies: i.e. normally, children develop pit-and-fissure caries initially and later proximal and smooth surface caries.

Caries occurrence in individual diagnostic groups showed that tetraplegic children had lower DMFS-scores than other CP-groups. This finding is in agreement with Magnusson and De Val's findings, and can be explained by the fact that in the tetraplegic group, there

> The caries rate of the combined CP-group was significantly lower than that of the controls.

I wish to express my sincere appreciation to Professor M. Michael Cohen, Jr., DMD, PhD, Dalhousie University, Halifax, for his interest in this study and the revision of the English language of the manuscript.

were relatively more children with severe motor and mental handicap: i.e. the groups with the least caries in the study.[5] The finding that the ataxia group differed from the other diagnostic groups with higher DMFS-scores than among controls can possibly be explained by the fact that there were only seven children in the group. Thus, the results for this group may not be totally reliable.

The present study showed, in agreement with the Swedish study, the lowest caries occurrence to be in the most severely mentally and motor handicapped CP-children.[5]

Difference in caries occurrence in the handicap groups may result from a lower chance among the severely handicapped of obtaining sugary foods; but the difference can also be explained by delay in eruption of the permanent teeth, which may occur more often in severely motor and mentally handicapped CP-children than in mildly motor and mentally handicapped children.[4] CP-children without major handicaps did not differ from normal children in caries occurrence, possibly because the time of eruption of permanent teeth is identical in the two groups. A similar study in an older age-group should show, if this hypothesis is correct, the same caries rate or slight difference in caries rate in CP-patients, regardless of motor and mental handicap, as in normal subjects.

Most studies of CP-children have shown that their oral hygiene is worse than in normal children.[4,5,15] Thus, differences in oral hygiene cannot explain the lower rate of caries in CP-children.

CONCLUSION

For CP-children fourteen and fifteen years of age, the following conclusion may be drawn from this study:

- ☐ DMFS-scores are significantly lower in CP-children than in normal children, mainly because more CP-children are caries-free.
- ☐ Mental handicap and especially motor handicap are of importance for the CP-child's caries rate: i.e. the more severe the motor and mental handicap is, the lower the CP-child's DMFS-score. The specific CP-diagnosis does not seem to have definite influence on the child's DMFS-score.
- ☐ Mildly motor handicapped CP-children without mental handicap have the same caries rate as normal children.
- ☐ The need for caries treatment is generally lower in CP-children than in normal children and especially lower in CP-children with severe motor and mental handicap, which is precisely the CP-group that is most difficult to treat for caries.
- ☐ Suggestions for possible changes in the children's dental health care planning for prevention, examination intervals, and treatment of CP-children can only be made finally, when similar studies of CP-children's plaque and gingivitis index, occlusion, and oral function have been performed.

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Treatment selections for fissured grooves of permanent molar teeth

John W. Brownbill, BDSc, MDSc, FRACDS
James C. Setcos, BDSc, DDS, MSc

Despite the declining caries rate, the number of carious lesions in fissured grooves remains high.[1] The long recognized dilemma of how to manage fissured grooves of recently erupted permanent teeth is now aided by the expanded variety of materials and techniques available.[2,3] Selection of treatment options, however, is now more complex. This study was devised to determine preferred treatments as selected by pediatric and other dentists.

MATERIALS AND METHOD

Twenty dentists from the areas of pediatric dentistry, operative dentistry, prosthodontics, general dentistry and dental materials, who use both fissure sealants and amalgams in their practices of dentistry, agreed to participate in the study. Six permanent molar teeth were selected from a pool of extracted third molars which were initially disinfected in 10 percent formalin and stored in tap water. They were selected to be morphologically similar to first permanent molars with fissured grooves that the authors found difficult to diagnose as carious or sound. These teeth had thirteen areas of fissured grooves or pits that were distinct and separate areas for treatment consideration.

After mounting the teeth individually in plaster, rubber dam was applied and the teeth were photographed, and then photographed again with simulated occlusal contacts as produced by lightly rubbing articulating paper between each study tooth and a tooth not in the study. Also, with a dental film placed in the usual bitewing relationship, each tooth was radiographed from the buccal using normal clinical exposure settings, tube distance and angulation. Throughout the study, the teeth were stored in water, except when they were being examined, treated, or studied.

The teeth were examined at dental units where operating light, air syringe, and radiograph viewer were available. The same new two-ended explorer was used throughout the study. No effort was made to influence the participants, and an author was present at all examinations to answer questions and to indicate the outline of each groove or pit. The participants were not told that they would be asked to participate later in the study and were given the following statement before commencing the examinations:

"*Diagnosis*: This is a survey of treatment selections for pit and fissure areas on molars. These teeth have been chosen to simulate the conditions found in deeply fissured first molars. A radiograph of the tooth is available. Please choose only one treatment option for each designated groove area. Each area will be considered independently of the other grooves in that tooth, as if each was on a separate tooth. To simulate clinical conditions, five minutes are available for examination."

Dr. John W. Brownbill is Associate, Department of Community and Preventive Dentistry, University of Melbourne, Australia and Consultant, Department of Pediatric Dentistry, University of Minnesota. Dr. James C. Setcos is Assistant Professor of Dental Materials at Indiana University School of Dentistry, 1121 W. Michigan Street, Indianapolis, IN 46202.

Table 1 ☐ Original treatment selected for grooves by twenty panelists.

		Tooth Groove	1 Mes of Occl	2 Occ-Ling	2 Occl	3 Occl	3 Mes-Buce	3 Dis-Buce	4* Occl	4* Mes-Buce	4* Dis-Buce	5 Mes of Occl	5 Dis of Occl	6 Buce	6 Occ-Buce	Total	Percent
		Nothing (1)		3				8		3	15	1		9		21	10.5
T	R	Topical flouride (2)						1			1			2		3	1.5
R	E	Smooth & polish (3)												1		1	0.5
E	Q	Glass ionomer sealant (4)	1	2			1	1		1	2			1		6	3.0
A	U	Resin sealant (5)	6	12	6	2	7	9		7	2	2	1	4	1	50	25.0
T	I	Preventive resin (6)	3		6	5	2	1		2		7	6	3	6	39	19.5
M	R	Glass ionomer restoration (7)			1								1			2	1.0
E	E	Gold foil restoration (8)				1	3		1			1	1		1	7	3.5
N	D	Amalgam (9)	8	2	5	10	6		16	4		7	9		11	58	29.0
T		Posterior composite resin (10)	2	1	2	2	1		2	3		2	2		1	13	6.5
		Onlay (11)							1							0	0.0
Total			20	20	20	20	20	20	20	20	20	20	20	20	20	200	100.0

*This tooth not included in analysis. Later gold onlay preparation included the two buccal grooves.

Participants were told that each pit or groove area must be viewed in isolation, and independently of other oral or socioeconomic conditions of the patient. Reflecting the multiple modalities now available to dentists, the following treatment options were offered for each groove or pit area:

☐ Nothing (no treatment)
☐ Topical fluoride
☐ Glass ionomer sealant
☐ Resin sealants
☐ Preventive resin restoration (sealed composite resin)
☐ Glass ionomer restoration
☐ Gold foil (direct gold)
☐ Amalgam
☐ Posterior composite resin
☐ Any other (specify)

Following the diagnostic stage of the survey, eight of the panelists were asked to prepare the teeth for the restorations that they had chosen for ten pit or groove areas. The selected panelists prepared cavities that they had planned as necessary for that groove. The panelists were given the following instructions:

"*Cavity preparation*: Thank you for participating in the diagnostic phase of this survey. Please prepare this groove in accordance with your suggestion, which was ( ). Other panelists also have been asked to prepare cavities. Please indicate whether carious dentin was present in the groove, if operated upon."

The six teeth, now prepared, were reassessed by all twenty panelists. The following instructions were given:

"*Cavity assessment*: Thank you for continuing to participate in this survey. Please assess the cavity preparations in the grooves. Please indicate whether you consider:

(a) The cavity has been adequately prepared.
(b) Too much tooth has been removed.
(c) Too little tooth has been removed.
(d) Both (b) and (c), i.e. Too much tooth has been removed in places and not enough in others.

Once again, please indicate your treatment of choice for this groove. You may indicate your original option as shown, or change your option."

The panelists were asked to assess the amount of tooth removed in relation to their own selections. No explorer was used, otherwise the preparations were examined under conditions similar to the first examination, but now the panelists had the knowledge of their original diagnoses, the type of cavity preparations, the cavity itself to examine, and were informed whether the operator found caries during preparation. The panelists were asked whether they wished to change from their original treatment selection.

In analyzing the diversity of treatment options, planned restorations were arbitrarily classed as being conservative, if they were preventive resin or a treatment requiring removal of less tooth substance. Treatment options requiring removal of more tooth substance than preventive resin were classed as radical. In assessing changes of selected treatment being more or less radical depended on moving up or down through the order from "nothing (no treatment)" to "onlay" as listed in Table 1.

RESULTS

Table 1 shows the original suggestions for the treatment of all thirteen fissured grooves. Because later preparations of the occlusal surface destroyed its two buccal grooves, tooth #4 was eliminated from the analysis. The table shows a wide variation of selections of required treatment, with amalgam (29 percent) and resin sealant (25 percent) being the most common. Only twice was not one or the other mode selected, and only

Table 2 ☐ Later treatment selected for grooves by the panelists.

		Tooth Groove	1 Mes of Occl	2 Occl Ling	2 Occl	3 Occl	3 Mes-Bucc	3 Dis-Bucc	4* Occl	4* Mes-Bucc	4* Dis-Bucc	5 Mes of Occl	5 Dis of Occl	6 Bucc	6 Occl Bucc	Total	Percent
		Preparation	(9)	(5)	(6)	(7)	(4)	(1)	(11)	(10)	(2)	(8)	(6)	(3)	(10)		
		Presence of caries	+	?	+	+	?	+	+	+	+	+	+	?	+		
		Nothing (1)		2			2	7			2	1		6		18	9.0
T	R	Topical flouride (2)										1				1	0.5
R	E	Smooth & polish (3)												3		3	1.5
E	Q	Glass ionomer sealant (4)					2							1		3	1.5
A	U	Resin sealant (5)	2	16		1	9	8		2		3		6		45	22.5
T	I	Preventive resin (6)	2	1	7	5	3	1				2	2	2	5	30	15.0
M	R	Glass ionomer restoration (7)														0	0.0
E	E	Gold foil restoration (8)	1		1		1	1				1	1	1		7	3.5
N	D	Amalgam (9)	13		11	13	3	3	13	4	4	9	13	1	12	78	39.0
T		Posterior composite resin (10)	2	1	1	1			2			3	4		3	15	7.5
		Onlay (11)							2	2	2					0	0.0
Total			20	20	20	20	20	20	17	8	8	20	20	20	20	200	100.0

*This tooth not included in analysis. Later gold onlay preparation included the two buccal grooves.

Table 3 ☐ Consideration of prepared cavities relative to original selections by the panelists.

Tooth Groove	1 Mes of Occl	2 Occ-Ling	2 Occl	3 Occl	3 Mes-Bucc	3 Dis-Bucc	4 Occl	4* Mes-Bucc	4* Dis-Bucc	5 Mes of Occl	5 Dis of Occl	6 Bucc	6 Occl Bucc	Total	Percent
Correct amount removed	10	18	9	2	6	8	1			12	9	5	6	86	39.1
Too much removed	2		6	2			19	6	6	2	4	15	3	53	24.1
Not enough removed	7	2	4	14	14	12				4	7		9	73	33.2
Too much & not enough removed	1		1	2						2			2	8	3.6
Total	20	20	20	20	20	20	20	6	6	20	20	20	20	220	100.0

*Buccal grooves of this tooth not included in analysis. Gold onlay preparation had included the two buccal grooves.

six times were they not first and second mode. Interestingly, fifteen or twenty chose to prescribe "nothing" for a groove that later was removed in the extension of an occlusal onlay preparation. Eight panelists were selected to prepare ten pits and grooves in the study teeth. Two grooves were lost to assessment, because of extension of another groove on the same tooth (#4) during onlay preparation. One panelist prepared a central pit on #5 for a preventive resin restoration. Subsequently another panelist prepared the distal pit on #5 for a gold foil, found caries undermining the oblique ridge, and extended the cavity into the central pit, obliterating the preventive resin preparation. One groove was not prepared.

Table 2 shows the later treatment selection after the review of the prepared areas. Once again the incomplete data from tooth #4 have been eliminated from the analysis. According to the operators, all grooves that were operated upon with fissure penetration contained caries. This led to a significant shift to more radical selections later (chi square analysis). Amalgam or resin sealant was the selected mode in all cases, but never clearly first and second mode together. The increase in amalgam (39 percent) was at the expense of resin or glass ionomer sealant and preventive resin.

Table 3 lists the opinions about the amount of tooth substance removed. It shows satisfaction with the more popular preparations such as amalgam, resin sealant, and preventive resin; but dissatisfaction with traditional conservative approaches such as polishing, topical fluoride application and "no treatment". Although the amount of material removed was acceptable to most panelists, some expressed the view that they would place amalgam in the gold foil cavity. There was overwhelming disapproval of the radical onlay preparation.

Table 4 lists the radical and conservative selections. Pediatric dentists were significantly more conservative in their original and later treatment selections than other dentists (chi square and binomial analysis). There were more changes to "more radical", than changes to "more conservative" treatment by all dentists, reflecting the fact that all penetrated fissured grooves were found to be carious.

The authors' philosophy for noncarious fissures is to seal and reseal as needed.

DISCUSSION

The dissatisfaction with both the very radical and very conservative treatments of fissured grooves of permanent molars was evident in this study. Half a century ago Hyatt emphasized the difference between a groove and a fissure and highlighted the need to treat all fissured grooves of recently erupted teeth.[2,3] Management is a choice between a fissure sealant and a restoration. The authors' philosophy for noncarious fissures is to seal and reseal as necessary. Noncarious fissures will not become carious whilst a sealant remains intact.[1] Hyatt, Simonsen, and Henderson and Setcos have all discussed the difficulty of diagnosing the extent of caries in a fissured groove, which is again confirmed in this study and thousands of dental operatories every day.[2-6] Logically, teeth with carious fissures should have the occlusal stops marked and the caries removed; then be assessed before deciding which material to use and what further cavity preparation is necessary. If only a small volume of the fissure is carious and does not undermine occlusal enamel stops, a preventive resin may be placed (Simonsen and Henderson and Setcos) as this will give a better prognosis for both tooth and restoration than an amalgam (Simonsen, and Ripa).[1,4-6] Amalgam fillings minimally extended into all fissured grooves give excellent service and are the treatment of choice where occlusal stops are to be restored, because current posterior composite resins are not recommended for areas of high occlusal stress.[7,8] If the carious destruction undermines a cusp crest or beyond and the lateral enamel is unsupported, radical overlay restoration is not necessary in many cases. If restored in composite resin, this enamel can be bonded and strengthened; thus the prognosis for the tooth is

Table 4 □ Analysis of changes in diagnoses to more conservative and more radical by panelists.

Dentist	Original conservative diagnoses	Original radical diagnoses	% Original conservative diagnoses	Later conservative diagnoses	Later radical diagnoses	% later conservative diagnoses	Change to more conserv. diagnoses	Change to more radical diagnoses	Total change diagnoses
Pediatric dentist	12	1	92	8	3	73	0	3	3
Pediatric dentist	11	2	85	2	11	15	0	9	9
Operative	6	7	46	4	7	36	0	2	2
Pediatric dentist	8	5	62	8	5	62	1	1	2
Operative	7	6	54	4	7	36	0	1	1
Operative	8	5	62	4	7	36	1	4	5
Pediatric dentist	9	4	69	7	6	54	2	6	8
Prosthodontist	5	8	38	4	7	36	2	1	3
Pediatric dentist	12	1	92	10	1	91	0	1	1
Pediatric dentist	11	2	85	9	2	82	1	2	3
Operative	4	9	31	4	9	31	3	3	6
Prosthodontist	5	8	38	2	9	18	2	3	5
Operative	6	7	46	3	8	27	0	1	1
Pediatric dentist	10	3	77	6	5	55	1	3	4
Operative	7	6	54	4	9	31	2	9	11
General	4	9	31	3	8	27	1	0	1
Materials	12	1	92	10	3	77	3	3	6
Materials	3	10	23	2	9	18	0	0	0
General	6	7	46	5	6	45	1	1	2
Operative	7	6	54	5	8	38	0	10	10
Total	153	107	59	104	130	44	20	63	83
Mean	7.65	5.35	58.85	5.20	6.50	44.48	1.00	3.15	4.15
Stand Dev	2.89	2.89	22.22	2.61	2.65	22.22	1.03	3.03	3.27
All ped dentists	73	18	80	50	33	60	5	25	30
Mean	10.43	2.57	80.22	7.14	4.71	61.54	0.71	3.57	4.29
Stand Dev	1.51	1.51	11.63	2.61	3.30	24.62	0.76	2.94	3.04
All others	80	89	47	54	97	36	15	38	53
Mean	6.15	6.85	47.34	4.15	7.46	35.29	1.15	2.92	4.08
Stand Dev	2.27	2.27	17.44	2.21	2.56	14.74	1.14	3.17	3.50

Some participants included tooth #4 (gold onlay) in their scoring and others did not. If recorded these scores are included in this analysis.

improved. The wear on the composite resin may mean, however, that regular repair will be necessary.

CONCLUSION

There is an increasingly wide variety of options for the management of fissured grooves. As shown in this survey, pediatric dentists are more conservative than other dentists in treatment selections. The extremes of both radical and traditionally conservative management are unpopular. For these permanent molars, glass ionomer and gold foil were rarely selected as treatment options. After finding caries in prepared grooves, selections generally shifted toward more radical treatment options.

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EFFECT OF PRENATAL ALCOHOL EXPOSURE ON GROWTH AND MORPHOLOGY

There is a significant relationship between alcohol use throughout pregnancy and weight and length of the infant at 8 months of age. The sample was divided into women who drank at the rate of one or more drinks per day throughout pregnancy, all other drinkers, and women who abstained. After adjustment for sex, gestational age, age at examination, and maternal height, infants of mothers who drank at the rate of one or more drinks per day throughout pregnancy had significantly lower average weight ($P = .004$) and length at 8 months of age ($P = .01$). The adjusted mean weight of infants exposed to alcohol throughout pregnancy was 8289 g compared with a mean weight of 9104 g at follow-up examination for infants of mothers who abstained from drinking alcohol. The adjusted mean length was 696 mm for infants of mothers who were heavy alcohol users compared with 723 mm for infants of mothers who abstained from using alcohol. The head circumference of the infants was also reduced, but the difference was not statistically significant.

Day, N.L. *et al*: Effect of prenatal alcohol exposure on growth and morphology of offspring at 8 months of age. Pediatrics, 85-748-752, May 1990.

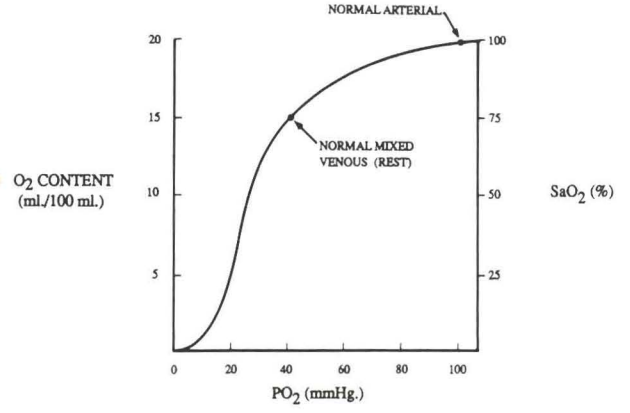
Pulse rate and oxygen saturation in children during routine dental procedures

Mitchell Poiset, DDS
Ronald Johnson, DDS
Robert Nakamura, PhD

When a child is undergoing a sedation procedure in the dental office, the medications given decrease the child's activity, allowing the dentist to complete the necessary dental procedures. In addition to reducing the child's fear, apprehension, and movement, the sedative may lead to suppression of physiologic functions such as respiration, heart rate, gag reflex, and the ability to maintain an airway. If these functions are suppressed to the degree that the patient is unable to ventilate properly, a potentially life-threatening hypoxemia could arise. Thus, the safety of a sedation technique depends on whether the patient is adequately ventilated and sufficiently oxygenated.

To understand the state of hypoxemia and how it occurs, one must first understand the concepts of blood oxygen tension, arterial oxygen saturation, and the blood's methods for carrying oxygen and delivering it to body tissues. Figure 1 shows the oxygen-hemoglobin dissociation curve. At a normal value of 20 mg Hb/100 ml blood, when the partial pressure of the oxygen in the blood is approximately 100 mgHg, the hemoglobin is 100 percent saturated, i.e. there are no more hemoglobin molecules available to bind the oxygen molecules. Thus 100 mmHg is about the value obtained when the patient is breathing room air at a normal rate. If the patient is inhaling higher than normal oxygen concentrations, say 80 percent O_2 and 20 percent N_2O from a nasal hood, the partial pressure of oxygen (PO_2) can rise as high as 600 mmHg. But due to the sigmoid shape of the dissociation curve, there will be no rise in the oxygen saturation (SaO_2). To obtain a sharp decrease in the SaO_2, there must be a significant drop in the arterial PO_2. In order to go from 100 percent SaO_2

Figure 1. Sigmoid relationship between O_2 content and O_2 partial pressure of blood. The percent O_2 saturation of hemoglobin (SaO_2) in given on the right-hand scale. Normal resting values for arterial and venous blood at sea level are shown.[1]



All work was performed at the University of Southern California, School of Dentistry, Department of Pediatric Dentistry. Dr. Poiset was a postdoctoral student, Department of Pediatric Dentistry, University of Southern California, School of Dentistry; he is now in private practice, San Diego, CA. Dr. Johnson is Professor and Chairman, Pediatric Dentistry, University of Southern California, School of Dentistry, Dr. Nakamura is Associate Professor, Obstetrics and Gynecology, University of Southern California, School of Medicine.

to 75 percent (that of venous blood), the PO_2 must drop from 100 mmHg to 40 mmHg.

The relationship between PO_2 and O_2 content of hemoglobin is a feature of its four subunit structure. The characteristic sigmoid shape of the dissociation curve is due to interaction between individual hemoglobin subunits (heme-heme interaction) such that the presence of O_2 on one heme group affects the affinity for O_2 binding at other sites. And as, with progressively increasing PO_2, the four O_2 binding sites become occupied sequentially and the successive binding causes the content or affinity curve to become sigmoid.[1]

Hypoxemia is defined as subnormal oxygenation of arterial blood short of anoxia, the absence of oxygen in the blood. The clinical signs of hypoxemia are restlessness, confusion, anxiety, and apprehension. These signs can be seen in many patients for reasons other than hypoxemia, however, and thus are not specific for hypoxemia. Bradycardia and cyanosis are seen in severe hypoxemia and indicate the occurrence of a critical situation.[2] The grading of hypoxemia and the relation to SaO_2 and PO_2 are shown in Table 1.

Table 1 □ Levels of oxygen saturation and partial pressure of oxygen during normal oxygenation and various states of hypoxemia.[2]

Condition	Percent saturation O_2	PO_2
Normal	97-100	97-100
Normal O_2 tissues	>95	>80
Mild hypoxemia	90-95	60-80
Moderate hypoxemia	70-90	40-60
Severe hypoxemia	<75	<40

In the current practice of pediatric dentistry, the minimum requirement for monitoring any child undergoing a sedation procedure is a precordial stethoscope. This is an inexpensive and reliable device which allows accurate and instant evaluation of the patient's heart rate and rhythm, as well as respiratory rate and sounds. The disadvantages of the precordial stethoscope are that some of the vital signs monitored to detect changes in the patient's oxygenation only show noticeable changes when the patient is entering a crisis situation. The precordial stethoscope can detect snoring that can alert the practitioner to change the patient's head position; but for the respiratory rate a decrease is only seen when the patient is in severe hypoxemia. An increase in respiratory rate can be due to moderate hypoxemia, or it could also be related to anxiety or pain. The precordial stethoscope is only reliable in alerting the dentist, therefore, when a crisis in oxygenation is occurring, not in predicting and preventing it. The same factors hold for heart rate. An increase is found with pain and anxiety, but a decrease occurs only when severe hypoxemia occurs. Other monitoring devices available for use in the dental office are the blood pressure cuff, either manual or automatic, and the electrocardiograph. Although these devices are not inexpensive, they give valuable information such as blood pressure, heart rate, and rhythm. The vital signs being measured do not give early warning about changes in the patient's oxygenation, however, because the blood pressure increases with anxiety and pain, and only decreases when severe hypoxemia occurs.[2]

One device that allows detection of decreases in patient oxygenation, before a dangerous situation is reached, is the pulse oximeter. It gives continuous percentage measurements of the patient's arterial hemoglobin oxygenation as well as the pulse rate. Pulse oximetry functions by positioning any pulsating arterial vascular bed between a two-wavelength light source and a detector. The pulsating vascular bed, by expanding and contracting, creates a change in the light path length that modifies the amount of light detected. The familiar plethysmograph waveform results. The amplitude of the varying detected light depends upon the size of the arterial pulse change, the wavelength of the light used, and the oxygen saturation of the arterial hemoglobin. Because the detected pulsatile waveform is produced solely from arterial blood, using the amplitude at each wavelength and Beer's Law (absorption is dependent on the number of molecules in the path of a light ray) allows exact beat-to-beat continuous calculation of arterial hemoglobin oxygen saturation with no interference from surrounding venous blood, skin, connective tissue, or bone.[3] Since the pulse oximeter functions using any pulsating arterial vascular bed, multiple locations for placement of the probe are available including fingers, toes, web of the hand between the thumb and first finger, ear, and the bridge of the nose. Three different types of probes are currently available: the finger clamp; the ear probe; and the butterfly, which is the most versatile—it can be placed in any of the above mentioned locations and secured with tape. The finger or toe is the most popular location for placement of the probe. It is easy to apply and secure and will not interfere with the dental procedure. The web of the hand is convenient for use on very small children due to the small size of their fingers and toes. Thus a device is available which allows instant, accurate, and continuous monitoring of the patient's oxygenation status.

Research in the field of pulse oximetry has been con-

Table 2 □ Change in pulse rate in beats/minute above baseline for each step of the operative procedure.

	Patient													
Procedure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Topical	0.0	6.8	6.0	3.2	5.2	2.0	2.0	5.0	2.8	6.6	3.4	2.2	0.0	5.0
Injection	2.6	5.2	13.6	0.0	7.6	3.0	0.8	8.0	2.4	7.6	2.6	0.0	0.0	8.0
Post injection	9.6	2.0	11.6	8.4	7.0	10.6	9.0	10.0	10.0	14.8	2.4	8.0	8.0	12.0
Anesth uptake	9.6	0.0	10.6	0.0	1.7	0.0	3.4	4.4	0.0	6.0	1.8	3.0	0.0	8.6
Rubber dam	8.4	4.0	12.0	0.0	10.0	8.0	3.0	7.2	8.0	8.4	6.6	4.4	0.0	12.8
Drill	5.4	0.0	8.4	0.0	3.2	2.2	4.4	5.4	0.0	9.6	8.0	2.4	0.0	2.6
Fill	6.2	0.0	5.4	0.0	0.0	2.0	3.6	3.4	0.0	7.2	7.6	2.0	0.0	0.0
Post OP baseline	6.4	0.0	0.0	0.0	0.0	4.0	2.2	0.0	0.0	8.8	3.4	3.0	0.0	0.0

ducted predominantly by the medical profession and has focused on demonstrating the correlation between the SaO_2 values obtained with a pulse oximeter and the SaO_2 values obtained by direct blood sampling from an indwelling arterial catheter. Monaco, Shulman, Mihm, and Yelderman have shown an accurate and consistent correlation between the two methods of determining SaO_2, and the values obtained differ by only 1 percent to 2 percent.[3-6] Yelderman emphasized the accuracy was only valid in the range of 70-100 percent SaO_2, due to the restricted ability to obtain arterial SaO_2 below 70 percent for the measurements.[3] Duncan used the pulse oximeter to determine the incidence of hypoxemia of patients undergoing outpatient general anesthesia.[7] He found that 30.6 percent of the patients breathing room air developed hypoxemia. Mueller and Drummond studied children undergoing sedation procedures in the dental office and compared the SaO_2 to heart rate, blood pressure, and respiratory rate for detecting mild to moderate hypoxemia.[2,8,9] The pulse oximeter was found to be the most sensitive early monitor of O_2 desaturation.

The purpose of this study was to examine the effect routine dental procedures have on heart rate and SaO_2 in unsedated children. Also, it should establish what effects routine dental procedures have on SaO_2 and heart rate and possibly develop a baseline for additional studies of SaO_2 in sedated pediatric dental patients using the pulse oximeter.

METHODS AND MATERIALS

The patients used in the study were all five- to seven-year-old, normal, healthy children, seven boys and seven girls. The patients were taken at random from the patient population of the pediatric dental clinic at the University of Southern California, School of Dentistry and all operative procedures were performed in the same room with the same operator and dental assistant. An occlusal amalgam restoration on a mandibular primary second molar was performed on each child. All procedures were completed under rubber dam with a #14 clamp on the tooth being restored. Previous restorative experiences and behavior in the dental office were not considered in patient selection.

The child's SaO_2 and pulse rate were measured using the Ohmeda 3700 Pulse Oximeter and an Ohmeda pin chart recorder which automatically recorded the pulse rate. The Ohmeda 3700's graphic display shows a 20-minute trend for SaO_2 at 3/5 minute (36 second) intervals. After the operative procedures were completed, the Sao_2 recordings were transferred manually to the chart paper at the appropriate time intervals.

When the operative procedures were to begin, the following steps were performed uniformly on each child. The patient was seated in the dental chair and given five minutes to adjust to the new environment. Then, the finger probe of the pulse oximeter was applied and a base line for pulse rate and SaO_2 was determined over a five-minute period. The dental procedures were then begun. Topical anesthetic was applied and the time marked on the chart recorder. After one minute the injection was given and the exact time the needle pierced the tissue was marked. The time of removal of the needle was also marked. Five minutes after anesthesia, the rubber dam was placed, and the time noted. The times at which drilling, filling, and removal of the rubber dam began were noted and a five-minute postoperative baseline was recorded.

The time of the operative procedures was divided into 8 periods: A. Topical anesthetic application; B. Injection; C. One minute postinjection; D. Anesthetic uptake; E. Rubber dam; F. Drilling; G. Filling; H. Postoperative baseline. The pulse rate for each period was determined using the area under the curve obtained on the pin chart recorder and measured as beats/minute over the initial five-minute baseline. The SaO_2 for each time period was averaged, then recorded as a decrease or increase in SaO_2 from the average of the initial five-minute baseline.

The changes in SaO_2 and pulse rate were analyzed using the Friedman two way analysis of variance by ranks. The changes in pulse rate between different procedures were analyzed using the Wilcoxon matched-pairs, signed-rank test.

RESULTS

The recorded values for pulse rate and SaO_2 are shown in Tables 2 and 3, respectively. The average change in

pulse rate and SaO_2 for each procedure is shown in Table 4. The pulse rate appeared to increase steadily and peak at postinjection or the sixty-second period immediately following the removal of the needle from the tissue. The pulse rate peaked a second time, when the rubber dam was placed; then gradually decreased to levels near the initial five-minute preoperative baseline values. No apparent trend for the change in SaO_2 was observed. The data were analyzed using the Friedman two-way analysis of variance test to determine whether the various steps of the operative procedure had significantly different effects on the pulse rate and SaO_2. For SaO_2, analysis showed no statistical correlation between operative procedures and a change in SaO_2. For pulse rate, a definite correlation was found. Routine dental procedures do have a statistically significant effect on pulse rate at the $p < .001$ level. Table 5 shows the increase in pulse rate for the various procedures from the highest to the lowest, and Figure 2 shows graphically the average increase in pulse rate during the operative procedures.

To determine whether there is a statistical difference in the changes in the pulse rate between the individual procedures, the data were analyzed using the Wilcoxon matched-pairs, signed-rank test. A significant change in pulse rate from procedure to procedure was found in all instances, except for the period of topical application to injection and for filling to postoperative baseline. The results are shown in Table 6.

DISCUSSION

Support for the accuracy and reproducibility of the data was given by the fact that one child was seen twice in this study. The values for change in pulse rate and in SaO_2 were the same for each of the individual operative procedures for that child.

The greatest increase in pulse rate was during the postinjection period.

For all cases the largest increase in pulse rate was during the postinjection period: the sixty-second period after the needle was removed from the tissue; not when the needle pierced the tissue and not while the anesthetic fluid was being injected, as might be expected. Several explanations for this finding are offered. First, perhaps the expansion of the connective tissue by the anesthetic fluid was more painful than the piercing of the mucosa by the needle, and this painful sensation was not fully perceived until the end of the sixty-second injection period. Thus, the pulse rate was not seen to increase until after the needle was removed. It is also possible that the child sensed the pain

Table 3 ☐ Patient SaO_2 above or below baseline for each step of the operative procedure.

	Patient													
Procedure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Topical	+1.1	+1.0	−1.9	+0.7	+2.0	+0.1	−0.9	−1.3	−0.5	+0.5	−0.3	0.0	−0.9	−4.5
Injection	+1.1	0.0	−1.9	+0.2	+1.5	−0.9	−0.9	−3.8	0.0	−2.8	−0.1	+0.2	−0.3	0.0
Post injection	+1.1	0.0	−1.9	+0.2	+0.5	−1.9	−0.4	−1.8	0.0	−1.3	−0.3	−1.3	+1.1	−0.5
Anesth uptake	+1.1	+0.3	+0.5	+0.5	+0.5	−1.4	+0.4	−1.1	+0.7	+0.2	+0.2	−0.3	+0.1	0.0
Rubber dam	+0.1	+1.0	−1.4	−0.3	+1.0	−1.4	+0.1	−1.3	0.0	−0.3	+0.2	−1.3	+0.1	+0.5
Drill	+0.1	+0.9	−0.3	−0.9	+0.8	−1.1	−0.4	−0.2	0.0	+0.2	+0.2	+0.2	+0.3	+0.7
Fill	+0.1	+1.5	+0.5	−2.3	+0.6	+0.5	−0.1	−0.7	−1.3	−0.1	−0.5	−0.5	−0.3	+0.3
Post OP baseline	+0.1	+1.2	+0.7	−1.9	+0.9	−0.5	−0.6	−1.0	−1.0	−1.0	−0.4	−1.0	+0.6	−0.6

Table 4 ☐ Average increase in pulse rate and change in SaO_2 from baseline for each step of the operative procedure.

Procedure	Pulse rate	SaO_2
Topical	3.6	−0.2
Injection	4.4	−0.6
Post injection	8.8	−0.5
Anesthetic uptake	3.5	+0.1
Rubber dam	6.6	−0.3
Drilling	3.7	0.0
Filling	2.7	−0.2
Post OP	2.0	−0.3

Table 5 ☐ Average increase of pulse rate in beats/minute during the different steps of the operative procedure listed from greater to lesser change.

Procedure	Increase in pulse rate
Post injection	8.8
Rubber dam	6.6
Injection	4.4
Drilling	3.7
Topical	3.6
Anesthetic uptake	3.4
Filling	2.7
Post OP baseline	2.0

Table 6 ☐ Results of Wilcoxon Matched-pairs, signed-rank test to determine whether there are changes in pulse rate between the different steps of the operative procedure.

Procedures being compared	Result
Baseline to topical	Significant change
Topical to injection	No significant change
Injection to post injection	Significant change
Post injection to anesthetic uptake	Significant change
Anesthetic uptake to rubber dam	Significant change
Rubber dam to drilling	Significant change
Drilling to filling	Significant change
Filling to post OP baseline	No significant change

from the needle piercing the mucosa and from the expansion of the connective tissue, but the physiological response (i.e. the increase in pulse rate) to the noxious stimuli was not immediate, but delayed for approximately sixty seconds. The last possible explanation was that the body reacted to the epinephrine in the local anesthetic and that it took up to a minute for the drug to enter systemic circulation and elicit a physiologic response: i.e. the increase in pulse rate. (This explanation could easily be proven wrong by using local anesthetic without epinephrine in several test cases.)

After the application of the rubber dam, a steady decrease in the pulse rate was seen. Two questions could be raised by this trend. Did the various operative procedures truly have different effects on the pulse rate? Or was the decrease in pulse rate due to a gradual return of the child's physiologic functions to the baseline level after being stimulated by uncomfortable operative procedures?

Finally, although this study showed that there were no statistically significant changes in the SaO_2, there were two instances where children had the SaO_2 fall below 95 percent. In both cases it was during the injection period, from 0 to 60 seconds after the needle pierced the oral tissues. The fact that an episode of mild hypoxemia occurred during routine dental procedures on unsedated children emphasizes the fact that the operator must constantly be concerned about insufficient oxygenation of the patient during sedation procedures.

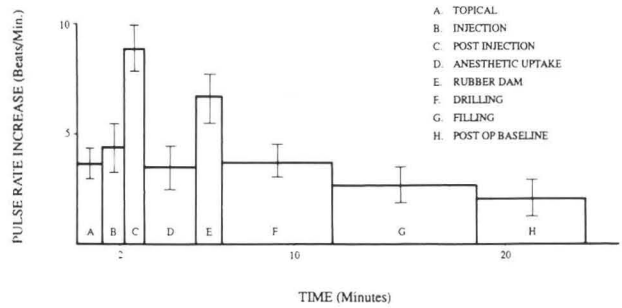


Figure 2. Increase in pulse rate versus time for each step of the operative procedure. Standard error of the mean is shown for each time period.

CONCLUSIONS

The following conclusions can be reached from this study. First, the SaO_2 does not vary statistically in pediatric dental patients undergoing routine operative procedures. Second, routine operative procedures do affect the pulse rate, and changes in pulse rate vary significantly during different procedures. Third, there is no relationship between changes in pulse rate and change in SaO_2 in unsedated children undergoing routine dental procedures. And lastly, if changes in SaO_2 occur in children while sedated, the drop in SaO_2 cannot be attributed to the operative dental procedures alone.

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Epidemiology

Decreases in dental caries do not mean that children no longer need dental services

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

The continuing decline in dental caries in children could give one the impression that there is a decreasing need for the services of pediatric dentists. But, to the contrary, parents and guardians continue to identify their children's major dental needs and the injurious consequences of dental diseases.

Since 1982, annual reports from the National Health Interview Survey (NHI Survey) conducted by the National Center for Health Statistics provide an opportunity to review the need and demand for dental services for children — not from the usual perspective of trained health personnel — but from the perspective of the individual(s) who will be requesting dental services for their children. The conclusion that one draws from a review of these reports is that, despite a continuing decrease in reported dental caries rates, there is a significant ongoing need for the services of pediatric dentists.

EARLIER REPORT

A previous review by this writer presented the results from the 1984 NHI Survey.[1] This earlier report considered (for the period immediately following the last economic recession) parental perceptions of the dental service needs of their children and some of the consequences of dental disease. The conclusion from this earlier review was that, "... although dental services

Dr. Waldman is Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11794-8715.

Table 1 ☐ Number of children: 1982, 1988.[2]

	1982	1988
Less than 5 yrs.	17,326,000	18,385,000
5–17 yrs.	45,336,000	45,184,000
Less than 18 yrs.	62,662,000	63,569,000

for children have changed, there will be a continuing demand by parents and guardians for high levels of dental services for children in our communities."[1]†

CURRENT REVIEW

The following presentation will compare the data from the 1982 NHI Survey†† with the most recent 1988 NHI Survey on the frequency and consequences of acute dental conditions‡ that affected children.[2] This particular period represents a time of dramatic changes for the dental profession, including:

- ☐ Increasing use of dental services.
- ☐ Improving economics of dental practice.
- ☐ Significant decreases in dental school enrollment.
- ☐ Decreases in pediatric dental training program enrollment.
- ☐ Particular changes in dental practice delivery modalities (e.g. increases in the number of partnerships, corporations and the number of employees per dental facility).

The sampling design for the NHI Surveys follows a multistage probability system which permits a continuous sampling of the civilian noninstitutionalized population residing in the United States. The survey is designed in such a way that the sample scheduled for each week is representative of the target population and the weekly samples are additive over time. In 1982, 42,000 households, with a probable sample of 110,000 persons, were included in the study. In 1988, 47,485 households were interviewed, resulting in a sample of 122,310 persons. Over the years, the response rates to the surveys have been between 95 and 98 percent.[2]

NUMBER OF CHILDREN

Between 1982 and 1988, there was an increase of almost one million children less than five years of age and a decrease of approximately 150,000 children between five and seventeen years of age (Table 1).

Table 2 ☐ Total number of acute dental conditions by gender: 1982, 1988.[2]

	Under 5 years		5–17 years	
	1982	1988	1982	1988
Male	409,000	415,000	293,000	289,000
Female	404,000	197,000	360,000	293,000
Total	813,000	612,000	653,000	582,000

Table 3 ☐ Number of acute dental conditions by race and family income: 1982, 1988.[2]

	Under 18 years	
	1982	1988
Race		
White	1,089,000	1,036,000
Black	261,000	159,000
Income		
Less than $10,000	220,000	224,000
$10,000–$19,999	356,000	445,000
$20,000–$34,999	369,000	350,000
$35,000+	338,000	152,000

NEED AND DEMAND FOR DENTAL SERVICES

Between the two study years, there was a decrease of 25 percent in the number of acute dental conditions reported for children less than five years of age; and 11 percent decrease for children between five and seventeen years. In both age-groups, the decrease was reported primarily for female children with minimal changes for male children (Table 2). Decreases in the number of acute dental conditions were reported for nonminority children and children in higher income families. While there were minimal changes for minority children and children in low income families, however, there was an increase of 25 percent in the number of acute dental conditions for children in families with incomes between $10,000 and $19,999 – a financial group just above Medicaid eligibility standards and with minimal available disposable incomes for the "luxury" of dental care (Table 3).

In addition, there were decreases in the number of acute dental conditions reported per one hundred persons, but limited changes in the percent of conditions treated (Table 4).‡‡

†Generally, need is defined as a biological and psychological state of health as perceived by trained health personnel. However, for purposes of the National Health Interview Survey, need is defined in terms of the respondent's perception.
A demand is associated with market behavior, which is related to consumer wants, prices for health services, prices of other goods and financial resources.

††Although the annual NHI Surveys have reviewed varying components of the dental health status and use of dental services by the population for more than twenty-five years, the 1982 study report was the first presentation that included the perceived dental status of children.

‡A condition is considered acute if a) it was first noticed no longer than three months before the reference date of the interview, and b) it is not a condition that is considered chronic regardless of the time of onset.[2]

‡‡It should be noted that, for the most part, the ratio and percent data regarding dental needs of children (e.g. acute dental conditions per one hundred persons and percent of acute dental conditions treated) used in the National Health Interview Survey reports, have relative standard errors in excess of 30 percent and should be used with extreme care. Therefore, for the most part, these ratio and percent data have not been included in the current presentation.
The relative standard error of an estimate is obtained by dividing the standard error (i.e. primarily a measure of sample variation) by the estimate itself and is expressed as a percent of the estimate.[2]

The decreases, between 1982 and 1988, in the number of acute dental conditions reported for children, paralleled the decreases in the same general period, in the prevalence of decay in primary and permanent teeth, and the increase in the percent of children who are caries-free (Table 5). (The last two national studies on the prevalence of dental caries were conducted in 1979-80 and 1986-87.)

In addition, between 1983 and 1986, there was an increase in the percent of children between two and four years of age, and four and seventeen years who visited a dentist in the previous year (Table 6).

RESTRICTED ACTIVITY DAYS

Between 1982 and 1988 there was a one-third decrease in the number of restricted activity days* associated with acute dental conditions reported for children under five years of age. The decrease was more pronounced for girls than boys. Similarly, there was a decrease in the number of restricted activity days for older children. The general decrease was the result, however, of a combination of more than a twenty-five percent decrease in the number of restricted activities days reported for older female children and a 40 percent increase for older male children (Table 7).

Between the two study years, decreases in restricted activity days associated with acute dental conditions were reported for nonminority children and children in families with lower incomes. Increases in restricted activity days were reported by parents and guardians of minority children and children in higher income families (Table 8).

Table 4 ☐ Number of acute dental conditions per 100 persons and percent treated: 1982, 1988.[2]

	Number per 100 persons		Percent of conditions treated	
	1982	1988	1982	1988
Under 5 yrs.	4.7	3.3*	73.8%*	78.4%*
5–17 yrs.	1.4*	1.3*	56.2*	50.5*

*Relative standard error of more than 30 percent

Table 5 ☐ Prevalence of caries: 1979–80, 1986–87.[3,4]

	1979–80	1986–87
Primary teeth Mean decayed Filled surfaces (age 5–9 yrs.)	5.31	3.91
Permanent teeth Mean: decayed, missing, filled surfaces (age 5–17 yrs.)	4.77	3.07
Percent caries free (age 5–17 yrs.)	36.6%	49.9%

Table 6 ☐ Children with a dental visit in the pat year: 1983, 1986.[4]

Age	1983	1986
2–4 yrs.	28.4%	33.5%
5–17 yrs.	67.0	71.5

It should be noted that between 1982 and 1988, there were numerous differences (for the various gender, racial and economic groups) in the reported changes in the numbers of acute conditions and associated restricted activity days.

NUMBER OF BED DAYS

Between 1982 and 1988 there was an overall decrease in the number of bed days** associated with acute dental conditions for younger children. The general decrease was the result, however, of a combination of a one hundred percent increase for young boys and an almost two-thirds decrease for young girls. And for older children, there was an increase in bed days associated with acute dental conditions, but as a result of a series of opposite changes (a decrease for males and a more than one hundred percent increase for females) (Table 9).

During the same period, increases in bed days associated with acute dental conditions were reported for minority and nonminority children, and children in families with higher incomes (Table 10).

Table 7 ☐ Number of restricted activity days associated with acute dental conditions by gender: 1982, 1988.[2]

	Under 5 years		5–17 years	
	1982	1988	1982	1988
Male	950,000	793,000	560,000	778,000
Female	446,000	150,000	2,136,000	1,547,000
Total	1,396,000	943,000	2,696,000	2,326,000

Table 8 ☐ Number of restricted activity days associated with acute dental conditions by race and family income: 1982, 1988.[2]

	Under 18 years	
	1982	1988
Race		
White	3,017,000	2,449,000
Black	615,000	819,000
Income		
Less than $10,000	1,811,000	986,000
$10,000–$19,999	1,136,000	381,000
$20,000–$34,999	331,000	724,000
$35,000+	354,000	925,000

*Refers to a relatively short-term reduction in a person's activities below his or her capacity.[2]

**A day during which a person stayed in bed more than half of a day because of illness or injury.[2]

***A day in which a student five to seventeen years of age missed more than half a day from school in which (s)he was enrolled.[2]

Table 9 ☐ Number of bed days associated with acute dental conditions by gender: 1982, 1988.[2]

	Under 5 years		5–17 years	
	1982	1988	1982	1988
Male	103,000	217,000	272,000	228,000
Female	398,000	150,000	335,000	794,000
Total	502,000	367,000	606,000	1,022,000

Table 10 ☐ Number of bed days associated with acute dental conditions by race and family income: 1982, 1988.[2]

	Under 18 years	
	1982	1988
Race		
Wite	909,000	1,078,000
Black	199,000	310,000
Income		
Less than $10,000	390,000	366,000
$10,000–$19,999	55,000	169,000
$20,000–$34,999	188,000	188,000
$35,000+	255,000	412,000

Table 11 ☐ Number of lost school days associated with acute dental conditions by gender: 1982, 1988.[2]

	5–17 years	
	1982	1988
Male	289,000	424,000
Female	1,082,000	299,000
Total	1,370,000	723,000

Table 12 ☐ Number of lost school days associated with acute dental conditions by race and family income: 1982, 1988.[2]

	5–17 years	
	1982	1988
Race		
White	1,072,000	629,000
Black	299,000	94,000
Income		
Less than $10,000	403,000	240,000
$10,000–$19,999	396,000	103,000
$20,000–$34,999	232,000	241,000
$35,000+	99,000	50,000

Table 13 ☐ Number of lost school days associated with acute dental conditions by geography and place of residence: 1982, 1988.[2]

	5–17 years	
	1982	1988
Geography		
Northeast	438,000	46,000
Midwest	433,000	228,000
South	149,000	352,000
West	350,000	97,000
Place of residence		
Standard metropolitan area		
Central city	895,000	402,000
Noncentral	378,000	147,000
Nonmetropolitan area	98,000	175,000

Again, it should be noted that the changes over time for the different demographic groups in the reported numbers of acute dental conditions, restricted activity days and now bed days associated with dental conditions, for the most part, were not consistent.

NUMBER OF LOST SCHOOL DAYS

Dental conditions affect school attendance. Between 1982 and 1988, there was a general decrease in the number of lost school days*** associated with acute dental conditions reported for most demographic groups (except males) (Tables 11 and 12).

In addition, there was a general decrease in the number of lost school days associated with acute dental conditions, for most geographic regions of the nation (except the South) and residents of standard metropolitan areas. There was an increase in lost school days for residents of non-metropolitan areas (Table 13).

Once again, there were inconsistencies between the changes in the number of lost school days and previously considered changes in the number of acute dental conditions, restricted activity days and bed days.

SOME ORDER FROM THE CONFUSION

The series of inconsistencies noted previously leads one to consider a variety of possibilities, including:

Between 1982 and 1988, there was a general decrease in lost school days because of acute dental conditions.

- ☐ There are limitations in asking the general lay population questions related to health status and associated problems.
- ☐ There are limited relationships between changes in the number of acute dental conditions and restricted activity days, bed days and lost school days.
- ☐ Various groups of children are affected differently by acute dental conditions.

While the NHI Surveys offer no resolution to these difficulties, they do establish a critical point. Despite the continuing decrease in dental caries, the individuals responsible for requesting dental services for their children continue to recognize hundreds of thousands, if not millions of acute dental conditions and related instances of limitations and losses of school days. These problems are for both boys and girls, minority and non-minority children, children in families in each of the economic groups, and for children who live in all regions of the nation and in urban and rural areas.

This continued awareness of the need and demand for dental services for children is reflected in:

- ☐ The continuing increase in the percent of children with a dental visit in the previous year.
- ☐ The 1989 report from the American Academy of Pediatric Dentistry on increasing pediatric dentist busyness in the vast majority of practices. □Seventy-four percent of pediatric dentists reported increased numbers of patients seeking care and increased numbers of patient visits.
- ☐ Twelve percent of pediatric dentists reported decreases in the level of practice activity.
- ☐ Three percent of pediatric dentists reported their schedule of patients was "seriously deficient."[5]

The data from the National Health Interview Surveys should be used as a general guide to the public's subjective view of the changing picture of health care needs. From this perspective, and in light of the continuing reports of increasing use of dental services, surely it appears that "decreases in dental caries do not mean that children no longer need dental services," and "...there will be a continuing demand by parents and guardians for high levels of dental service for children in our communities."[1]

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CYCLOPOLYMERIZABLE MONOMERS

Increasing the content of the reinforcing filler and the development of bulky and rigid monomer systems is the usual method of production of dental composites for utilization as posterior restorations. Thus, while there appears to be ample experimental evidence correlating the filler concentration to the properties of filled composites and the degree of conversion to properties in the unfilled resin, there is little in the literature attempting to correlate degree of conversion, filler concentration, and mechanical properties in highly filled dental composites.

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Who provides what dental services for children? We need more information

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

Changing patterns of dental disease and variations in the use of dental services are having profound effects on dental practice and are raising significant questions regarding the appropriate emphasis on particular components of the curricula of schools of dentistry and testing procedures for state licensure.

SOME OF THE CHANGES

Dentists are spending an increasing percent of their time on diagnostic, endodontic, orthodontic and preventive services for the general population. At the same time they are decreasing the percent of their time spent on operative and denture services (Table 1).

Similarly, the almost fifteen hundred respondents to the recent American Academy of Pediatric Dentistry's study on five-year-service-trends reported increases in the number of times each month that they provided diagnostic and preventive procedures, as well as increases in the interception management of developing malocclusions for their child patients. The pediatric dentist respondents reported an increase in composite restorations, however, and no change in the number of times each month that they provided amalgam restorations.[2]

But children also receive dental services from general practitioners and other specialists. The difficulty is that there is limited available information on the type and extent of services provided by general practitioners and specialists.

SOME OF THE INFORMATION WE KNOW

- ☐ Between 1979-80 and 1986-87, there was a continuing decline in the prevalence of caries in primary and permanent teeth for all ages of school children. In addition during this same period, in each age between five and seventeen years, the percent of children who were caries-free increased.[3,4]

While the decay (D) and missing (M) components of the decayed-missing-filled-surface (DMFS) rates decreased, however, the filled (F) component increased.

- ☐ Throughout the 1980s, there was a progressive increase in the percent of children with reported visits to dentists. By 1986, almost a third of chil-

Table 1 ☐ Mean percent of time per week spent by solo dental practitioners by categories of services: 1981, 1987.[1]

Service	1981	1987
Diagnostic	9.6%	11.4%
Endodontic	6.2	8.0
General service	3.4	3.4
Operative	38.0	30.7
Oral & Max. Surg.	6.5	5.5
Orthodontics	7.6	9.4
Periodontics	5.0	6.0
Preventive	9.5	11.9
Prosthodontics	14.4	13.9

Dr. Waldman is Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11794-8715.

dren between two and four years and 70 percent of children between five and seventeen years of age had visited a dentist in the previous year.[5]

- ☐ Information from the 1983 National Health Interview Survey (NHI Survey) provides input from parents and guardians on the use of dental services by children between two and seventeen years of age. The respondents reported almost 120 million dental visits. Pediatric dentists provided almost 19 percent of the visits for children between two and four years of age and approximately 9 percent for children between five and eleven years; 1.4 percent for children between five and eleven years; 1.4 percent for children between twelve and seventeen years of age (Table 2). (It should be noted that the designation of a specialty visit is set forth by the respondent and does not necessarily conform to the classification established by the dental profession.)

Unfortunately, the NHI Survey has not repeated this service distribution material in subsequent reports, nor are there any plans to obtain this information during the next several years.[8]

- ☐ Since 1983, the ADA Surveys of Dental Practice provide some information on the distribution of the ages of patients treated by general practitioners and specialists. The study reports, however, do not distinguish the services provided by members of the different specialties; rather it combines the services under a single "specialist" category.
- ☐ Between 1983 and 1987, there were minimal changes in the percent of patients in independent‡ general practices that were less than fifteen years of age (approximately 18 percent).
- ☐ Results from the Surveys indicate that, as compared to the practice of independent generalists, patients under the age of fifteen represented an increasingly greater share in "all" independent specialist practices (from 30.9 percent to 39.7 percent). To some extent, this reflects the higher proportion of orthodontists among all specialists.[1]
- ☐ Younger general and specialist independent dentists (i.e. those who graduated from dental school after 1980; 11.6 percent of all independent dentists), as compared to older independent dentists, reported that children under age fifteen represented a greater percent of their patient population.

‡An independent dentist is an owner (sole proprietor, partner or shareholder in an incorporated practice) or partial owner of a private practice.

Table 2 ☐ Number and percent of dental visits by type of practice and patient age, 1983.[6,7]

	Age					
	2–4 years		5–11 years		12–17 years	
	No.	Percent	No.	Percent	No.	Percent
	(Numbers in millions)					
Pediatric dentists	1.4	18.8%	4.3	9.2%	.9*	1.4%
Orthodontists	<0.1*	0.2	7.9	16.8	26.1	41.1
Other specialists	0.2	2.7	0.9	1.9	3.5	5.5
Generalists	5.6	77.7	34.1	72.1	32.9	52.0
Total visits	7.2	100%	47.3	100%	63.4	100%

*Relative standard error in excess of 30 percent

- ☐ Solo specialists, as compared to the non-solo specialists, reported that children under age fifteen represented a greater percent of their patient population.
- ☐ By 1987, only 3 percent of all general practitioners and 7 percent of specialists provided no services to patients under age fifteen (Table 3).
- ☐ In the first quarter of 1989, Dental Practice Outlook (which is published in cooperation with the American Dental Association) reported that children under fifteen years of age represented 16.9 percent of general practitioner patients.[9] Unfortunately, the report does not explain whether this decrease in the proportion that patients under fifteen represented in practice, was the result of an actual decrease in the number of children and/or an increase in the number of older patients.
- ☐ It would seem that there is an almost unlimited wealth of data in the records of various government agencies (e.g. Head Start programs) and third-party insurance companies regarding the service pattern of generalist and specialist providers. Unfortunately, there is no central system to retrieve and coordinate the information. In addition, there is no central system to review the dental services for children who are not covered by third-party programs.

WHAT WE DON'T KNOW AND WHY WE NEED TO KNOW IT

The efforts to reduce dental caries are showing increasing success.

- ☐ Does that mean that dental schools need no longer provide training programs on operative dental techniques?
- ☐ Similarly, the incidence of edentulism is declining. Should dental schools eliminate or at least reduce the prosthodontic components of the curricula?

Table 3 ☐ Patients less than 15 years of age in dental practices by type of practitioners: 1983, 1985, 1987.[1]

	Percent of patients less than 15 yrs.			Dentists with no patients less than 15 yrs.	
	1983	1985	1987	1985	1987
All Independent dentists					
Generalists	18.8%	18.2%	18.3%	3.1%	2.6%
Specialists	39.9	38.4	39.7	8.2	6.3
Independent dentists graduating after 1980					
Generalists		18.8	20.1		
Specialists			51.6		
Solo dentists					
Generalists	17.9	18.0	18.3	3.4	3.1
Specialists	42.3	43.3	43.2	7.1	6.5

- ☐ Should increasing curricula time commitments address the changing and developing complexities of practice management, litigations and the use of new diagnostic and treatment technologies that are emerging from research laboratories?
- ☐ If we do not curtail the traditional technical aspects of educational programs and we still recognize the need to enhance the educational programs to maintain currency with the exigencies of the developing environment for dental practice, do we increase the length of the dental education program?
- ☐ What are consequences of eliminating aspects of the educational experiences to assure competency for the eventualities of a diverse dental practice?
- ☐ And what of the licensing process; what techniques should examinations (assuming they are maintained) review to ensure minimal standards?

If some decisions could be made on these and other demanding issues that reflect the evolving landscape of dental service needs, attention could be directed to the issue of timing, i.e. should all students continue to receive instruction in the "basics" of dentistry, or should the emphasis for particular aspects of service be directed to postdoctoral programs?

But these and many other decisions about the response of dental education to the changing realities of dental practice are dependent upon the actual and projected profile of providers of dental services. For example, if general practitioners continue to serve the majority of children (leaving for pediatric dentists the complexities of special patient populations) then continued emphasis must be directed to pediatric dentistry at the predoctoral level of training. On the other hand, if pediatric dental services were to be concentrated in an "interested" segment of general practitioners and pediatric dental specialists, education at the predoctoral level could be established as an elective or selective program. Or should all students continue to receive a "minimal" exposure to pediatric training, since providers must be proficient in all phases of care, even if they infrequently carry out a particular service?

This concept of compartmentalizing dental education based on anticipated utilization (while seemingly alien to the traditional orientation of a broad based educational experience) would be in line with the rules adopted by the New York State Board of Regents (the body which establishes professional licensing protocol in the state). In accordance with the rules of the Board relating to definitions of unprofessional conduct, individuals may be considered to be acting in an unprofessional manner by "... accepting and performing professional responsibilities which the licensee knows or has reason to know that he or she is not competent to perform..."[10] The penalty for professional misconduct includes fines, suspension of an individual's license,

Pediatric dentists provided 19 percent of dental services for children between 2 and 4 years of age, and 9 percent for those between 5 and 11 years.

requirements for retraining and even annulment of one's license.

At first reading, the idea that practitioners could be considered to be functioning in an unprofessional manner should they carry out a function which he or she "knows or has reason to know that he or she is not competent to perform" would seem to be a reasonable interpretation of the responsibilities of a professional. This modification in the rules may well be the beginning of an effort, however, to establish the principle that an individual who holds a valid general license in a particular field *may not* practice all phases of services that traditionally have been considered within the jurisdiction of the particular profession. For example:

- ☐ The practitioner who occasionally performs an endodontic or surgical procedure (and even a pediatric dental service) each year.
- ☐ The practitioner who seldom, if ever, attends the many continuing education programs offered by the dental societies, hospitals and other related agencies.
- ☐ The dental administrator or researcher who spends the majority of his or her career away from the dental chair, but who subconsciously dreams that he or she can return to clinical dentistry at the drop of a pen, word processor or test tube.

For these individuals (and many others) the phrase "has reason to know that he or she is not competent to perform" may need to be interpreted as *should recognize* or *should know* that he or she is not competent to perform.

But before any dramatic changes in dental curricula can or should be considered, we must have an ongoing monitoring of "who provides what dental service to whom;" in this particular case, children.

The public's need for dental services in the twenty-first century, at least in its early years, will not be that different from what it is today. But gradually, it will be transformed as programs to prevent dental disease continue to produce widespread gains.

Is the decline in the proportion of patients below the age of fifteen years reported in 1989 by general practitioners the beginning of a long term change in patient profile? Will general practitioners increasingly turn their attention to the needs and increasing demands of the older segment of our communities, while welcoming the opportunity to refer "restless younger children" to pediatric dentists? And what of the increasing population of special population patients (including the developmentally disabled, the chronically and acutely ill, the hospitalized, the high-risk patient and any number of others with special physical and/or psychological needs)? To what extent will general practitioners serve this pediatric population or will the pediatric dentist increasingly become the "sole provider" of the service needs of these groups in our communities? We need more information, if we are to plan and modify our educational programs to meet the developments and challenges of the dental needs of the youth in our communities in the next century.

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Occlusion in the primary and early mixed dentitions in a group of Tanzanian and Finnish children

Heidi Kerosuo, DDS

Prevailing occlusal anomalies of the primary dentition are somewhat different from those described in the permanent dentition.[1-3] Anterior open-bite and lateral crossbite have generally been reported to be the most prevalent anomalies of the primary occlusion in Caucasian children, prevalences varying from 6 percent to 53 percent in anterior open-bite and from 2 percent to 19 percent in lateral crossbite.[2-5]

According to several studies, the status of the primary occlusion affects the development of the permanent occlusion, to the extent that certain traits and anomalies of the primary occlusion are often reflected in the permanent occlusion; anterior open-bite resulting from sucking habits, however, is usually temporary and is most often self-corrective at the primary dentition stage.[6,9-11] The primary dentition, however, provides the basis for studying occlusion, and for predicting the occlusion of the permanent dentition.

The character of the dentition varies among populations and ethnic groups; information on variation of the primary dentition is almost entirely limited to Caucasians in industrialized countries.[1-4,12-18] Comparisons of occlusion among ethnic groups are rare, especially for the primary dentition. Infante found that in a group of American two- to five-year-olds, a mesial occlusion was more frequent among black children than among white children; whereas Penido *et al* found no difference in the sagittal molar relationship between small groups of American black and white three- to five-year-olds.[19,20] No reports have been found on occlusion of the primary teeth in African children.

The aim of this study was to observe variation in occlusal characteristics in the primary and early mixed dentitions, in groups of Tanzanian and Finnish urban children, in relation to age, sex, and sucking habits.

MATERIAL AND METHODS

The study was carried out in Dar es Salaam, Tanzania and Hyvinkaa, Finland. The Tanzanian children were from five nursery schools that were selected to represent both high and low socioeconomic standards (SES). Two high and two low socioeconomic areas were selected and all nursery schools located in those areas were included in the study. All children present on the days of the study were examined; the total number was 580. Mean age of the subjects was six years and one month (range three to eight years). African (black) children comprised 83 percent of the series; the rest consisted of children of Asian and Arab origin, 10 percent and 7 percent, respectively. The Finnish subjects were selected by random sampling from all three- to seven-year-old children in the town of Hyvinkaa. All the Finnish children were of Caucasian origin, a total of 575 was examined. Two of the children selected refused to be examined and twenty-four did not appear for the examination. None of the children studied had received orthodontic treatment with appliances; but in the Finnish group some children had been treated by selective grinding of the primary teeth. Table 1 shows

Dr. Kerosuo is with the Department of Orthodontics, Institute of Dentistry, University of Kuopio, Finland.

the distribution of the children in the different ethnic groups, by age and sex.

In both countries the study included a clinical examination performed by the same examiner (H.K.), and a questionnaire. The clinical examination included registration of eruption status and of different occlusal characteristics and anomalies assessed in centric occlusion, as follows:

- ☐ The eruption status of the permanent teeth was assessed and classified in one of two categories: 0, not erupted; 1, erupted (i.e. the tooth had penetrated through the oral mucosa).
- ☐ The sagittal relationship of the dental arches was determined from the relationship of the mesial surfaces of the second primary molars and classified as a neutral, distal, or mesial relationship. In the case of a half-cusp displacement from neutral, the decision was made in favor of neutral; also applied in bilateral cases. In cases of unilateral distal or mesial relationship, if the other side was neutral, the final definition was made in favor of neutral.
- ☐ Anterior crossbite was recorded when one or more of the maxillary incisors occluded lingually to the mandibular incisors.
- ☐ Anterior open-bite was recorded when there was no vertical overlapping of the incisors. Incisors in edge-to-edge relationship were not considered to be in open-bite or if there was lack of overlap due to incomplete eruption of the incisors.
- ☐ Lateral crossbite was recorded when one or more of the maxillary primary canines, molars or permanent molars occluded palatally to the buccal cusp of the opposing mandibular teeth.
- ☐ Scissors bite was recorded when one or more primary or permanent maxillary molars occluded buccally to the buccal surfaces of the corresponding mandibular teeth.
- ☐ Crowding in the anterior segment was recorded when the estimated space within the dental arch was not enough for the incisors to be aligned properly.

In the early mixed-dentition stage, occlusion in the anterior segments could not always be determined, owing to lack of or early eruption of the incisors. Such cases were recorded as free of deviate occlusion in their anterior segments, and were included in calculating frequencies of occlusal deviations.

In the diagnosis of occlusal traits and deviations, the intraexaminer reliability was tested by having the same examiner reexamine thirty children both in Tanzania and in Finland. There was complete agreement (kappa = 1.0) in the repeated examinations for anterior crossbite, anterior open-bite and lateral crossbite.[21] For sagittal molar relationship and for crowding, kappa values were 0.94 and 0.67, respectively.

Table 1 ☐ Distribution of children examined by age, sex, and ethnic group.

	Tanzanian						Finnish	
	African		Asian		Arab			
Age (yrs)	boys	girls	boys	girls	boys	girls	boys	girls
3	5	10	3	5	0	1	94	73
4	30	20	9	7	5	4	61	61
5	68	73	5	8	3	5	69	64
6	86	68	8	6	8	8	55	47
7	51	36	5	1	3	2	28	23
8	25	10	1	0	1	0	–	–
Total	265	217	31	27	20	20	307	268

The questionnaire completed by the parents included questions about age, ethnic group, and sucking habits of the child. The Tanzanian questionnaire included one question on sucking: whether or not the child sucked his finger. The Finnish questionnaire also included questions of the duration and type of sucking (pacifier or finger). In the statistical analysis the z-test, the Student's *t* test and the chi-square test were used to compare the proportions of occlusal anomalies among different groups. The Duncan-Walker's logistic regression model was used to analyze the effect of independent variables (ethnic group, age, and sex) on the probability of belonging to the group having a certain malocclusion trait. For each logistic regression model, the study population was divided into two dichotomous groups (absent = 0, present = 1) according to the following occlusal traits: distal molar relation, lateral crossbite, anterior crossbite, anterior openbite, and crowding. The odds ratios and 95 percent confidence intervals (CI) were calculated. Age was included in the model as a continuous variable, thus the odds ratio for age was not calculated.

Table 2 ☐ Mean number and standard deviation (SD) of permanent teeth erupted among the children examined in different ethnic groups according to age.

	African		Asian/ Arab		Finnish		Statistical significance		
Age (yrs)	mean	SD	mean	SD	mean	SD	Afr/ Finn	Afr/ A&A	A&A/ Finn
3	0.0	0.0	0.0	0.0	0.0	0.5	–	–	–
4	0.4	1.4	1.0	2.8	0.1	0.4	NS	NS	NS
5	3.0	3.1	2.7	3.3	1.1	1.8	***	NS	*
6	6.7	3.2	6.2	3.1	5.3	3.3	***	NS	NS
7	9.9	2.4	8.5	3.4	8.5	2.7	**	NS	NS
8	10.8	1.5	8.0	2.8	–	–	–	NS	–

Statistical evaluation: Student's t-test
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
NS, not significant.
–, not applicable.
Afr, African; Finn, Finnish; A&A, Asian and Arab.

Table 3 ☐ Percentage distribution of sagittal relationships of the dental arches in different ethnic groups.

Sagittal relationship	African (black) (n = 482)	Asian/Arab (n = 98)	Finnish (n = 575)	Statistic significance Afr/ Finn	Afr/ A&A	A&A/ Finn
Neutral	97	94	84	***	NS	*
Distal	1	6	13	***	***	NS
Mesial	2	0	1	NS	NS	NS
Unidentified	0	0	2			

Statistical evaluation: z-test
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
NS, not significant.
Afr, African; Finn, Finnish; A&A, Asian and Arab.

Table 4 ☐ Percentage distribution of different occlusal and space anomalies of primary dentition stage in African and Finnish children.

Anomaly	African (black) (n = 151)	Finnish (n = 399)	Statistical significance
Anterior crossbite	8	6	NS
Anterior open-bite	5	11	NS
Lateral crossbite	1	13	***
Crowding	3	5	NS

Statistical evaluation: z-test
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
NS, not significant.

Table 5 ☐ Percentage distribution of occlusal and space anomalies in different age groups among black African (Afr) and Finnish (Finn) children. Both primary and early mixed dentition included.

	3-4 yrs		5-6 yrs		7-8 yrs	
Anomaly	Afr n = 65	Finn n = 289	Afr n = 295	Finn n = 235	Afr n = 122	Finn n = 51
Anterior crossbite	9	6	8	7	7	2
Anterior open-bite	6	12	7	5	10	8
Lateral crossbite	2	9	1	17	1	14
Crowding	5	5	9	16	21	26

Table 6 ☐ Odds ratios and 95 percent confidence intervals (CI) for ethnic group (compared to Finnish) and sex in various occlusal anomalies. For all tests age was controlled.

Anomaly	Odds ratio	CI		Probability
Distal bite				
African (black)	0.1	0.0	0.2	***
Asian & Arab	0.4	0.2	1.0	NS
sex (female)	1.0	0.6	1.5	NS
Lateral crossbite				
African	0.1	0.0	0.2	***
Asian & Arab	0.3	0.1	0.8	*
sex (female)	1.8	1.1	2.8	*
Crowding				
African	0.5	0.3	0.7	***
Asian & Arab	0.5	0.2	1.0	NS
sex (female)	1.0	0.7	1.4	NS

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
NS, not significant.

RESULTS

Eruption pattern

African (black) children had significantly more permanent teeth erupted at the ages of five, six, and seven years than Finnish children of corresponding ages (Table 2), and also had slightly more than the corresponding group of Asians and Arabs. At the age of four the differences in the eruption pattern among ethnic groups were nonsignificant and the standard deviations of the means were large.

Occlusion

In the primary dentition stage 18 percent and in the early mixed dentition stage 30 percent of Tanzanian children had some type of occlusal deviation recorded in this study. The corresponding percentages for Finnish children were twice as high, 36 percent and 59 percent, respectively; whereas no difference was found between African and Asian/Arab children.

Neutral sagittal dental-arch-relationship was more prevalent in both African and Asian/Arab groups compared to the Finnish group (Table 3). Prevalence of distal molar occlusion was significantly higher in Finnish children than among African children, and also somewhat higher than in the Asian/Arab group. Mesial molar occlusion was rare in all three groups.

In the primary dentition, anterior open-bite and lateral crossbite were the most prevalent occlusal anomalies among Finnish children, occurring in 11-13 percent of these subjects (Table 4). In African and also in Asian/Arab children, lateral crossbite was rare. The most common occlusal anomaly among African children was anterior crossbite and among Asian/Arab children anterior open-bite, 8 percent and 10 percent respectively. Crowding was rare in all ethnic groups in primary teeth ranging from 2 to 5 percent.

As regards age, in the oldest group among both African and Finnish children, crowding of the anterior area was most prevalent (Table 5). Among the Finnish children a higher frequency of anterior open-bite was found in the youngest age-group than in the older ones. Among the African children there was an opposite trend; the prevalence of anterior open-bite increased slightly with age.

Among Finnish children, boys slightly more often had a dentition with no occlusal or dental deviations recorded, compared to girls, 51 percent and 42 percent, respectively ($p = 0.038$). Among Tanzanians the corresponding proportions were 71 percent and 75 percent, respectively. In all ethnic groups there was a

tendency for girls to have slightly higher prevalences of lateral crossbite than boys did. Among African children crowding was twice as common in boys as in girls, 14 percent and 7 percent, respectively ($p = 0.020$). Among Finnish children, there was an opposite tendency.

African children had significantly lower odds ratios to distal bite, lateral crossbite, and crowding than Finnish children did; whereas to anterior open-bite and anterior crossbite, no difference was found between the odds (Table 6). In the model for anterior open-bite the only remaining significant variable was age. The odds ratios for Asian and Arab children were also lower than for those in the Finnish group, but the difference was significant only in the case of lateral crossbite. The probability of having lateral crossbite was higher in girls than in boys.

Sucking habits

In the African group, 10 percent and in the Asian/Arab group, 4 percent of the children were reported by their parents to have a fingersucking habit. Among the Finnish children, 10 percent had either a pacifier or sucked their fingers at the time of the study. Two-thirds of the Finnish children had freed themselves from the sucking habit by the age of three years. Pacifier sucking was much more common (77 percent) than finger sucking (6 percent), in Finnish children, and girls were slightly more often finger-suckers (9 percent) than boys (4 percent) were.

Among the finger-sucking Tanzanian children there was a higher proportion of anterior open-bite (32 percent) than in the group with no finger-sucking (5 percent). Among the Finnish children, the difference in frequency of anterior open-bite between those with a sucking habit and those without was still greater, 59 percent and 4 percent, respectively. In the Finnish group the prevalence of lateral crossbite (15 percent) was also significantly higher ($p < 0.003$) in children with a history of a sucking habit after the age of one, than in children with no history of sucking after that age (4 percent).

DISCUSSION

The study population consisted of children of four ethnic origins. Due to the small number of children in the Asian and Arab groups, these two groups were combined for analysis of data; and due to the small number of observations, this combined group was excluded from some statistical analyses.

Mesial molar occlusion was rare in all groups

Differences in diagnostic methods and criteria in assessing occlusal variations make comparison between studies problematic. The prevalences of some variables, e.g. sagittal molar relationship, can vary markedly, depending on interpretations of what constitutes transitional and unilateral cases. In order to compare the occlusal traits between ethnic groups in this study, the diagnostic criteria, therefore, were standardized and the same examiner studied both groups of children. Furthermore, the high kappa-values confirm the reproducibility of the criteria.

When the early mixed dentition is studied, depending on the stage of dental development, not all aspects of the occlusion can be assessed, owing to missing or partially erupted incisors. Because the exact measurement of overjet and overbite was difficult during different stages of eruption, they were omitted from the examination. Also, failure to observe the occlusion often enough during the early stages of eruption of the incisors may have biased the number of frequencies of anterior occlusal deviations that were observed. Comparisons by age may have been affected by the earlier eruption of the permanent teeth of Tanzanian children, which caused us to omit inadvertently certain observations of the oldest group of Finnish children. Thus, the prevalences of anterior open-bite, anterior crossbite, and crowding might be lower in Finnish children than among Tanzanians of the corresponding age-group.

The lower prevalence of occlusal deviations among Tanzanian children than among Finnish children agrees with several previous studies on occlusion of permanent and late mixed dentitions of children from different African and European countries.[1,2,14,16,17,22]

Also the significantly lower frequency of distal molar relationship in African children compared to Finnish

children in this study parallels findings from previous studies on permanent dentitions, in which the prevalence of distal occlusion generally has been found to be lower in African children than in Caucasians.[1,2,14,17,22,23] For primary teeth no corresponding prevalences have been available from Africa; but for frequency of distal relationship, the same difference in primary teeth between black and white American children has been reported by Infante.[19]

For prevalence of a mesial arch relationship, no difference was found among ethnic groups; this contradicts Infante's finding that black children have a higher prevalence of mesial occlusion than white children do.[19] The occurrence of mesial arch relationship, however, differs also in permanent dentitions, according to various reports from Africa, ranging from relatively high (10-17 percent) prevalences found in Nigerians and Kenyans to low (0-2 percent) prevalences in groups of Nigerian and Tanzanian children.[13,14,16,22,23].

Anterior open-bite and lateral crossbite were found to be the most frequent anomalies among Finnish children, which agreed well with previous reports on Caucasian children; but in African and Asian/Arab children the occlusal variation was different.[2-5] A notable difference between Tanzanian and Finnish children was the prevalence of lateral crossbite. A similar difference in the frequency of lateral crossbite was reported previously for black and white American children.[19] For lateral crossbite and anterior open-bite, sucking habits have been found to be an etiological factor.[24-26] Thus the explanation for the different frequencies of lateral crossbite in these two cultures might be due to some extent to differences between sucking habits in early childhood. In this study pacifier sucking was very common, for at least some period of time among Finnish children, whereas pacifiers were not available in Tanzania. The self-corrective nature of anterior open-bite after the pacifier-sucking is stopped may have reduced the differences in the prevalences of anterior open-bite among ethnic groups. Due to the fact that lateral crossbite is more persistent, the consequences of sucking habits are seen better in the higher frequency of lateral crossbite among the Finnish children. The tendency among Finnish children for the prevalence of anterior open-bite to decline with age reflects the decrease in pacifier sucking with age. In African children, the reverse trend might indicate the greater persistence of the finger sucking habit and on the other hand reflect some skeletal, muscular, or genetic differences among the ethnic groups.[27] In addition, the difference in the frequency of lateral crossbite between boys and girls might be influenced by the slight difference in sucking habits found between Finnish boys and girls.

The prevalence of a mesial arch relationship did not vary among ethnic groups

The prevalence of crowding in the anterior area increased with age in both African and Finnish children. This agrees with previous reports indicating that crowding is rare in the primary dentition, but increases as dental development proceeds.[2] The prevalence of crowding in the permanent dentition has been found to be higher in Caucasian children than in African children.[1,2,15-17] The same trend was seen in this study in the older groups with early mixed dentitions; but at an early age no differences in crowding were found between African and Finnish children.

In conclusion, the young age of the study group allowed the comparison of natural occlusions without any orthodontic interference, which in older age-groups becomes more difficult, as far as Finnish children are concerned. These results indicate clear differences in the occlusal patterns among the groups of Tanzanian and Finnish children. The difference in the prevalence of lateral crossbite can to some extent be considered to reflect the different sucking habits found in these two groups; but especially concerning distal bite and anterior open-bite. Some genetic and/or muscular differences can be expected among the ethnic groups also.

The author, H.K., is very grateful to the Department of Dentistry, University of Dar es Salaam for the opportunity to work there during the years 1983-84 and to collect the Tanzanian material. She thanks Dr. David Ngassapa for his assistance and local expertise in collecting the Tanzanian data and Mr. Veli Koistinen for his assistance in the statistical analysis. She also thanks Drs. Tellervo Laine, Eino Honkala and Viljo Nyyssonen for their valuable comments concerning the manuscript.

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MEDICALLY UNINSURED CHILDREN

The consequences of inadequate prenatal care may be profound, with a direct relationship to an increased incidence of low-birth-weight infants and perinatal and infant mortality. The Infant Mortality Rate remains a serious problem in the United States. This country made significant progress in reducing infant deaths over the 30 year span from 1950 to 1980. However, it appears that the subsequent rate of decline in the 1980s has been distinctly slower than that of the 1970s. In addition to this slowing of the aggregate national rate, a number of states and cities have experienced an increase in their overall and ethnic-specific mortality rates. In 1985, the Infant Mortality Rate among whites actually increased in 19 states, and the Infant Mortality Rate among blacks increased in 12 states. Data from the National Center for Health Statistics revealed that 15 percent of the 54 largest United States cities experienced an increase in infant mortality for all races from 1979 through 1984, and 35 percent reported higher nonwhite rates. The Children's Defense Fund recently reported that the international standing of the United States for infant mortality had declined to where the United States was now tied for last place among 20 other industrialized nations.

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Case reports

Dentinal dysplasia, type I: report of case

Dennis R. Miers, DDS
Frank L. Herbert, DDS

Dentinal Dysplasia, Type I is an autosomal dominant hereditary condition rarely encountered in dental practice. In one study, Witkop estimated that the trait appears to have a frequency of only about one in one hundred thousand propositi.[1]

Ballschmiede first described this anomaly in 1920 and called the condition "rootless teeth" because of the short, blunted appearance of the roots of the spontaneously exfoliated teeth in seven children of the same family.[2]

Nineteen years later Rushton, in 1939, first designated a similar anomalous condition as "Dentinal Dysplasia."[3] This report involved only one individual without any evidence of familial involvement.

Twenty-three years later, Logan *et al* made an extensive review of the literature and reported eighteen other cases plus eleven of their own in 1962.[4] Within eight years, six more cases had been reported by Elzay and Robinson, Brookreson and Miller, and Miller.[5-7]

Shields *et al* distinguished between Type I (dentin dysplasia and Type II (anomalous dysplasia of dentin). They developed a chart, furthermore, that related the clinical, radiographic, histopathologic and commonly evident features to assist in the differential diagnosis of dentin dysplasia (Types I and II) and dentinogenesis imperfecta (Type I -III).[8]

Dr. Miers is Assistant Professor, Department of General Dentistry, Louisiana State University School of Dentistry. Dr. Herbert is Professor of General Dentistry, Louisiana State University School of Dentistry.

In an effort to assist clinicians, Witkop suggested that Type I be called "radicular dentin dysplasia" and Type II be called "coronal dentin dysplasia".[9]

Dym *et al* published a comprehensive review of the literature in 1982 in which they noted a third variant of dentinal dysplasia that radiographically had traits common to both Type I and Type II reported by Ciola and associates in 1978. This prompted them to suggest the recognition of Dentinal Dysplasia, Type III.

Dentinal Dysplasia, Type I is clinically unremarkable except that the teeth may be loose, easily fractured and/or malaligned (Figure 1). Radiographically, the teeth demonstrate short, tapering roots; obliteration of pulp chambers before eruption; horizontal line at dentinoenamel junction (crescent shaped pulp chambers); multiple apical radiolucencies and reduced radiographic contrast of dentin.

Microscopically, one encounters normal mantle dentin, abnormal radicular dentin, interglobular dentin, normal enamel, and scalloping of the dentinoenamel junction.

REPORT OF CASE

A nine-year-old white male presented in an emergency status occasioned by a minor accident during play at school thirty-one days previously. Extreme mobility of the lower left permanent central incisor tooth with accompanying discomfort and significant soft tissue inflammation precipitated the visit to the dentist. Radiographic examination of the involved tooth and adjacent area disclosed a complete fracture of the root at the junction of the middle and apical thirds. The radiograph also disclosed a very unusual configuration of the

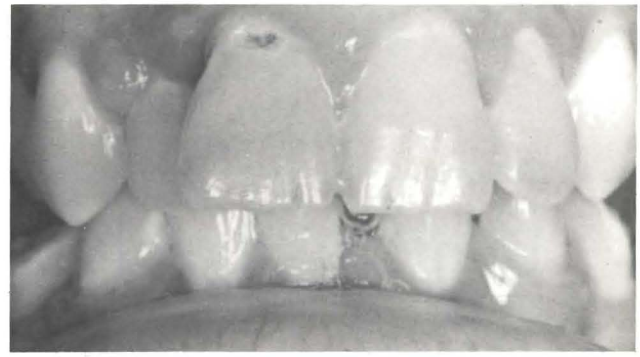

Figure 1. Unremarkable clinical appearance of teeth except for neglected caries and malalignment.

Figure 2. Emergency radiographs at nine years of age show fracture of mandibular left central incisor and distorted root formation of adjacent teeth. Note opaque material in root canals and radiolucent areas around apices.

Figure 3. Radiographs at age thirteen years, five months reveal distorted, anomalous root formation of all teeth. Note also: unerupted status of teeth #2,15,18,20,29 and 31.

Anomalous root development occurred in all teeth.

adjacent tooth roots and an apparent absence of coronal pulp chambers. Radicular pulp morphology is further characterized by discontinuous, interrupted horizontal shadow images and apical radiolucencies (Figure 2). Both fragments of the fractured incisor were removed uneventfully and sent to an oral pathologist for histopathologic examination. The patient was dismissed with routine postoperative instructions and advised to return in five days for observation.

Report of the microscopic examination by the pathologist was as follows: "Decalcified celloidin sections stained with H. and E. of a mandibular incisor tooth that was fractured in the apical third of the root disclosed an unremarkable coronal fragment but the root fragment reveals disturbed dentinogenesis. The dentin in this area exhibits a marked tendency toward whorling and has distorted or obliterated the pulp canal in some areas.

"Diagnosis: Dentinal dysplasia of unknown etiology. This appears to have been a developmental anomaly that probably predisposed the tooth to fracture."

The patient was not seen again for four years, when he reappeared once again for emergency care. At this time a complete intraoral radiographic examination was made as well as a panoramic visualization of the jaws (Figures 3 and 4).

All teeth demonstrated anomalous root development. In addition, maxillary and mandibular permanent second molars and mandibular second premolars were still unerupted with incomplete root formation at age thirteen years, five months.

The oral health status was deplorable and, as a result of neglect, several teeth required removal because of pulpally penetrating caries. (The lower right first permanent molar had recently been removed in an emergency by another dentist.) The lower left first permanent molar was removed under local anesthesia and sent to the oral pathologist for histopathological examination and report, which was as follows:

"Decalcified H. and E. sections reveal longitudinal sections of a molar tooth in which the enamel has been lost by decalcification and which shows well-preserved periodontal ligament attached to portions of the root surface. When the crown is examined, two pathologic changes are seen: advanced dental caries is evident but the main finding is the almost complete obliteration of the pulp chamber by an unusual type of calcified material which consists of normal dentin, osteodentin, and

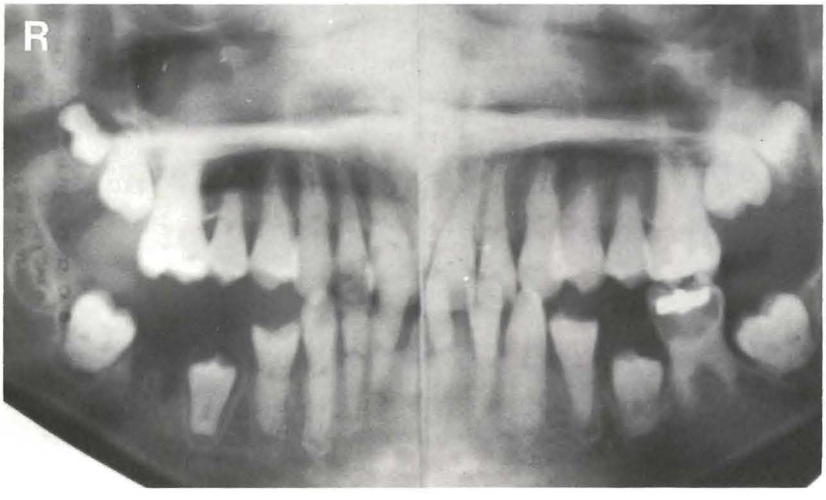

Figure 4. Panoramic radiograph discloses short, blunted roots, bulging of maxillary canine roots and taurodont form of carious lower right first molar. Note also: dark, chevron-shaped shadows in mid-section of most roots.

cementum-like substance. Some of the material is arranged in the form of whorls. Remnants of the pulp chamber may be seen. The roots appear unusually short and also show a change similar to that seen in the pulp chamber although the involvement in the root is more extensive. Only a thin layer of normal dentin is seen in the periphery.

"Diagnosis - These findings are consistent with the previous diagnosis of Dentinal Dysplasia. This condition is hereditary and transmitted as autosomal dominant."

The medical history of the child parallels the dental history in that professional care had been sought only on an emergency basis. The health record obtained from his physician reported nothing of significance - only the usual minimum "well baby" visits and an occasional visit for upper respiratory infection and routine childhood bumps and bruises. The only laboratory study in his dossier is a blood count prompted by abdominal tenderness and distress in the area of McBurney's point several years ago. The blood count was within normal limits and no treatment was rendered. There is no cleidocranial dysostosis and none of the skeletal stigmata of vitamin D deficiency is present.

A very sparse familial history is available. The child is reported to be the progeny of an unwed young teenage mother who abandoned the child in infancy. He has been cared for by an elderly aunt of the mother whose lifestyle can be characterized as that of the low socioeconomic stratum.

An attempt to elicit a hereditary history was thwarted by the fact that nothing was known of the father and little more of the abandoning mother. It was reported that the mother had lost all of her teeth at a very early age; the etiology of her edentulousness was unknown, however, since her dental care had been received in a dental school clinic and records of her case were no longer available. If one may be permitted the privilege of speculation, it would not seem out of order to presume genetic transmission of this rare hereditary disturbance of dentin in this child.

CONCLUSION

The discovery and positive diagnosis of a rare hereditary disturbance such as Dentinal Dysplasia, Type I in the private practice of dentistry is an exciting and challenging occasion. Thorough clinical, radiographic, histopathological and multitherapeutic modalities must be enlisted as well as referral for expert genetic investigation and counseling, if satisfaction is to be achieved for all concerned. Recent reports indicate that modern dental procedures and techniques can provide alternatives to the removal of teeth and prosthodontic replacement for victims of this hereditary disturbance.[11]

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Idiopathic odontoma formation following avulsion of immature permanent incisors: two case reports

Wataru Motokawa, DDS, DDSc
Raymond L. Braham, BDS, LDSRCS, MScD
Kunihisa Taniguchi, DDS, DDSc

Traumatic injuries are frequent occurrences in both the primary and permanent dentitions. Dental trauma to the developing permanent incisors may induce various complications including pulpal necrosis, root resorption, obliteration of the pulp canal, arrested root development and dilaceration.

Various cases of apical root formation following traumatic avulsion and reimplantation of immature permanent incisor teeth have been reported in the literature. Gibson stressed the importance of maintaining comprehensive radiographic records over several years in order to permit comparison in the event of unexpected developments.[1] Numerous other case reports documented spontaneous and induced root end closure (apexification) subsequent to traumatic avulsion.[2-5]

LITERATURE REVIEW

Several cases of continued root development and hard tissue formation following total avulsion and loss of or reimplantation of immature permanent teeth have been documented.[1-5]

With regard to continued root formation following root reimplantation with filling of the root canal, Oliet documented an unusual case of apexogenesis following obturation of the root canal with gutta percha and immediate reimplantation of an avulsed permanent central incisor in an eight-year-old girl.[2] In this case, forty-six months after treatment, apexification as described by Frank was noted radiographically.[6] The crown eventually fractured off, 8.5 years post-reimplantation, as a result of root resorption. Yamashita *et al* reported a case in which, over a period of time, development of a small amount of root-like structure was observed radiographically at the root apex of a reimplanted maxillary left permanent central incisor in which the root canal had been filled with gutta percha.[5]

Hard tissue formation following traumatic avulsion and loss of immature permanent teeth has been reported by several authors. Gibson observed continued root development after traumatic avulsion of a partially formed maxillary permanent central incisor.[1] Barker and Mayne reported on a case of avulsion and loss of two mandibular permanent lateral incisors in a boy, age seven years.[3] Ten months later there was radiographic evidence of hard tissue formations in the bone that had filled in the sockets of these lost teeth. These formations had a central radiolucency and the surrounding tissue was circumscribed, in each case, by a "periodontal membrane" and a "lamina dura".

Reporting on the histologic examination of the aforementioned posttraumatically formed roots, Gibson showed the junction between pretraumatic and posttraumatic dentin as clearly demarcated by a broad ac-

Dr. Motokawa is Associate Professor, Department of Pedodontics, Fukuoka Dental College, Fukuoka, Japan. Dr. Braham is Clinical Professor, Pediatric Dentistry, Department of Growth and Development, School of Dentistry, Clinical Professor (Dentistry), Department of Pediatrics, School of Medicine, University of California, San Francisco, CA. Dr. Taniguchi is Associate Professor, Department of Oral Pathology, Fukuoka Dental College, Fukuoka, Japan.

centuation of the normal incremental contour lines.[1] Posttraumatic dentin contained sparse and irregular tubules. Burley and Reece reported the histologic development of dentin and cementum, while Yamashita *et al*, in a detailed histological study, described the root as "resembling a bowling-pin and containing not only normal dentin and cementum but also cylindrical denticles."[4,5] Histologic studies in the two ensuing case reports bear out the previous findings.

CASE REPORTS

Case 1

A six-year-and-ten-month-old female patient was referred from the oral surgery clinic to the pedodontic clinic at Fukuoka Dental College. Seventeen months previously she had suffered an accidental avulsion of the maxillary left permanent central incisor that had been treated by extraoral filling of the root canal with gutta percha and reimplantation. It should be noted that current pediatric dental and endodontic thinking advises against extraoral filling of the root canals of avulsed teeth because of the increased risk of damage to the remnants of the periodontal membrane attached to the avulsed tooth. Radiographic follow-up initiating the above referral revealed increased lateral resorption at the cervix together with elongation and increased mobility of the reimplanted tooth. Careful radiographic examination in the pedodontic clinic revealed that apexification had continued from the site of the original "blunderbuss" apical foramen which was present at the time of reimplantation. Severe lateral root resorption was also noted (Figure 1). The radiograph also revealed the presence of an apical canal in a formed root tip together with a lamina dura. A review of the postoperative radiograph taken at the time of reimplantation (Figure 2) showed that the tooth was in good position, the root canal was wide and the apex was incompletely formed with excellent root-filling. At the time of the original treatment for trauma, a calcium hydroxide pulpotomy was carried out on the maxillary right permanent central incisor, which had been partially luxated and repositioned.

In view of the totally negative prognosis, the maxillary left permanent central incisor was extracted with separate surgical removal of the radiographic root tip (Figure 3).

Histologic examination of the decalcified radicular specimen (Figures 4-6) revealed an amorphous matrix resembling irregular root structure. Irregularly tubulated dentin and cementum with formed cellular inclu-

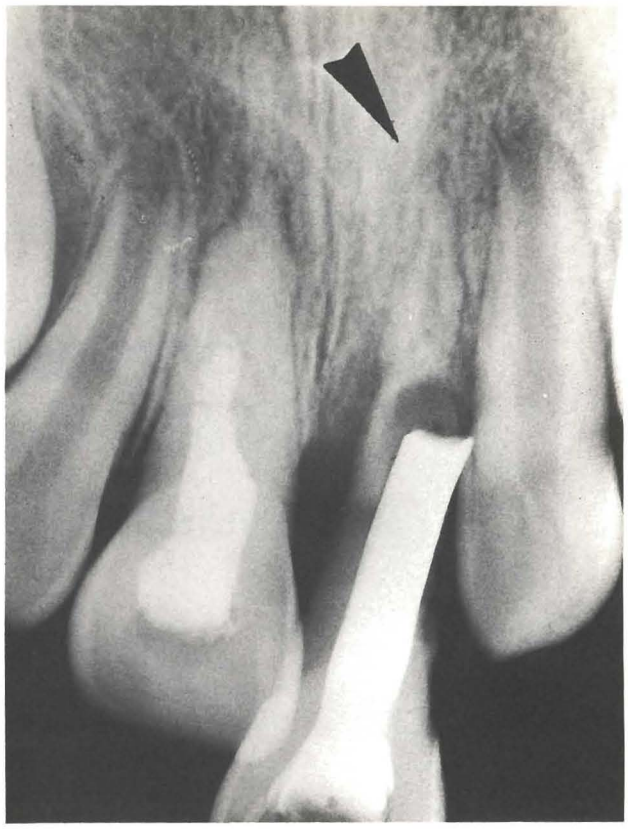


Figure 1. Radiograph taken seventeen months postreimplantation showing apexification and marked lateral resorption of maxillary left permanent central incisor.

Figure 2. Radiograph immediately postreimplantation of maxillary left permanent central incisor.

Figure 3. Extracted maxillary left permanent central incisor and continuously formed root-like odontoma.

Figure 4. Decalcified section of continuously formed root-like odontoma with wide-open apex (x 10 magnification. H. and E. stain).

Figure 5. Dentin with irregular tubules and cementum and cellular inclusions (x 80 magnification. H. and E. stain).

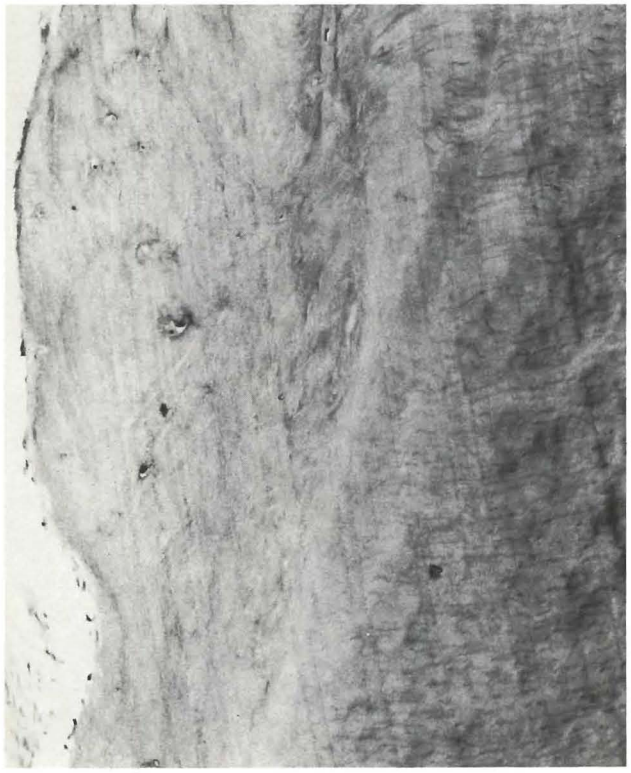
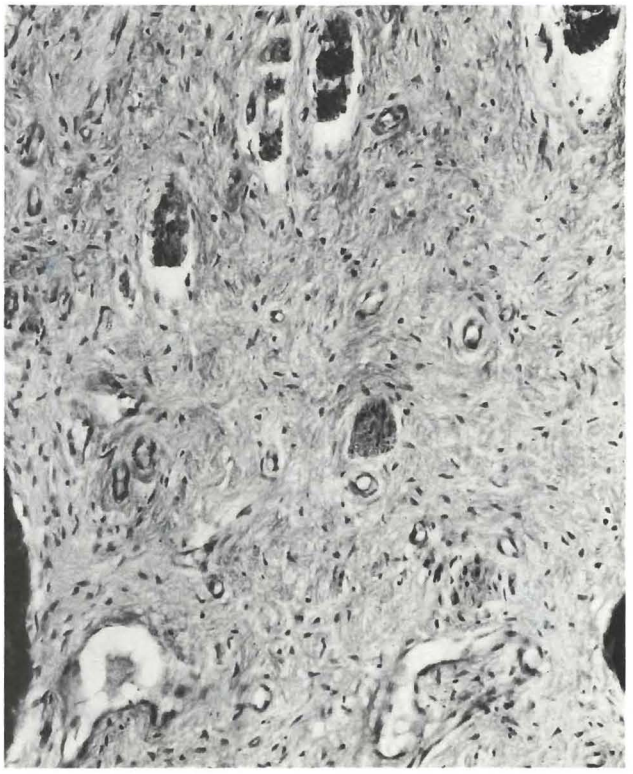


Figure 6. Pulp showing atrophied odontoblasts and a few denticles (x 80 magnification. H. and E. stain).



sions were noted. The pulp tissue was fibrous with a total absence of viable odontoblasts although a few atrophied odontoblasts and denticles were noted.

Case 2

A seven-year-old boy was referred to the pedodontic clinic at Fukuoka Dental College by a surgeon who had been treating him for laceration wounds and injuries sustained ten days previously.

On examination the maxillary right permanent central incisor was found to be missing, while the maxillary left permanent central incisor exhibited slight mobility and extrusion (Figure 7). Radiographic examination (Figure 8) showed a wide root canal present in the maxillary left permanent central incisor with the apex unformed. The maxillary right permanent central incisor was totally avulsed. Seventeen months later, the maxillary left permanent central incisor showed radiographic evidence of continued root development, while the site of the avulsed maxillary right permanent central incisor exhibited evidence of what appeared to be hard-tissue formation resembling a retained apical third of root at the location of the original root apex (Figure 9). This hard tissue was surgically removed and the soft tissue contained therein was carefully separated out (Figure 10).

Histologic sections and examination (Figures 11-13) revealed irregular root-like tissue as previously described in Case 1. The dentin showed a distinct dentinal tubular architecture with a marked irregular pattern. There was a formed irregular cementum of uniform thickness containing scattered vascular and cellular inclusions. The pulp tissue was completely fibrous with an almost total absence of odontoblasts and occasional denticles.

DISCUSSION

In considering the origins of continuing hard-tissue and hard-tissue-like formation, Gibson asserted that the formative dental papilla undoubtedly possesses considerable powers of recuperation from injury both traumatic and infective in nature.[1] He postulated that these powers of recovery originate largely in the pool of undifferentiated mesenchymal cells from which new odontoblasts might arise. Burley and Reece suggested that this ability arose from the retention and continued viability of Hertwig's root sheath following the traumatic root incident.[4] Yamashita *et al* considered the root development to be abnormally formed under the influence of the injury and the occlusal function of a

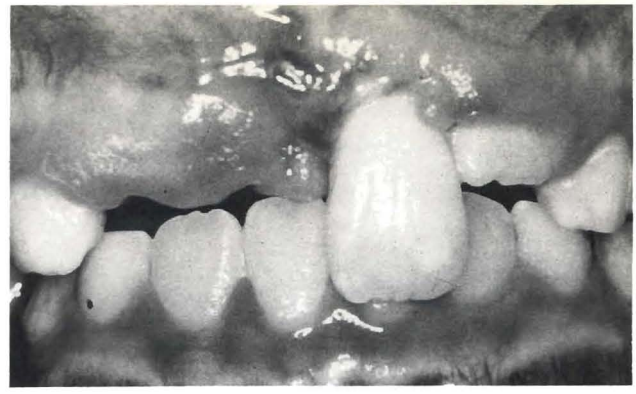


Figure 7. Clinical appearance ten days posttrauma showing avulsion of maxillary right permanent incisor.

Figure 8. Radiograph taken ten days posttrauma.

Figure 9. Radiograph taken seventeen months posttrauma showing hard-tissue in socket of maxillary right permanent central incisor.

Figure 10. Extracted root-like odontoma and its internal pulpal tissue.

Hertwig's epithelial sheath can induce further growth of the root.

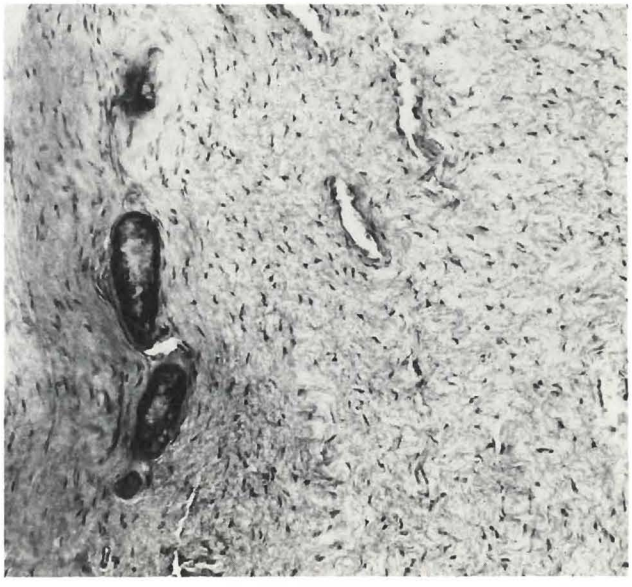
partial denture fabricated to replace the lost tooth.[5] They suggested that the most apical portion originated from Hertwig's epithelial sheath. The findings of the two cases reported here indicate that Hertwig's epithelial root sheath possesses reparative properties and can induce further growth of the root.

In each case in which root development continued after reimplantation, the root canals were filled with gutta percha prior to reimplantation. Maeda *et al* reported a case of posttraumatic reimplantation of an immature maxillary permanent central incisor in an eight-year-old boy, however, in which the root canal was filled with calcium hydroxide.[7] They felt that calcium

Figure 11. Section of extracted root-like odontoma (x 10 magnification. H. and E. stain).

Figure 12. Tubular dentin and irregular cementum with vascular and cellular inclusions (x 80 magnification. H. and E. stain).

Figure 13. Fibrous pulp tissue showing no odontoblasts and relatively few denticles. (x 80 magnification. H. and E. stain).



hydroxide was better than gutta percha when reimplanting permanent teeth, because of its osteogenic acceleration potential. Heithersay documented that calcium hydroxide in various forms was successful in inducing apexification, when introduced into the canals of immature permanent teeth, while Manhart asserted that calcium hydroxide should without a doubt be accepted as the treatment of choice for complex situations such as vital pulp therapy, immature open apices, large purulent periapical lesions, perforations, root fractures and internal resorption.[8,9]

Nicholls, in describing the technique of induction of root-end closure in incompletely formed permanent teeth with necrotic pulps, asserted that calcium hydroxide was the medicament of choice.[10]

SUMMARY

From the findings of Case 1 and those cases reviewed in the literature it would appear that overfilling a canal with gutta percha prevents continued root formation after reimplantation of the tooth. The canal should be underfilled, therefore, if gutta percha is used as the obturating medium. Consequently, the authors recommend that calcium hydroxide be used as the root canal filling material of choice after reimplanting immature permanent teeth subsequent to traumatic avulsion. Since, however, calcium hydroxide paste tends to be resorbed, periodic refilling of the canal with the paste is required.

Case 2 emphasizes the importance of periodic postoperative radiographic evaluation for several years after traumatic avulsion of immature permanent teeth.

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PREPAREDNESS FOR PEDIATRIC EMERGENCIES

Of the 434 questionnaires sent to Washington, DC, Maryland, and Virginia area pediatricians with hospital privileges at three separate institutions, 175 responses (40 percent) were returned.

The most common office emergency encountered was severe respiratory distress; seizures were almost as common. Patients with obstructed airways and shock were not uncommon, and those with severe trauma were less frequently encountered. Patients with true cardiac arrest were rarely encountered.

Despite the infrequent occurrence of these potentially life-threatening emergencies, only 50 percent of the physicians had a predetermined or formalized plan for managing such emergency cases. A total of 77 percent of the office practices had some member certified in basic life support and 25 percent had some member certified in advanced cardiac life support. Only 42 percent of the physicians felt adequately equipped for life-threatening emergencies. The response time of local emergency medical services was in the 1- to 3-minute range for 40 percent of the practices and in the 5- to 10-minute range for 49 percent of the office practices.

Altieri, M. *et al:* Preparedness for pediatric emergencies encountered in the practitioner's office.
Pediatrics, 85:710–714, May 1990.

ABSTRACTS

Walker, Jerry D.; Jensen, Mark E.; Pinkham, Jimmy R.: A clinical review of preventive resin restorations. J Dent Child, 57:257-259, July-August, 1990.

There has been increasing use of preventive resin restorations for restoration of permanent molars. The purpose of this investigation was to evaluate a sampling of these restorations placed in the undergraduate clinic at the University of Iowa. Three hundred and twenty-eight teeth were evaluated, and in 323 instances the composite was considered to be intact and of good quality. In sixty of the teeth the sealants were either partially or completely missing or there was caries present. It was concluded that the primary reason for failure of these restorations was the loss of the sealant material. Nevertheless, these restorations would remain the treatment of choice for small pit and fissure caries in our clinics.

Molars, permanent; Restorations, preventive resin; Caries, pit and fissure; Sealants

Donly, Kevin J.: Posterior composite resin: use for anterior restorations. J Dent Child, 57:260-262, July-August, 1990.

Restoration of a twelve-year-old female dental patient's anterior teeth posed the problem of severe enamel hypoplasia, caries secondary to enamel hypoplasia, and intrinsic discoloration. Posterior composite resin was chosen to be the restorative material. This case report presents an alternative for "special patients" in "special circumstances". The two-year success in this particular case shows the value of dental treatment on the basis of individual need.

Pediatric dentistry; Hypoplasia, enamel; Caries; Restoration, anterior; Composite resin, posterior

Seiler, Connie L.; Shellhart, W. Craig; Casamassimo, Paul S.: Efficacy and safety of intravenous ketamine for the severely handicapped. J Dent Child, 57:263-266, July-August, 1990.

Sedation was induced using intravenous ketamine prior to dental treatment in a total of thirty-nine procedures, performed on thirty-eight severely or profoundly handicapped patients. The sedations were conducted safely and to completion in all but one instance. The mean dose of ketamine was 0.5 mg per pound of body weight. Pulse and blood pressure showed slight elevation above preoperative baseline during the procedure and quickly returned to baseline levels (within six hours after the procedure). Emesis and seizures during or after the sedations occurred in fourteen and ten sedations, respectively. No correlation was noted between preoperative diagnosis, history or medications—or duration of procedure—and emesis and seizures.

Ketamine, intravenous; Sedation; Dentistry, institutional; Handicaps, severe; Emesis; Seizures

Nielsen, Lis Almer: Caries among children with cerebral palsy related to CP-diagnosis, mental and motor handicap. J Dent Child, 57:267-273, July-August, 1990.

The purpose of this study was to compare the prevalence of caries among Danish children with cerebral palsy (CP) with normative data, and to evaluate whether the prevalence of caries among CP-children is related to CP-diagnosis, mental or motor handicap. A total of 105 CP-children age 14-15 years were classified according to CP-diagnosis, degree of mental and motor handicap, DMFS-score and type of caries. Controls were children age 14-15 years registered in the Public Health Department's Odontological Register. CP-children had significantly lower DMFS-scores than the controls and lowest DMFS-scores were found in children with severe mental and motor handicap. The frequency of CP-children without caries (16.1 percent) was significantly greater than in controls (6.6 percent), whereas the frequency of children with pit and fissure caries was similar in the two groups. Motor handicap and mental handicap were significantly negatively related to DMFS-scores contrary to CP-diagnosis. Mildly motor-handicapped, CP-children without mental handicap were similar to normal children regarding caries occurrence.

Cerebral palsy; Caries; Handicapped children; DMFT-scores

Brownbill, John W. and Setcos, James C.: Treatment selections for fissured grooves of permanent molar teeth. J Dent Child, 57:274-278, July-August, 1990.

Twenty dentists from selected dental school departments were asked to examine 13 fissured grooves or pits in extracted molars and recommend a treatment from a list of options, ranging from no treatment to cast-metal restoration. There was a wide variation in initial treatment selections, with amalgam (29 percent) and resin sealants (25 percent) being the most common. Each of the grooves was prepared for one of the treatment options; and the dentists were then asked to reselect a treatment option for each restoration. Caries was found in all fissures that were prepared, leading to a general shift toward selecting more "radical" plans for restoration. The increase in the selection of amalgam (to 39 percent) was at the expense of the sealant- and preventive-resin treatment options. There was satisfaction with the cavity preparations made for amalgam, resin sealant and preventive resin restorations; but dissatisfaction with polishing, topical fluoride applications, "no treatment", and the radical onlay preparation. Pediatric dentists were significantly more conservative in both their original and later diagnoses than were the other dentists in this study.

Dental treatment; Fissured grooves; Molars; Pediatric dentists; Practitioners, dental; Cavity preparations

Poiset, Mitchell; Johnson, Ronald; Nakamura, Robert: Pulse rate and oxygen saturation in children during routine dental procedures. J Dent Child, 57:279-283, July-August, 1990.
Fourteen normal healthy children 5 to 7 years of age were given occlusal amalgam restorations on the mandibular second primary molar. The child's oxygen saturation (SaO_2) and pulse rate were continuously monitored using a pulse oximeter and a pin chart recorder. It was found that there were statistically significant differences in pulse rate in children undergoing various operative dental procedures, while the oxygen saturation did not vary statistically for the same procedures. It was concluded that there is no significant relationship between recorded changes in the pulse rate and SaO_2 in children undergoing routine restorative procedures.
Sedation; Patient monitoring; Hypoxemia; Pulse rate; Oxygen, arterial, saturation; Pediatric dentistry

Waldman, H. Barry: Decreases in dental caries do not mean that children no longer need dental services. J Dent Child, 57:284-288, July-August, 1990.
A review of National Health Interview Surveys was carried out to explore the changes in the perceived need for dental care for children and consequences of dental disease. Findings include a decrease in acute dental conditions and complex variations in associated restricted days, bed days, and lost school days (as dental conditions affect school attendance).
Pediatric dentistry; Dental services, need (and) demand for; Dental conditions, acute

Waldman, H. Barry: Who provides what dental services for children? We need more information. J Dent Child 57:289-292, July-August, 1990.
Changing patterns of dental disease and variations in the use of dental services are having profound effects on dental practice. A review is provided of the available information on which practitioners provide dental services to children. A need for additional information to consider the adjustment of pre- and postdoctoral dental education is explored. There are significant questions regarding the appropriate emphasis on particular components of the curricula of schools of dentistry and testing procedures for state licensure.
Dental services, delivery of; Diagnostics; Endodontics; Orthodontics; Prevention; Operative dentistry; Denture services; Dental education; Curriculum

Kerosuo, Heidi: Occlusion in the primary and early mixed dentitions in a group of Tanzanian and Finnish children. J Dent Child, 57:293-298, July-August, 1990.
The aim of this study was to observe occlusal variation in the primary and early mixed dentition among groups of 580 Tanzanian and 575 Finnish children. Black African children comprised 83 percent of the Tanzanian group, with the remainder of Asian or Arab origin. Finnish children were all of Caucasian origin. Tanzanian children had fewer occlusal anomalies than Finnish children did. In primary dentition the most prevalent occlusal anomaly among Finnish children was lateral crossbite (13 percent); among African children anterior crossbite (8 percent); and among the combined Asian/Arab group of children, anterior open bite (10 percent). African children had significantly lower prevalences of distal bite, lateral crossbite and crowding than Finnish children did. With regard to distal bite and crowding, the present results agree with previous studies on permanent occlusions in African and Caucasian children.
Anomalies, occlusal; Ethnic groups; Dentition, primary (and) early mixed; Thumbsucking

Miers, Dennis, R. and Herbert, Frank L.: Dentinal dysplasia, type I: report of case. J Dent Child, 57:299-302, July-August, 1990.
Dentinal dysplasia, type I is an autosomal dominant hereditary condition rarely encountered in dental practice. The discovery (and positive diagnosis) of such a rare hereditary disturbance in the private practice of dentistry is an exciting challenge. The case of a nine-year-old Caucasian boy is described in this case report. Thorough clinical, radiographic, histopathological, and multi-therapeutic modalities must be enlisted, as well as referral for expert genetic investigation and counseling.
Dysplasia, dentinal type I; Diagnosis, differential; Heredity

Motokawa, Wataru; Braham, Raymond L.; Taniguchi, Kunihisa: Idiopathic odontoma formation following avulsion of immature permanent incisors: two case reports. J Dent Child, 57:303-308, July-August, 1990.
Continued apical root development, and/or formation of hard-tissue-like radicular structures, has been known to occur following reimplantation and root canal treatment of immature permanent incisors. This paper presents two such cases of idiopathic odontomas and reviews the clinical and histologic findings. The second case emphasizes the importance of periodic postoperative radiographic evaluation for several years after traumatic avulsion of immature permanent teeth.
Root development; Endodontics; Reimplantation; Odontoma, idiopathic.