

Every story a child tells, acts out through play, or writes contributes to a self-portrait—a portrait that he can look at, refer to, think about, and change, a portrait others can use to develop an understanding of the storyteller. Each time a child describes an experience he or someone else has had, he constructs part of his past, adding to his sense of who he is and conveying that sense to others. Each time a child makes up a story about something that might have happened to himself or to another, he expands his world. The stories we tell, whether they are about real or imagined events, convey our experience, our ideas, a dimension of who we are. It is through telling stories that children develop a personal voice, a way of communicating their unique experience and view of the world.

—Susan Engle



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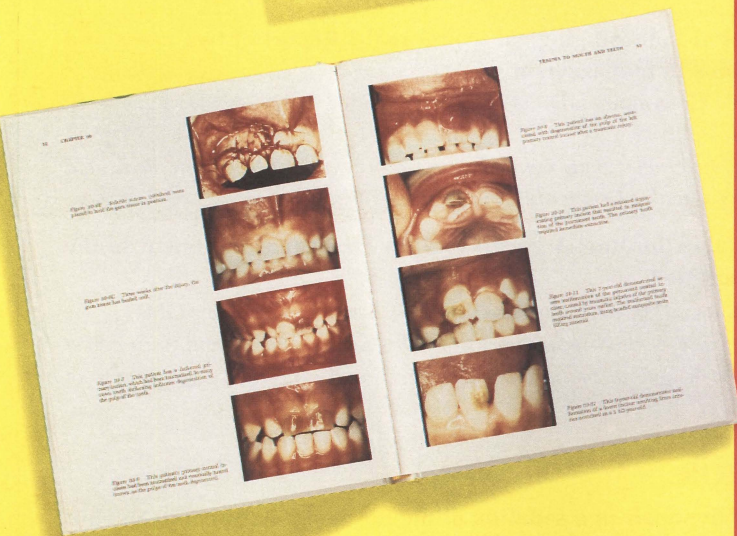
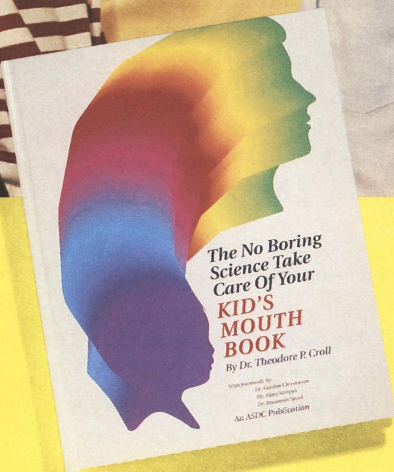
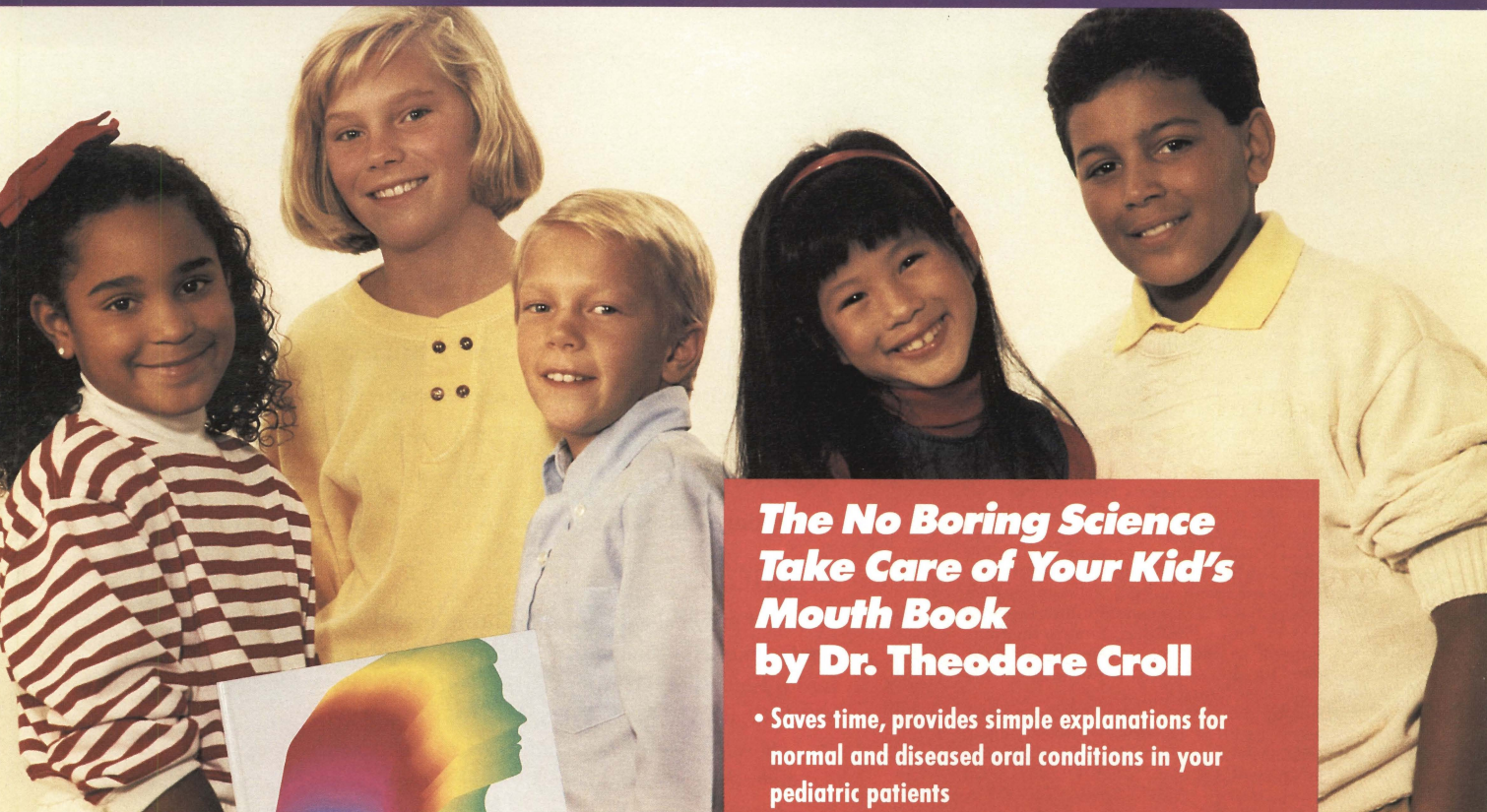
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**Dr. Theodore Croll, the author, is a board-certified pediatric dentist with an intuitive ability to manage children.**

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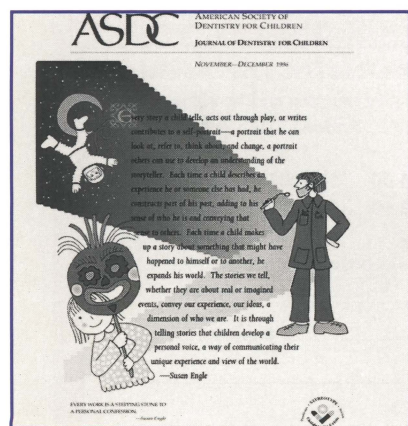
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Prospective authors should consult "Information for Authors." Reprints of this document may be obtained from the Editorial Office.

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The stories we tell, whether they are about real or imagined events, convey our experience, our ideas, a dimension of who we are. Art and design by Sharlene Nowak-Stellmach

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## CLINIC

### 393 Effect of supervised use of an alum mouthrinse on dental caries incidence in caries-susceptible children: A pilot study

Carl J. Kleber, MSD, PhD; Mark S. Putt, MSD, PhD; Charles E. Smith, DDS, MPH; Charles W. Gish, DDS, MSD

*The objective of this study was to compare the effect on dental caries formation in caries-susceptible children of daily supervised rinsing for a year with a rinse containing 0.02 M alum (500 ppm) versus home-use of a fluoride dentifrice.*

### 403 Damage to the primary dentition resulting from thumb and finger (digit) sucking

Osamu Fukuta, DDS, PhD; Raymond L. Braham, BDS, LDSRCS, MScD; Katsumi Yokoi, DDS, PhD; Kazuo Kurosu, DDS, PhD

*The authors studied the influence of thumb and finger-sucking on the anterior and posterior components of the primary dentition, in the age-groups of three, four, and five years.*

### 408 Phenobarbital-induced gingival overgrowth? Report of two cases and complications in management

Androniki P. Gregoriou, DDS; Paul E. Schneider, DDS, MSD; Pamela R. Shaw, DDS

*Each of two males with marked gingival overgrowth had been medicated exclusively with phenobarbital for seizure disorders.*

### 414 Electronic apex locator: A useful tool for root canal treatment in the primary dentition

Alexander Katz, DMD; Eliyahu Mass, DMD; Arie Y. Kaufman, DMD

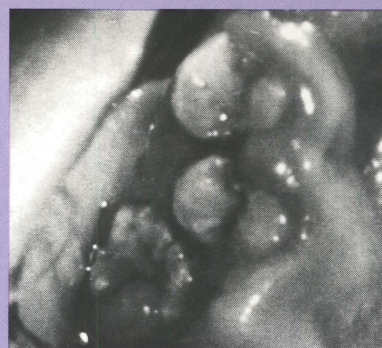
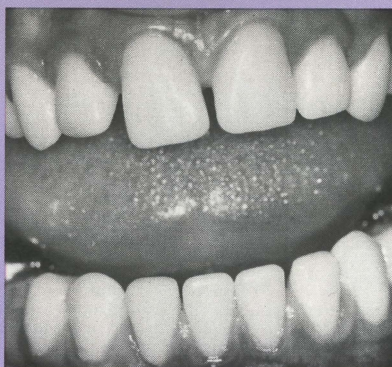
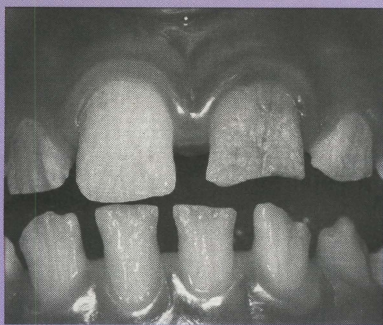
*The purpose of this study was to test this device and its ability to detect the tooth length in mature primary teeth with different degrees of root resorption.*

## BEHAVIOR

### 418 The use of hypnosis in a sedation clinic for dental extractions in children: Report of 20 cases

Andrew J. Shaw, BDS, FDSRCS; Richard R. Welbury, MB, BS, BDS, PhD, FDSRCS

*Although not commonly used, hypnosis has been shown to be effective in reducing anxiety in children receiving dental treatment.*



#### 421 The effectiveness of midazolam and hydroxyzine as sedative agents for young pediatric dental patients

Joseph Shapira, DMD; Gideon Holan, DMD; Eyal Botzer, DMD; Ari Kupi-eztky, DMD; Eliyahu Tal, DMD; Anna B. Fuks, CD

*The authors investigated the efficacy of 3.7 mg/kg of oral hydroxyzine for sedating young children during dental treatment, and compared it with 0.2 mg/kg intranasal midazolam.*

### EPIDEMIOLOGY

#### 426 Epidemiologic study of 19-month-old Edmonton, Alberta children: Caries rates and risk factors

Philip Weinstein, PhD; William F. Smith, DMD, MSc, MBA; Nonie Fraser-Lee, BCom, MHSA; Tsutomu Shimono, DDS, PhD; Jiro Tsubouchi, DDS, PhD

*Although dental decay has declined significantly in the population group in this study, dental disease remains a significant problem for approximately 13 percent of this age-group.*

#### 434 Are you treating youngsters who are or should be receiving mental health services?

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

*The author provides a general introduction to the extent and nature of childhood and difficulties associated with adolescent mental health problems.*

### DEMOGRAPHICS

#### 438 Yes, overall crime statistics are down, but juveniles are committing more criminal offenses

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

*There has been a significant decrease in violent crimes nationally and a steady increase in criminal violence committed by juveniles.*

### REPORT OF CASES

#### 443 Rehabilitation of young patients with amelogenesis imperfecta: A report of two cases

Dominique Bouvier, DDS, PhD; Jean-Pierre Duprez, DDS, PhD; Dominique Bois, DDS, PhD

*Recently the use of composite resin veneers, stainless steel crowns, and other successful treatment modalities have enabled dentists to restore dentitions mutilated by attrition.*

#### 448 Fibrodysplasia ossificans progressiva: Report of a case with guidelines for pediatric dental and anesthetic management

Burton L. Nussbaum, DDS; Irene O'Hara, MD; Frederick S. Kaplan, MD

*The interest to the dental clinician is that even the mildest trauma may initiate ossification.*

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#### Calendar

1997  
ASDC Seminar, ADA, Chicago, IL, May 10.  
ASDC Annual Meeting, Registry Resort, Naples, FL, October 22-26.  
1998  
ASDC Annual Meeting, Hyatt Regency Beaver Creek, Avon, CO, October 14-18.

# For The Busy Reader

## **Effect of supervised use of an alum mouthrinse on dental caries incidence in caries-susceptible children: A pilot study—page 393**

In this study on dental caries the daily use of an alum rinse to prevent dental caries is compared with the preventive effectiveness of an approved fluoride dentifrice. In addition the authors investigated the cariostatic activity of using the alum rinse in combination with the F dentifrice.

The authors emphasize that dental caries is still a chronic health problem that continues throughout life; and although the incidence is declining in some subpopulations, prevalence of the disease remains very high overall.

Requests for reprints should be sent to: Dr. C.J. Kleber, Health Science Research Center, School of Health Sciences, Indiana University-Purdue University, 2101 Coliseum Blvd. East, Fort Wayne, IN 46805-1499.

## **Damage to the primary dentition resulting from thumb and finger (digit) sucking—page 403**

The authors investigated the influence of thumb and finger-sucking on anterior and posterior segments of the primary dentition, in the three age-groups of three, four, and five years. Anterior open-bite and maxillary protrusion represent the most frequent malocclusion associated with digit sucking. The evidence of this study points to three to four years of age as the most appropriate range for digit-sucking to stop spontaneously.

Requests for reprints should be sent to: Dr. Raymond L. Braham, Box 0438, School of Dentistry, University of California, San Francisco, San Francisco, CA 94143.

## **Phenobarbital-induced gingival overgrowth? Report of two cases and complications in management—page 408**

Phenobarbital, a barbiturate, is prescribed as a sedative hypnotic and anticonvulsant medication for generalized or partial seizures. Its use can have one or many serious side effects including gingival overgrowth, the subject of

this article. Clinically and histologically the cases were similar in appearance to fibromatosis gingivae. The authors discuss the treatment management of these patients.

Requests for reprints should be sent to: Dr. Paul E. Schneider, Department of Pediatric Dentistry, LSU School of Dentistry, 1100 Florida Avenue, Box 139, New Orleans, LA 70119.

## **Electronic apex locator: A useful tool for root canal treatment in the primary dentition—page 414**

The newest electronic apex locator, *Root ZX*, is unique in its ability to detect the apex effectively in dry, as well as in wet, environments. The purpose of the study was to test the ability of the device to detect the tooth length in mature primary teeth with varying degrees of root resorption. The device was quick, comfortable, and accurate, and thus preferred over radiographic methods.

Requests for reprints should be sent to: Dr. Alexander Katz, Department of Endodontology, The Maurice and Gabriela Goldschleger, School of Dental Medicine, Tel Aviv University, Tel Aviv 69978, Israel.

## **The use of hypnosis in a sedation clinic for dental extractions in children: Report of 20 cases—page 418**

Not all children are able to accept sedation and still require a general anesthetic for treatment. Although not in common use, hypnosis has been effective in reducing anxiety in children receiving dental treatment. Preliminary reports show that there may be a beneficial effect from hypnosis, used in conjunction with inhalation sedation. The study aimed to select patients who might benefit from the use of hypnosis, to assess the clinical success of informal hypnotic imagery, and to determine the increase in the length of an appointment.

Requests for reprints should be sent to: Mr. A.J. Shaw, Department of Child Dental Health, The Dental Hospital, Richardson Road, Newcastle upon Tyne, NE2 4BW.

**The effectiveness of midazolam and hydroxyzine as sedative agents for young pediatric dental patients—page 421**

The purpose of the study was to investigate the efficacy of 3.7 mg/kg of oral hydroxyzine for sedating young children during dental treatment, and to compare it to 0.2 mg/kg intranasal midazolam. The authors compare the results and suggest that deterioration of behavior in infants whose initial behavior is good can be prevented by using a sedative agent.

Requests should be sent to: Dr. Joseph Shapira, Department of Pediatric Dentistry, Hadassah Faculty of Dental Medicine, P.O. Box 12272, Jerusalem, Israel.

**Epidemiologic study of 19-month-old Edmonton, Alberta children: Caries rates and risk factors—page 426**

Disadvantaged children are very vulnerable to infant caries. Infant feeding patterns that are etiologic risk factors are influenced by cultural and ethnic factors. Before interventions for baby-bottle tooth decay can be developed and tested the prevalence and risk factors associated with the disease must be identified.

Requests for reprints should be sent to: Dr. Philip Weinstein, Professor, University of Washington, Dental Public Health Sciences, Box 357475, Seattle, WA 98195-7475.

**Are you treating youngsters who are or should be receiving mental health services?—page 434**

Because of the behavior problems that occur as a result of poor mental health, it is imperative that practitioners realize that bad behavior may be the result of the mental health condition rather than of the nature of the dental service. It is estimated that approximately 600,000 adolescents suffer from mental disorders and 115,000 of these were admitted annually in the mid 1980s to psychiatric facilities. As a society we spent approximately \$4.8 billion for child and adolescent mental health service in 1990.

Requests for reprints should be sent to: Dr. H. Barry Waldman, Professor, Dental Health Services, Department of General Dentistry, State University of New York at Stony Brook, Stony Brook, NY 11794-8706.

**Yes, overall crime statistics are down, but juveniles are committing more criminal offenses—page 438**

In 1994 one criminal offense occurred every two seconds, etc. A frightening panorama of criminal offense in this country. FBI reports indicate that during the 1990s, despite national decreases in criminal activities, children in our cities, suburbs, and rural areas increasingly are involved in violent crimes, property crimes and delinquency crimes. Crime has infected all our neighborhoods, with the peak hours being 3 PM to 6 PM.

Requests for reprints should be sent to: Dr. H. Barry Waldman, Professor, Dental Health Services, Department of General Dentistry, State University of New York at Stony Brook, Stony Brook, NY 11794-8706

**Rehabilitation of young patients with amelogenesis imperfecta: A report of two cases—page 443**

It is reported that amelogenesis imperfecta has an incidence of approximately one in 14,000. Modern treatment techniques and materials enable dentists to restore many of these dentitions to acceptable function. The restored dentitions have a positive psychological effect on the personalities of these children.

Requests for reprints should be sent to: Dr. Dominique Bouvier, UFR Odontologie, Département de Pédiodontie, Rue Guillaume Paradin, 69372 Lyon cedex 08 - France.

**Fibrodysplasia ossificans progressiva: Report of a case with guidelines for pediatric dental and anesthetic management—page 448**

This is a very rare and progressively disabling genetic disorder. The ossification begins during the first decade of life. The most common sites of early ossification are the neck, spine, and shoulder girdle. The interest to the dentist is that even the mildest trauma may initiate the ossification.

Requests for reprints should be sent to: Dr. Frederick S. Kaplan, Department of Orthopaedic Surgery, Silverstein Two, 3400 Spruce Street, Philadelphia, PA 19104.

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## For your information

**S**eventy years ago a group of concerned dentists met to form a national society dedicated to the promotion of dentistry for children. They named it "The American Society for the Promotion of Dentistry for Children". This remarkable, history-making event took place in 1927 because of the dedicated persistent efforts of Samuel D. Harris who had spent a year in the Forsyth Clinic in Boston extracting teeth from hundreds of children. There was little time for restorative dentistry, for these children, because of the overwhelming need to make them minimally comfortable and free of acute infection. Dr. Harris knew that something had to be accomplished on the national level, if children's dental health problems were to be recognized for their association with the general health of children. Not only had the general public failed to respect the importance of children's dental health, but the health professions, including the dental profession, also paid it little heed.

Many dental schools devoted no part of their curriculums to dentistry for children; at best a series of lectures, ten or twelve, was offered in the second year—usually under the auspices of the department of operative dentistry. There was little effort devoted to relating the lectures to clinical practice. On reflection the lectures were mostly theoretical in nature, rather than based on actual clinical experience. In defense of the pioneers, however, we should be reminded that anesthesia, local as well as general, was a crude art compared to modern anesthetic modalities. Sedation was virtually unknown and little as it was practiced, unsafe. Operative techniques were equally crude, compared to the sophistication of today's armamentarium. It was basically the dedication to an important cause and the love for children that carried dentists who treated children through the day. The bad behavior of some patients was managed instinctively, rather than by established psychological principal.

Largely through the persistent efforts of ASDC members, throughout the 1930s, the ADA eventually required in pediatric dentistry the teaching of formal courses plus clinical experience for school accreditations.

In 1947 a group of ASDC members, limiting their practices or teaching to pediatric dentistry, founded the Academy of Pedodontics, now the Academy of Pediatric Dentistry, which is celebrating its 50th anniversary this year.

The movement in behalf of children's dental health has come a far way toward awakening interest and concern in the health professions. Nevertheless a lethargy

has occurred on the part of many because of the mistaken notion that fluoridation has eliminated dental caries as a major health threat. Most of us know that this is not true and that approximately 50 percent of our children either suffer from the disease or are at high risk of contracting it. Thus our vigilance must be continued or renewed, whatever the case may be.

The ASDC will continue to emphasize the need for the general practitioner to treat children not only because of the need for proximity of pediatric dental services, but because of the volume of needed services. ASDC will continue to encourage the generalist by providing journal articles dealing with current concepts and techniques in pediatric dentistry. The editorial philosophy of ASDC calls for a focus on the whole child, and of treating the dental needs of children as important contributions to the well-being of the whole child. ASDC will continue to make available excellent brochures and other printed materials, such as Dr. Ted Croll's book for children and parents. ASDC plans to broaden its regional seminar program, at low cost to ASDC members. These programs have proved very popular, primarily because of their quality, low-cost, and easy access. Any state unit interested in sponsoring a regional seminar with national office input should direct a letter to Dr. John Willis, President ASDC, 875 N. Michigan Avenue, Suite 4040, Chicago, IL 60611-1901. In addition, ASDC continues to plan for annual meetings that promise excellent scientific programs in interesting hotels and resorts at the lowest possible cost to you.

We take special note of the honor accorded Dr. Albert L. Anderson, Jr., ASDC president in 1958; at a luncheon sponsored by the Children's Hospital Foundation in San Diego, the establishment of The Anderson Center for Dental Care was announced. It was in recognition of Dr. Anderson's work in behalf of children with special needs that the Center was created. Congratulations to Al from his many friends in ASDC.

It is planned that Dr. George Teuscher will retire as ASDC editor at the end of 1997. In the meantime it is planned to add a managing editor to the national office staff to assume responsibility for the particular duties of a managing editor. A committee chaired by Dr. Dennis Ranalli will receive applications for the position of editor, and plans to begin the selection process at the time of the ad interim meeting of the ASDC Board of Trustees. Applications may be sent to Dr. Dennis Ranalli, American Society of Dentistry for Children, 875 N. Michigan Avenue, Suite 4040, Chicago, IL 60611-1901.

# ASDC CONTINUING EDUCATION REGISTRY

## An ASDC Membership Service

As a member of ASDC, simply mail a record of your attendance at a lecture, seminar, or dental meeting to the ASDC National Office and it will be recorded in the computer, credited to your personal continuing education program. Record forms will be provided on request.

To bring your record up to date, complete a form (which we will be happy to send you) showing your credits to date and we will credit them to your personal computer record. To receive this free member benefit, you need not be a candidate for the ASDC Fellowship or Mastership.

If you elect at anytime to become a candidate for an ASDC Fellowship or Mastership, the following requirements will apply.

### THE FELLOWSHIP

- You pay nothing until your application is approved. Approval means that all credits have been submitted by the candidate to the National Office on the standard form provided by ASDC, and approved by the Committee on Continuing Education.
- Notification that a sufficient number of C.E. credits for the ASDC Fellowship were approved will be sent to you from the National Office. A fee of \$200 is then due.
- Membership in ASDC for a minimum of three years preceding the convocation is required.
- Four hundred (400) C.E. hours in dentistry for children or related subjects are required for the Fellowship. They must be acquired within the eight-year period preceding the candidate's anticipated convocation date. A continuing education course in dentistry for children is defined as a course that can increase the dentist's knowledge and skills in treating children.
- A maximum of 100 Continuing Education hours will be credited for the following:
  - Ten (10) C.E. hours for a chapter in a textbook or a published paper on dentistry for children, in a respected professional journal.
  - Five (5) C.E. hours for each hour of lecturing to professional or lay groups, or to dental students on the subject of dentistry for children.
  - Five (5) C.E. hours for a Table Clinic presented on dentistry for children.
- A maximum of 75 percent of the total requirement (300 of 400 C.E. hours) may be allowed for any one category of study (i.e. orthodontics, endodontics, perio-

dontics, etc.). Hours of postdoctoral studies toward a specialty degree or certificate are not applicable toward Continuing Education Credits.

### THE MASTERSHIP

- All candidates for the ASDC Mastership must be ASDC Fellows.
- A total of six hundred (600) C.E. hours are required for the ASDC Mastership. The courses for these C.E. hours must be taken on or after August 1 of the year in which the candidate's application for Fellowship was approved.
- All C.E. hours must be related to dentistry for children.
- All C.E. hours must be earned within the eight-year period immediately preceding the candidate's anticipated convocation date.
- A maximum of 50 percent of the C.E. hours may be obtained in a single subject area (orthodontics, periodontics, endodontics, etc.). Please note that courses in Financial Management and Investment will not be counted toward fulfillment of requirements. Behavior management courses are, of course, accepted.
- A maximum of 25 percent of the 600 C.E. hours may be obtained by presenting table clinics, mini clinics, C.E. lectures, articles in respected professional journals, chapters in textbooks on the subject of child health, monographs, etc., at the same rates as noted in the ASDC Fellowship requirements.
- At the time all requirements for the Mastership have been met, a fee of \$300 will be due.

- The deadline for applications for the current Mastership class will be August 1, 1994.

### GENERAL COMMENTS AND REGULATIONS

- All continuing education courses are subject to approval and evaluation by the Committee on Continuing Education.
- All requests for application forms must be sent to the ASDC National Office.
- The candidate will be required to apply to ASDC for selection as an ASDC Fellow or ASDC Master, using the standardized ASDC application form.
- The final selection of the candidate will be by authority of the Committee on Continuing Education, with the approval of the Board of Trustees.
- The candidate must be present at the convocation to receive the Fellowship or Mastership award.
- The completed application for a Fellowship Class or Mastership Class must be received in the National Office no later than August 1 of the anticipated convocation year.
- The candidate will be notified of the decision of the Committee by the end of the first week in September.
- Each Fellow or Master will receive a plaque bearing the candidate's name, certification of his Fellowship or Mastership status, and the date of the Convocation. No titles will be shown.
- The Fellowship plaque will be in bronze letters. The Mastership plaque will be in silver-colored lettering.

### ENROLLMENT IN THE ASDC CONTINUING EDUCATION REGISTRY

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Phone

Year I joined ASDC

# ASDC AWARDS 1997

For the past several years, the American Society of Dentistry for Children has recognized the contributions to dentistry for children of general practitioners, pedodontists, and nondentists, by presenting awards each year at the Society's annual meeting. The awards are made in three categories: Distinguished Service Award is presented to a general practitioner, or specialist other than pediatric dentist, member of ASDC whose service in the promotion of dentistry for children in his/her community or state has been outstanding.

Award of Excellence is presented to persons who have performed with distinction in the field of pediatric dentistry in the areas of research, administration, teaching, practice or publications. Award of Recognition is presented to nondentists, in recognition of their contributions to dentistry. The following individuals have been honored by ASDC during the past five years:

<i>Year</i>	<i>Distinguished Service</i>	<i>Excellence</i>	<i>Recognition</i>
1992	J. Lawrence Tannenbaum Naugatuck, CT	John A. Bogert Chicago, IL	Robert T. Matsui Sacramento, CA
1993	Elisha D. Ben-Zur Zurich, Switzerland	James R. Roche Carmel, IN	Healthy Mothers/Healthy Babies Coalition California Chapter
1994	Sheila McGuire Washington, D.C.	Wayne A. Moldenhauer Dubuque, IA	St. Louis Dental Health Theatre St. Louis, MO
1995		H. Barry Waldman Stony Brook, NY	Bright Futures
1996		Jimmy R. Pinkham Iowa City, IA	Procter & Gamble

*Nominations for the 1997 Awards:* Nominations for any or all award categories may be submitted by any ASDC member or by State Units. Nominations for previous years may be resubmitted. The deadline for submitting nominations is April 15, 1997. Nominations should be sent to: Carol A. Teuscher, Assistant Executive Director, ASDC, 875 N. Michigan Ave., Suite 4040, Chicago, Illinois 60611-1901.

Applications for award nominees not selected during the previous year will be held on file for five years in the ASDC National Office. These will be resubmitted to the committee for consideration along with new applications submitted by State Units during the current year.

This is an excellent opportunity to recognize the contributions to dentistry for children by ASDC members and nondentists. State Units are urged to submit nominations.

Simply submit a letter giving the name of the person nominated, his/her address, name of school where professional degree(s) was received, year of graduation, nature of current professional activity, and reasons why you consider the individual worthy of the award. Indicate the award for which the nomination is made. Direct questions to Carol Teuscher.

# Classified advertising

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**Example: March 10 is the closing date for the May issue.**

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## OPPORTUNITIES FOR PEDIATRIC DENTISTS

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**California—Oakland**—Full-time/part-time positions available for California licensed, boarded or board eligible pediatric dentists. Responsibilities include hospital and community dental care. Please respond to Edward A. Rothman, DDS, Director of Dentistry, Children's Hospital Oakland, 747 Fifty-second Street, Oakland, CA 94609-1809. (510) 428-3316. Salary commensurate with qualifications. C.H.O. is an E.O. employer.

**Canada—Calgary, Alberta**—Locum pediatric dentist needed for an expanding pediatric dental practice while owner is on pregnancy leave. Associateship an opportu-

nity for the right candidate. Send resume to: Dr. S. Schwann, 386-10333 Southport Road, S.W., Calgary, Alberta T2W 3X6, or call 403-640-0000 or Fax 403-640-2599.

**Maryland**—Immediate opening for a pediatric dentist in our multispecialty pediatric-based group practice located just outside of Washington, D.C. Minimum guarantee against a percentage of collection. Many fringe benefits. Experience with conscious sedation necessary. Contact Dr. Sylvan Mintz at 301-839-1330.

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**New York—Queens**—Fortuitous timing as pediatric dentist is about to retire. Many as-

sets for a pediatric dentist to consider for a long established career office. Will assist in transfer. Call 516-621-5555.

**Ohio—Lorain**—Well-established 20 year practice adding a full-time pediatric dentist. Group practice with specialists in pediatrics, periodontics, and orthodontics. Guaranteed base. Excellent opportunity. Call 216-282-6677.

**Oregon—Beaverton**—Established in 1970, we are a pioneer in the industry. Willamette Dental Group, P.C. has a history of financial stability and growth. Our multi-site group practice has excellent opportunities for pediatric dentists. We continue our position at the forefront of dentistry as we rapidly expand in the Pacific Northwest with its many recreational and life style advantages. WDG provides a stable environment and offers a large, diverse patient base. Our dentists enjoy the freedom of administrative headaches since we provide all support services allowing you to focus on providing quality care. Guaranteed salary and a bonus program. Our benefit package includes: Pension, 401K, medical, life, disability & professional liability insurance, paid time off, professional leave, etc. We will help defray costs of Board exams, interviews and moving expenses. Visit our WebSite at <http://www.teleport.com/~dental> Send resume: Shannon Jones, Professional Services Provider, Willamette Dental Group, P.C., 14025 S.W. Farmington Road, Suite 300, Beaverton, OR 97005 or call (503) 526-4417, FAX (503) 526-4415, e-mail [dental@teleport.com](mailto:dental@teleport.com)

**Pennsylvania—Northeast-Philadelphia**—Wonderful opportunity for full and/or part time pediatric dental associateship in the Philadelphia area. Respected and highly regarded practice needs you if you are an experienced pedodontist looking for more. Unique office atmosphere which caters to our young patients is a plus. Community-oriented in our endeavor to educate our children about dental health. This already large and busy practice continues to grow. Looking for energetic, enthusiastic, quality-oriented dentist(s) who truly loves children. Associateship will lead to partnership for the right person interested in a secure future. Send resume to: Raymond M. Solomon, DDS, 10125 Verree Road, Suite #106, Philadelphia, PA 19116 or call 215-677-0380.

**Pennsylvania—Southwest**—Exceptional opportunity for pediatric dentist to join a well-established, high-net solo practice. Enjoy our new state-of-the-art T.H.E. designed office with 6 op intra-oral video and casey education system, KCP2000 and network comput-

erization. This very progressive, highly respected practice attracts new patients from a 60 mile radius. Outstanding location in a family-oriented community, offering all major recreational activities and a wonderful quality of life. Applicant must be comfortable with sedation. Orthodontic background a plus. Please send handwritten letter of interest with photo and resume to: ASDC, Box #1192, 875 N. Michigan Avenue, Suite #4040, Chicago, IL 60611-1901.

#### FACULTY POSITIONS AVAILABLE

**New Jersey—Newark**—The UMDNJ-New Jersey Dental School invites application for a full-time tenure track faculty position at the assistant or associate professor rank in the Department of Pediatric Dentistry. Responsibilities include didactic and clinical instruction to predoctoral and postdoctoral students, as well as clinical or basic science research. Qualified individuals will be considered for the position of Director of Clinical Programs within the department.

Candidates must have a DDS/DMD degree from an ADA accredited dental school and ABPD eligibility or certification. Previous teaching experience, as well as a demonstrated interest in clinical or basic research, are highly desirable but not essential.

Interested individuals should communicate with Dr. Milton Houpt, Chair, Department of Pediatric Dentistry, UMDNJ-New Jersey Dental School, 110 Bergen Street, Newark, New Jersey 07103.

The University of Medicine and Dentistry of New Jersey is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply.

**New Jersey—Newark**—The UMDNJ-New Jersey Dental School is seeking an additional full-time staff dentist for the Center for Treatment of the Handicapped. Responsibilities include the provision of dental care with and without conscious sedation in the Center, and treatment under general anesthesia in the adjoining University Hospital. Responsibilities also include instruction to predoctoral and postdoctoral students. Qualified applicants for the position must be licensed or licensable in the State of New Jersey and must have experience in parenteral conscious sedation. Experience in the management of dental problems for the handicapped, including the performance of treatment under general anesthesia in the operating room environment is essential.

Interested individuals should communicate with Dr. Milton Houpt, Chair, Department of Pediatric Dentistry, UMDNJ-New Jersey Dental School, 110 Bergen Street, Newark, New Jersey 07103.

The University of Medicine and Dentistry

of New Jersey is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply.

**New Jersey—Newark**—The UMDNJ-New Jersey Dental School is seeking part-time clinical faculty with a time commitment of two or three days per week on a ten-month contract. Responsibilities include clinical instruction to predoctoral and postdoctoral students in the pediatric dental clinic and the adjoining hospital operating room.

Candidates must have a DDS/DMD degree from an ADA-accredited dental school and ABPD eligibility or certification. Previous teaching experience, as well as a demonstrated interest in clinical or basic research, are highly desirable but not essential.

Interested individuals should communicate with Dr. Milton Houpt, Chair, Department of Pediatric Dentistry, UMDNJ-New Jersey Dental School, 110 Bergen Street, Newark, New Jersey 07103.

The University of Medicine and Dentistry of New Jersey is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply.

**New York—New York**—Columbia University School of Dental and Oral Surgery: Full-time, tenure-track position at the assistant professor level available January 1, 1997. Responsibilities include didactic, pre-clinical and clinical teaching at the predoctoral and postdoctoral levels, research, and scholarly activity. Responsibilities may also include supervision of residents in hospital outpatient clinic and operating room. Qualifications include DDS/DMD degree and completion of an accredited advanced education program in pediatric dentistry. Certification by or eligibility for the American Board of Pediatric Dentistry is required as is a license to practice in New York. Prior experience in academic and hospital dentistry preferred. Salary and academic rank are commensurate with experience and qualifications. Send curriculum vitae and references to Dr. Martin J. Davis, Assistant Dean for Student and Alumni Affairs, Director, Division of Pediatric Dentistry, Columbia University, 630 West 168th Street, P&S-3-452, New York, NY 10032. Columbia University is an equal opportunity/affirmative action employer.

**Ohio—Cleveland**—Case Western Reserve University School of Dentistry seeks applicants for a full-time tenure or non-tenure position at the Assistant/Associate Professor level in the Department of Pediatric Dentistry, effective July 1, 1997. Responsibilities will include teaching at predoctoral and postdoctoral levels, research and service duties as assigned by the department and appropriate to the appointment. The successful candidate

should have experience in dental education and practice and should have completed an accredited advanced education program in pediatric dentistry. Board eligibility or certification is required. Participation in or directorship of an advanced education program in pediatric dentistry may be involved. Academic rank and salary commensurate with qualifications and experience. Case Western Reserve University is an EEO/AA employer. Applications including a curriculum vitae and names and addresses of three references should be sent to the Dean, CWRU School of Dentistry, 10900 Euclid Avenue, Cleveland, OH 44106-4905.

**Ohio—Cleveland**—Case Western Reserve University School of Dentistry seeks applicants for a full-time tenure track position at the Associate-Full Professor level as chair of the Department of Pediatric Dentistry, effective January 1, 1997 or as soon as possible thereafter. Responsibilities will include teaching at predoctoral and postdoctoral levels, and research and service leadership in pediatric dentistry with a strong link to community dentistry, dental public health and health services research. Directorship of an advanced education program in pediatric dentistry may also be required. The successful candidate should have academic creden-

tials appropriate for appointment with tenure at the rank of Associate or Full Professor. Board eligibility or certification in Pediatric Dentistry is required and strong credentials in dental public health and/or health services research are preferred. Academic rank and salary commensurate with qualifications and experience. Case Western Reserve University is an EEO/AA employer. Applications including a curriculum vitae and names and addresses of three references should be sent to the Dean, CWRU School of Dentistry, 10900 Euclid Avenue, Cleveland, OH 44106-4905.

#### FELLOW PROGRAM

**Pennsylvania—Philadelphia**—Applications are now being accepted for a one-year Pediatric Dentistry Fellow Program. The program includes extensive clinical and hospital experience—in-patient, out-patient, and operating room—and is based at The Children's Hospital in Philadelphia. Lectures, seminars, and rounds will be offered at Children's Hospital, as well as the University of Pennsylvania. Participants may also spend a portion of their time teaching undergraduate dental students from the University of Pennsylvania School of Dental Medicine. The Fellowship offers vast experience and opportunities to treat special patients as well as healthy

children. Sedation techniques and treatment in the operating room are emphasized. Candidates completing a Pediatric Dentistry Specialty Program will find this an excellent opportunity to practice and at the same time to augment and complement their clinical skills and knowledge base. Candidates who are now graduating from an accredited dental school will find the program offers exceptional exposure to all aspects of Pediatric Dentistry and care of children. The Fellowship provides outstanding preparation for future Pediatric Dentist specialty training. All candidates must be graduates from an ADA-accredited dental school. Send curriculum vitae, dental school transcript, Postgraduate/Residency transcript, if applicable, and three references to Dr. Mark L. Helpin, Chairman, Pediatric Dentistry, University of Pennsylvania, School of Dental Medicine, 4001 Spruce Street, Philadelphia, PA 19104-6003. Application deadline is February 17, 1997.

#### OFFICE SPACE AVAILABLE

**Texas, Dallas/Fort Worth**—Beautiful space available in a well-established dental office located in one of the fastest growing areas of the Dallas/Fort Worth metroplex. The office contains two consult rooms and seven clinical work stations. For lease or sale. Call 817-581-4031.

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#### ABSTRACTS *continued from page 390*

taken on the permanent teeth, ensures an esthetic quality that lasts until adulthood. It entails the use of laboratory designed composite prostheses.

#### **Amelogenesis imperfecta; Treatment modalities**

**Nussbaum, Burton L.; O'Hara, Irene; Kaplan, Frederick S.: Fibrodysplasia ossificans progressiva: Report of a case with guidelines for pediatric dental and anesthetic management. J Dent Child, 63:448-450, November-December 1996.**

Fibrodysplasia ossificans progressiva (FOP) is a rare heritable disorder of progressive heterotopic ossification leading to joint ankylosis throughout the body. Permanent ankylosis of the jaw may be precipitated by minimal soft tissue trauma, a potentially devastating complication following routine dental care during childhood. Assiduous pre-

cautions are necessary in administering dental care to children who have FOP as exemplified in this case report. Routine dental prophylaxis is also necessary in order to minimize the need for invasive procedures.

#### **Fibrodysplasia ossificans progressiva; Dental care**

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## ABSTRACTS

**Kleber, Carl J.; Putt, Mark S.; Smith, Charles E. et al:** Effect of supervised use of an alum mouthrinse on dental caries incidence in caries-susceptible children: A pilot study. *J Dent Child*, 63:393-402, November-December 1996.

Aluminum salts have demonstrated anticaries activity in a number of laboratory and animal studies. The aim of this double-blind, pilot, clinical trial was to evaluate the effect of an alum (Al) mouthrinse on dental caries formation both by itself and in combination with an ADA-approved sodium fluoride (F) dentifrice. A total of 260 caries-prone children residing in a low-F area were preselected for the study and scored independently for caries by two experienced examiners. After using gender, age, and initial DMFT(S) scores for baseline stratification, the subjects were assigned to one of three treatment regimens: (1) placebo mouthrinse and F dentifrice, (2) Al mouthrinse and placebo dentifrice, and (3) Al mouthrinse and F dentifrice. The alum mouthrinse contained 500 ppm Al and the sodium fluoride dentifrice contained 1100 ppm F. Rinsing was supervised at school on weekdays for 30 sec/day, while the dentifrices were used *ad libitum* at home. Subjects were reexamined for caries and oral health after six and twelve months. Both examiners found that children who used the Al mouthrinse, in conjunction with either placebo or F dentifrices, had lower caries incidence than those who used the placebo mouthrinse/F dentifrice combination; but the differences were statistically significant at school on one of the examiners. No evidence of deleterious effects to the oral tissues was observed. The results of this pilot clinical trial demonstrated that daily supervised use of an alum mouthrinse inhibited caries development in decay-prone children at least as effectively as a F dentifrice.

**Alum mouthrinse; F dentifrice; Caries incidence**

**Fukuta, Osamu; Braham, Raymond L.; Yokoi, Katsumi et al:** Damage to the primary dentition resulting from thumb and finger (digit) sucking. *J Dent Child*, 63:403-407, November-December 1996.

It is estimated that approximately 50 percent of infants at one year of age suck a thumb or finger. The number decreases rapidly by ages four to five years. The average age for spontaneous cessation of the habit is 3.8 years of age. Anterior open bite is the most frequent malocclusion reported with digit sucking.

In this study the authors investigated the influence of thumb and finger-sucking in the anterior and posterior sections of the primary dentition in three age-groups: three, four, and five years. The study population included 930 subjects. Data for the non-oral-habit group were compared with the data for the thumb and/or finger-sucking group.

At all ages the frequencies of open-bite and maxillary protrusion for the thumb and finger-sucking group were higher than the non-oral-habit group. The frequencies did not appear age-related. There appeared to be an increased tendency to a permanent malocclusion in children who continued after four years of age.

**Thumb and finger sucking; Primary dentition**

**Gregoriou, Androniki P.; Schneider, Paul E.; Shaw, Pamela R.:** Phenobarbital induced gingival overgrowth? Report of two cases and complications in management. *J Dent Child*, 63:408-413, November-December 1996.

Gingival overgrowth is a known side effect of several seizure, immunosuppressant and calcium channel-blocker medications.

Gingival overgrowth is not a reported side-effect of phenobarbital. This case report describes two patients with marked gingival overgrowth who had been medicated with phenobarbital exclusively since the initiation of seizure

disorders. The clinical findings, surgical management, bleeding complications, and recommendations in management are discussed.

**Gingival overgrowth; phenobarbital medications**

**Katz, Alexander; Mass, Eliyahu; Kaufman, Arieh Y.:** Electronic apex locator: A useful tool for root canal treatment in the primary dentition. *J Dent Child*, 63:414-417, November-December 1996.

The purpose of this study was to test the ability of an electronic apex locator, *Root ZX* to measure the root canal length in primary teeth with partial resorption. Twenty extracted primary molars were embedded in an alginate model imitating *in vivo* conditions. *Root ZX* and radiographic measurements were compared in dry and wet environments to the actual tooth length. *Root ZX* identified the tooth length at the most coronal portion of the resorption. The content of the root canal did not influence the results. No statistical differences were found between electronic, radiographic and actual tooth length measurements, although the radiographic measurements were longer than the electronic ones. It is suggested that *Root ZX* is a preferable auxiliary device to measure root canal length in the primary dentition.

**Apex locator; Primary teeth**

**Shaw, Andrew J. and Welbury, Richard R.:** The use of hypnosis in a sedation clinic for dental extractions in children: Report of 20 cases. *J Dent Child*, 63:418-420, November-December 1996.

We report on the use of informal hypnotic imagery in a group of children who were unable to accept dental extractions under inhalation sedation and local anaesthesia. Over the last two and a half years, one hundred and seventy-nine children have been seen in a sedation clinic at Newcastle Dental Hospital. In

thirty-four cases it was necessary to stop treatment and from this group, twenty children were selected for the use of hypnotic imagery. Treatment was successfully completed in sixteen children and all parents who completed a written questionnaire (twelve) reported they were happy with their child's treatment. Our preliminary findings show hypnotic imagery can be used successfully as an adjunct to inhalation sedation and conventional management skills for dental extractions in children.

**Shapira, J.; Holan, G.; Botzer, E. et al: The effectiveness of midazolam and hydroxyzine as sedative agents for young pediatric dental patients. J Dent Child, 63:421-425, November-December 1996.**

The purpose of the study was to compare hydroxyzine (HYD) and 0.2mg/Kg midazolam (MDZ) as sedative agents for young pediatric dental patients. Twenty-nine healthy two-to-four-year-old children participated in the study. Hydroxyzine was dripped nasally 10 minutes before treatment. The patients' crying, alertness, movement and general behavior were blindly assessed and statistically analyzed. No differences were found between the mean general behavior scores nor between the first and second visits in both groups. A significant difference ( $p < 0.02$ ) was found in the acceptance of the face and nasal masks by children of the midazolam group between the first and second appointments. None of the children of this group cried nor moved at the first visit. The results of the study indicate that midazolam is somewhat more effective than hydroxyzine as a sedative agent for short procedures in young pediatric dental patients.

**Hydroxyzine; Midazolam; Sedative agents**

**Weinstein, Philip; Smith, William F.; Fraser-Lee, Nona et al: Epidemiologic study of 19-month-old Edmonton, Alberta children: Caries rates and risk factors. J Dent Child, 63:426-433, November-December 1996.**

A random sample of 938 19-month-old Edmonton children and their parents/

caretakers were studied. Parents were interviewed and children were examined. Specimens for a caries activity test were collected at the examination. Results indicated 25 percent of the children had moderate to high caries activity, as shown by the Cariostat, with 4.6 percent showing decalcification lesions and frank caries. Early caries (BBTD) were found to be related to bottle feeding practices, discomfort with allowing the child to cry, and with mother being foreign-born. Foreign-born status was associated with the above parenting practices. Preferences for preventive recommendations and other descriptive results were reported. **Caries activity; Caries activity test; Bottle feeding**

**Waldman, H. Barry: Are you treating youngsters who are or should be receiving mental health services? J Dent Child, 63:434-437, November-December 1996.**

Psychiatrists now recognize that the disorders of children are serious, treatable conditions and as precursors of adult psychopathology. These conditions can seriously influence the patient's behavior when undergoing dental treatment. The dentist will probably assume that the behavior problems are directly related to the nature of the dental service, rather than particular underlying personality characteristics of preschool and school-age children. It is important that practitioners recognize and understand these conditions as they attempt to provide adequate treatment.

No national epidemiological studies have been conducted in this country that would provide valid indicators of either the prevalence or incidence of mental disorders among children. Local studies, however, have been done that diagnosable disorders in children range from 17.6 percent to 22 percent, including 3 percent to 5 percent who have severe emotional or behavioral problems. The prevalence of many mental disorders is greater in males than in females, ranging from a ratio of 2:1 to 9:1. Lifetime prevalence of mental disorders, first diagnosed in infancy, childhood,

and adolescence range as high as 15,000 cases per 100,000 persons.

It is important for the dentist to recognize that (1) even the youngest of children seen in a dental practice may be in need of mental health services, (2) management problems may stem from mental health problems, and (3) families are unaware or unwilling to admit that a child may need help.

**Mental health; Child behavior**

**Waldman, H. Barry: Yes, overall crime statistics are down, but juveniles are committing more criminal offenses. J Dent Child, 63:438-442, November-December 1996.**

Despite a general national decline in criminal activities in the 1990s, juvenile criminal offenses continue to increase, (including violent, property and delinquency acts). In addition increased numbers of children are being held in juvenile jails. It is all but impossible for pediatric health providers to think that "their patients" and "their practices" are immune from the epidemic of crime that affects and is caused by "just kids."

**Bouvier, Dominique; Duprez, Jean-Pierre; Bois, Dominique: Rehabilitation of young patients with amelogenesis imperfecta: A report of two cases. J Dent Child, 63:443-447, November-December 1996.**

This paper presents a method for the rehabilitation of young patients with amelogenesis imperfecta, illustrated by two cases. The method comprises a temporary phase and a transitory phase. The aim of the temporary phase, which involves the use of temporary resin and NiCr crowns during primary or mixed dentition, is to reestablish the esthetic, occlusal and masticatory features of the child's dentition. It must respect the integrity of the pulp so as not to compromise the development of the dentition, and must be capable of adapting to any changes occurring during development. The transitory phase, which is under-

*Continued on page 388*



## President's message

**E**arly in 1973 after recently having been graduated by the University of Detroit School of Dentistry, I joined ASDC and began receiving the Journal. Many times since then I have recalled one of the first editorials I read by George Teuscher, where he stated, "For many, ASDC has been the shield which has given them courage to do battle for the cause of dentistry for children..." (Nov-Dec, 73) This particular issue had been preceded by an issue which reviewed *Dental Clinics of North America: Pedodontics 1973* and *Minor Tooth Movement in Children* by Sim, an issue with five articles on behavior of the child dental patient, and an issue which validated stainless steel crown therapy, space maintainers, and mixed dentition analysis. I was hooked!

In 1974 I attended my first ASDC Annual Meeting in Washington, and was surprised to learn that one of my Staff Attendings from Syracuse University Hospital Dental Internship Program, Walter Woods, was the next ASDC President. Of much greater meaning to me, however, was the experience of discovering that everyone that I met was interested in encouraging and nurturing my desire to be a part of this group of professionals who found joy in treating children. There was nobody who cared whether I was a specialist or a generalist. There was nobody who cared whether I had academic research or teaching credentials or tenure. But everyone cared that I wanted to be a better practitioner for children.

In 1976, having settled my family in southern Maine to practice pediatric dentistry, our few local ASDC members were called together by Stephen Meisel from Connecticut at the Sheraton Inn in South Portland. With boldness and sincerity, and with a heart bursting with what he believed in, he cajoled, and argued, and persuaded, and finally, convinced us that if we cared for children, we needed to be involved, actively participating in ASDC. Steve helped us rejuvenate our Maine Unit, which went on to sponsor thirteen annual seminars. Steve became a great ASDC President, and a great friend. Words cannot express my thanks to him for his influence in my ASDC life.

Twenty years later I humbly follow in the footsteps of

many ASDC Greats. And ASDC continues to publish the Journal which sets the clinical standard in dentistry for children, continues under the editorial direction of George Teuscher, focuses on educational seminars and exciting conventions in resort settings, has developed the best brochures available, and is increasing its health information dissemination and child advocacy roles. Best of all, ASDC continues to foster friendships between people who care for children.

This past year your ASDC Board of Trustees has produced a balanced budget, increased membership, reestablished national continuing education seminars, revised the Constitution and Bylaws, produced an Internet Web Page, translated two brochures into Spanish, increased linkage with child advocacy groups, encouraged closer ties with the Academy of General Dentistry and the American Academy of Pediatric Dentistry, published a Policy Statement on Tobacco Use in Children, and under the strong management and leadership of Peter Fos developed a Strategic Plan into the 21st Century.

Our recent Annual Meeting at the Westin Canal Place on the Riverwalk in New Orleans confirmed our vitality as well as again demonstrating the enthusiasm and skills that our National Office Staff has for planning scientific programs around social extravaganzas and local tours. Attendance was significantly up. My compliments to Slavka Sucevic and Carol Teuscher for all their hard and thorough efforts. Our plans for next year in Naples, Florida are beginning to take shape, and I expect a record breaking turn-out for fun in the sun on the Gulf shore.

In my next message I will discuss our committees' charges and directions, plans and activities, to implement our Strategic Plan. I pledge to you that this year will follow the Fos tradition. This year will be another year of action, not just of words. When I ask for your help and support, please respond promptly and with zeal, with wings on your feet and hope in your heart, that ASDC will continue to be that home of friendships for those who love and care for children.

John M. Willis

# EDITORIAL

## We are the stories we tell

We have all told stories to children at some times in our lives; and we have listened to children tell their stories. How many of us, however, have considered the value of story telling to the development of children. Susan Engle (*The stories children tell*. New York: W.H. Freeman and Company, 1995, pp 8,9) explains that during the 1960s and 1970s, when psychologists began to use the computer as a model for the mind and developed new methods of research, an emphasis on the way we think was reintroduced into psychology. Research on information processing, she continues, described human thought and resulting behavior in terms of decision trees, flow charts, and various other computer processes. The young child's mind was described as a series of processing rules, nested in ways that allow the child to build increasingly complex strategies as a function of his daily experiences.

What followed was that some of the ideas that grew from information processing led psychologists to look at the stories of children as well as of adults in a provocative new way. Stories are not simply signs of developmental competence, we also think through stories. Engle explains that cognitive psychologists have suggested that narratives are the form in which we organize experience, and that stories guide our memories and our experiences of what is happening and what may happen. In essence we take in fragments of information and organize them in narrative form.

As a result of this new emphasis on how we think we are allowed to take a fresh look at children's experiences, at what children say, and at the role of meaning in guiding how we think. Jerome Bruner said "that while we may learn about the physical world through logical rules and abstract principles, we learn about the social world through narratives. As children take in the stories they hear all around them, they also take in a particular interpretation of events and experience. People experience their lives as a series of overlapping and fluctuating stories." (Bruner, Jerome: *Acts of meaning*. Cambridge: Harvard University Press, 1990).

This idea explains how children integrate with their culture: listening to and telling stories are cultural activities. Through stories children learn about their culture and certain aspects of their culture influence the way they think about experiences.

How do we become storytellers? The three-year-old

weaves fragments of memory into a narrative. From the beginning the child acquires language by collaboration with its parents. During the first year following birth, parents are inclined to talk about many things to their children. Virtually all children are surrounded by language, and influenced by the cadence and intonations, probably as much as by the words themselves. It is noticeable that as infants approach an age when they become language users themselves, parents are inclined to simplify their vocabulary and their syntax. The clinician does the same thing when he attempts to explain a procedure to a patient. When the patient in turn repeats the explanation to a friend or family member, it will be in narrative form.

As adults, we need to know that every moment we spend with a child becomes a part of his development. What he sees in our faces and gestures becomes as much a part of his memory as the words themselves. Engle (*ibid*) explains, "Social and cognitive development are interwoven; grasping the physical world occurs through social interaction."

As clinicians we can take advantage of the opportunity to interact with our pediatric patients by recognizing the contributions we can make to their development. After we have explained what we are about to do—or what we have done—encourage the child to ask questions or to explain in his own words what he expects will be done. The techniques of storytelling can improve substantially our relationship with children. By encouraging such interchange, we can help the child develop a positive attitude toward health care, an attitude that will become a favorable and pleasant chip in his memory of dental experiences.

Quoting Engle, "Whether a particular story is remembered or not, the act of telling a story is always important to the developing child, because in the telling the child is both practicing telling stories and building up an inventory of stories that contribute to a life story and a self-representation. Who knows how he will use, save, savor, and blend these stories in the future. Why does that matter? Because to a great extent we are the stories we tell, and our memories of personal experiences are what give us a history and a sense of who we are—past, present, and future."

## CLINIC

# Effect of supervised use of an alum mouthrinse on dental caries incidence in caries-susceptible children: A pilot study

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**I**n many countries the prevalence of dental caries has declined in children during the past three decades. While many factors have probably contributed to this trend, there is a broad consensus that fluoridated water and fluoride-containing dentifrices have played the major role.<sup>1,2</sup> In spite of the progress, however, the optimistic view that the disease of caries will soon be eliminated is not supported by the epidemiologic data, and there are indications that this trend has ended.<sup>3,4</sup> Although almost half of U.S. children are caries-free, by age seventeen only 16 percent have no tooth decay. Furthermore, just 5 percent of adults (18 to 65 years) are caries-free, which indicates that caries attacks persist unrelentingly throughout life.<sup>5</sup> Thus, it is evident that fluoride (F) can still be considered only as partially effective in controlling caries.

In recent years, increasing prevalence of dental fluorosis has been reported for children from both fluoridated and nonfluoridated communities, apparently due to intake from various fluoride sources, including water, supplements, dentifrices, topical applications, and diet, but mainly fluoride-containing dental products.<sup>6,7</sup> To-

gether with studies purporting possible adverse health effects from fluorides, these observations justify a broadening of current caries-prevention strategies that presently rely heavily on fluoride products, to include the incorporation of antimicrobial or other chemotherapeutic agents in dental products.<sup>8-10</sup>

Many potential anticaries agents, other than fluoride, have been investigated and have demonstrated significant activity in a variety of laboratory and animal models as well as human clinical trials. Salts of polyvalent metals (e.g. Al, Cu, Fe, Sn, Sr and Zn), which represent one category of chemotherapeutic agents, have exhibited positive effects and some appear to have significant anticaries potential. Their use as anticaries agents without fluoride present, however, has not been investigated in clinical trials.

Aluminum (Al), which has been used in oral preparations since ancient times, in particular has demonstrated potential as a cariostatic agent.<sup>11,12</sup> Al salts can inhibit growth of oral bacteria, and reduce their ability to colonize enamel surfaces.<sup>13-19</sup> Another possible cariostatic mechanism of Al involves its interaction with dental enamel. A number of investigators have shown that Al reacts with intact enamel, powdered enamel, or synthetic apatite crystals, reducing the susceptibility to subsequent acid dissolution.<sup>20-26</sup>

Recent animal studies have demonstrated that Al, both in aqueous solution and in a compatible mouthrinse

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formulation, was effective in reducing dental caries formation in rats.<sup>27,28</sup> Furthermore, mouthrinsing with Al solutions has inhibited plaque accumulation in humans, and reduced the pathogenicity of plaque.<sup>29-32</sup> Although no human caries trials of Al alone have been reported, topical applications (3-4 times per year) of a solution containing Al, Fe, and F have been investigated in combination with bimonthly mouthrinsing using a F solution.<sup>33-35</sup> In every trial the Al-containing treatment resulted in better caries reductions than F alone. These findings imply that regular rinsing with Al solutions may inhibit caries development in humans. Due to natural astringency, however, Al solutions must be formulated into a compatible, flavored mouthwash vehicle to be acceptable for daily use by humans.<sup>36</sup>

The objective of this pilot clinical study was to compare the effect on dental caries formation in caries-susceptible children of daily supervised rinsing for a one-year period with a specially formulated, palatable mouthrinse containing 0.02 M alum (i.e. 500 ppm Al) versus home use of an ADA-recognized anticaries F dentifrice. Another goal was to investigate the cariostatic activity of using the alum mouthrinse in combination with the F dentifrice.

## METHODS AND MATERIALS

### Experimental design

This randomized clinical trial was a double-blind comparison of three parallel groups of children who used a test or placebo mouthrinse once daily under supervision in conjunction with home use of a placebo or F dentifrice for a twelve-month period. Dental caries was assessed by two independent examiners at entry, six months, and twelve months. For monitoring safety, soft tissue examinations were performed during each session, as well as after a month of product use. In order to reduce sample size and maintain experimental efficiency, subjects were preselected on the basis of initial caries.<sup>37</sup> Subjects with evidence of caries activity were stratified according to gender, age, and previous caries experience, then randomly assigned to one of three balanced groups.

### Study population

After approval of the protocol by the University's IRB, volunteers were recruited from the fifth and sixth grades of three elementary schools in a rural area of northcentral Indiana, where potable ground and community water supplies were fluoride deficient (< 0.4 ppm F).

These children were selected because they received little dental care and a large percentage of their first permanent molars were carious. Signed consent forms were obtained from children and their parents or guardians, after the nature of the study and possible risks were fully explained. A total of 260 caries-susceptible children (average age = 10.7 years) was accepted into the trial after completing a medical history questionnaire and receiving an oral examination. Subjects were initially screened for the presence of decayed, missing, or restored tooth surfaces in both primary and permanent dentitions. If no evidence of decay was present, the subject was not accepted into the study. Subject selection was based on good general health, no serious medical problems or transmissible diseases. Participants were not discouraged from receiving necessary dental treatment, but those undergoing orthodontic treatment were not allowed to participate. Approximately 370 volunteers were initially screened of which 30 percent were disqualified.

### Treatment regimen

Treatment consisted of once-daily supervised use of a mouthrinse and unsupervised home use of a dentifrice. The three treatment combinations and codes were as follows:

- P + F = Placebo mouthrinse and sodium fluoride dentifrice (code red).
- A + P = Alum mouthrinse and placebo dentifrice (code white).
- A + F = Alum mouthrinse and sodium fluoride dentifrice (code blue).

In order to maintain the double-blind status and the same usage patterns, the F dentifrice group was provided with a placebo mouthrinse and the alum mouthrinse group with a placebo dentifrice. For ethical reasons a negative control group (i.e. placebo rinse and placebo dentifrice) was not included.<sup>38</sup> The alum mouthrinse contained 500 ppm Al and was prepared as 0.02M (i.e. 0.885 percent)  $\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$  using a combination of nonionic surfactants<sup>a,b</sup> in a flavored, alcohol-free rinse vehicle at pH 3.8.<sup>30,36</sup> The placebo mouthrinse comprised the same rinse vehicle without Al. The F dentifrice<sup>c</sup> contained 1100 ppm F, and the placebo dentifrice contained no F or Al. The appearance, flavor, and packaging of the dentifrices and the mouthwashes were as

<sup>a</sup>Pluronic F127®, BASF Wyandotte Corporation, Parsippany, NJ 07054.

<sup>b</sup>Tween 20®, Ici Americas Inc., Wilmington, DE 19897.

<sup>c</sup>Crest® Toothpaste with Fluoristat®, Procter & Gamble Co., Cincinnati, Ohio 45202.

similar as possible. Sufficient quantities of the respective products were provided for the participants and their families to use throughout the study. Participants with the same telephone number or address were assigned to the same group to avoid confusion with different test products in the same household. In order to promote compliance and to provide variety, the flavor of the mouthrinses was changed monthly.

### Supervised rinsing

Supervised mouthrinsing sessions at each school were started soon after the children received their baseline examinations. During each school day a 10-ml volume of mouthrinse was used for thirty seconds under direct supervision after the noon meal at the school sites. A supervisor at each school was hired and trained to instruct the subjects in the proper rinsing procedure, to dispense and administer mouthrinses, and to time the daily rinsing regimen. The rinsing supervisors also maintained daily diaries of subject usage and dropouts. Group assignment was based on a color code of red, white and blue, as described above, to simplify the rinsing regimen. Test rinses were supplied in plastic containers equipped with calibrated dispensers and color coded according to group. Rinses were dispensed in appropriate red, white, or blue plastic cups, which were administered to the children in the specific color group. After rinsing, the children expectorated into the cups, placed them in a waste can, and returned to their classrooms. A clinical coordinator periodically monitored the rinsing programs at each site and ensured that sufficient test products were always available. When school was not in session, the rinses were self-administered at home under parental supervision. A sufficient supply of mouthrinse, calibrated dispensing cups, and written instructions were mailed to the parents of each participant at various intervals during the trial. Subjects used their assigned dentifrices ad libitum in accordance with their normal oral hygiene practices.

### Clinical procedures

Examinations were conducted at the school sites, using portable dental and radiographic equipment and standardized conditions of light, compressed air, dental explorers<sup>d</sup> and mouth mirrors. Each child received a clinical examination by two independent dental examiners at entry and then six and twelve months after be-

ginning the treatment regimen. The caries scores were dictated to trained recorders, who entered the data on separate case report forms for each subject. Licensed hygienists obtained posterior bite-wing radiographs for each subject at each examination. The films were developed on site in the event that retakes were necessary. Double-film packets<sup>e</sup> were used in order to provide each examiner with a set of radiographs for independent analysis. Also, a complimentary set was later sent to each subject's family dentist if requested. Before each examination period, the examiners and clinical staff participated in an organization session that allowed the examining team to review the procedures. These sessions provided an opportunity for the examiners and principal investigator to review the diagnostic criteria, but the examiners were not calibrated to each other.

### Caries assessments

Each subject was independently examined for clinical caries by two examiners, using the criteria established by the Conference on Clinical Testing of Cariostatic Agents.<sup>39</sup> Both examiners had extensive experience in assessing caries in clinical trials. The radiographs were scored independently by each examiner at a later date, and the results subsequently were incorporated with the clinical findings. After each examination period, referral letters were sent to the parents of all subjects in need of immediate dental care, and the school nurses were also informed.

### Intraoral examinations

Subjects were surveyed at each visit for possible soft and hard tissue reactions resulting from the treatment regimens. The intraoral examination included a visual inspection of the buccal, labial, and sublingual mucosa, gingivae, tongue, hard and soft palate, oropharynx, floor of the mouth, lips, and teeth. The site, size, and severity of any lesions or aberrations and tentative diagnosis, if possible, were recorded. A judgement was made as to whether or not any abnormalities were attributable to the test materials.

### Data analysis

Average incremental changes in DMFT(S) scores for each subject were calculated for both examiners and an-

<sup>d</sup>Premierlite Exp 23, Premier Dental Products.

<sup>e</sup>Kodak Ektaspeed EP-22 High-Speed DX Film, Eastman Kodak Co., Rochester, NY 14650.

alyzed by means of a statistics program.<sup>f</sup> Statistical tests included analysis of variance and LSD comparisons between groups, using a 1-tail test.<sup>40</sup> The caries data also were examined for

- Development of new decay with respect to tooth location and tooth surface type.
- Caries formation in permanent teeth erupting during the study.
- Number of caries reversals.

## RESULTS

### Baseline balance

The population demographics and baseline balance at the beginning of the trial and after six and twelve months are presented in Table 1. The initial allocation of subjects resulted in three treatment groups that were comparable in terms of gender, age, and average DMFT and DMFS for both examiners. The baseline balance among groups for gender, age, and caries prevalence was maintained at the interim and final examinations. Approximately 6 percent and 10 percent of the participants were lost from the study after six and twelve months, respectively. Attrition was due primarily to changes in residence, although a few subjects began orthodontic treatment. The attrition rate was comparable for all groups.

### Dental caries increments

The caries increments (i.e. the increase in the number of decayed, missing and filled permanent teeth and surfaces) for the children in each group after following the treatment regimen for six and twelve months are provided in Table 2 for both examiners. For Examiner CES after six months, the alum mouthrinse/placebo dentifrice (i.e. A + P) group and the alum mouthrinse/fluoride dentifrice (i.e. A + F) group had 42 percent and 41 percent fewer DMFT, respectively, than the placebo mouthrinse/fluoride dentifrice (i.e. P + F) group. These differences were statistically significant at  $p < 0.05$ . Similarly, the A + P and A + F groups had 36 percent and 45 percent fewer DMFS, respectively, than the P + F group, but the difference for the A + P group was of borderline significance (i.e.  $p = 0.06$ ). For examiner CES after twelve months, the DMFT scores for the A + P and A + F groups were 39 percent and 32 percent less, respectively, than the P + F group. Although the A + P group was statistically better than the P + F group, the difference for the A + F group was of borderline significance ( $p = 0.06$ ). For the corresponding DMFS scores at twelve months, the A + P group had 40 percent ( $p = 0.02$ ) and the A + F group had 32 percent ( $p = 0.06$ ) less DMFS than the P + F group.

For examiner CWG after six months, when compared to the P + F group, the A + P and A + F groups exhibited 24 percent and 10 percent less DMFT, respectively, and 25 percent and 21 percent less DMFS, respectively. None of the differences were statistically significant. For examiner CWG after twelve months, the DMFT and DMFS reductions for the A + P and A +

<sup>f</sup>SAS® Statistical Analysis System, SAS Institute Inc., Cary, NC 27511.

Table 1 □ Baseline demographics and caries prevalence.

Treatment		Sex			Age		Examiner CES				Examiner CWG				
Rinse	Dentifrice	N	M	F	Mean	SEM*	DMFT		DMFS		DMFT		DMFS		
							Mean	SEM*	Mean	SEM*	Mean	SEM*	Mean	SEM*	
Subjects starting study															
Placebo	Fluoride	86	41	45	10.6	0.2	3.41	0.31	4.78	0.50	2.95	0.29	4.02	0.45	
Alum	Placebo	87	42	45	10.6	0.2	3.32	0.27	4.78	0.50	2.77	0.27	4.00	0.48	
Alum	Fluoride	87	42	45	10.7	0.2	3.31	0.32	5.06	0.58	2.79	0.29	4.32	0.55	
Subjects completing 6 months															
Placebo	Fluoride	77	36	41	10.7	0.2	3.51	0.35	4.90	0.55	3.06	0.31	4.17	0.49	
Alum	Placebo	80	37	43	10.6	0.2	3.36	0.28	4.90	0.53	2.83	0.28	4.13	0.50	
Alum	Fluoride	80	38	42	10.6	0.2	3.30	0.34	5.08	0.62	2.76	0.31	4.33	0.59	
Subjects completing 12 months															
Placebo	Fluoride	78	37	41	10.6	0.2	3.49	0.34	4.90	0.55	3.04	0.31	4.14	0.49	
Alum	Placebo	79	37	42	10.6	0.2	3.29	0.29	4.75	0.54	2.73	0.29	3.95	0.51	
Alum	Fluoride	77	38	39	10.6	0.2	3.31	0.35	5.09	0.64	2.81	0.32	4.38	0.61	

\*Standard error of the mean.

Table 2 □ Caries increments for subjects completing treatment regimen.

Examination	Treatment		N	Δ DMFT					Δ DMFS				
	Rinse	Dentifrice		Mean	SEM*	% Red	z	Sig <sup>†</sup>	Mean	SEM*	% Red	z	Sig <sup>†</sup>
Examiner CES													
6-Month	Placebo	Fluoride	77	1.00	0.16	—	—	—	1.62	0.27	—	—	—
	Alum	Placebo	80	0.58	0.17	42%	1.82	p = 0.04	1.04	0.27	36%	1.55	p = 0.06
	Alum	Fluoride	80	0.59	0.14	41%	1.93	p = 0.03	0.89	0.22	45%	2.15	p = 0.02
12-Month	Placebo	Fluoride	78	1.33	0.21	—	—	—	2.15	0.35	—	—	—
	Alum	Placebo	79	0.81	0.18	39%	1.89	p = 0.03	1.29	0.27	40%	1.98	p = 0.02
	Alum	Fluoride	77	0.91	0.16	32%	1.59	p = 0.06	1.47	0.28	32%	1.55	p = 0.06
Examiner CWG													
6-Month	Placebo	Fluoride	77	0.75	0.14	—	—	—	1.22	0.23	—	—	—
	Alum	Placebo	80	0.57	0.14	24%	0.92	p = 0.18	0.92	0.20	25%	0.98	p = 0.16
	Alum	Fluoride	80	0.67	0.15	10%	0.38	p = 0.35	0.97	0.22	21%	0.78	p = 0.22
12-Month	Placebo	Fluoride	78	1.12	0.17	—	—	—	1.90	0.26	—	—	—
	Alum	Placebo	79	1.04	0.17	7%	0.34	p = 0.37	1.59	0.24	16%	0.88	p = 0.19
	Alum	Fluoride	77	1.06	0.19	5%	0.24	p = 0.40	1.66	0.32	13%	0.59	p = 0.28

\*Standard error of the mean.

<sup>†</sup>For 1-tail test and  $\sigma = 0.05$ , critical  $z = 1.65$ .

F groups relative to the P + F group were smaller than at the six-month examination, and the differences were not significant.

### Caries-free subjects

Caries-free volunteers (both primary and permanent dentitions) were not allowed to participate in this study. Subjects with  $dmft(s) > 0$ , but no decayed permanent teeth (i.e. initial DMFT(S) = 0), were included, however, in the study. Figure 1 presents the percentage of participants in each group with caries-free permanent dentition during the course of the study for both examiners. At the baseline approximately 10 percent and 15 percent of the subjects were scored as caries-free by examiners CES and CWG, respectively. For examiner CES the percentage of caries-free subjects remained essentially unchanged in the two groups that used the alum mouthrinse at the six- and twelve-month examinations, while the percentage in the group that used the placebo mouthrinse dropped for each interval. For examiner CWG the percentage of caries-free subjects also declined more in the P + F group than the A + P and A + F groups.

### Caries-susceptible subjects

Figure 2 presents the percentage of subjects who experienced an increase in dental caries after six and twelve months. Examiner CES found that 65 percent of the subjects in the P + F group developed new carious lesions compared to approximately 53 percent in the two alum mouthrinse groups by the end of the study. For

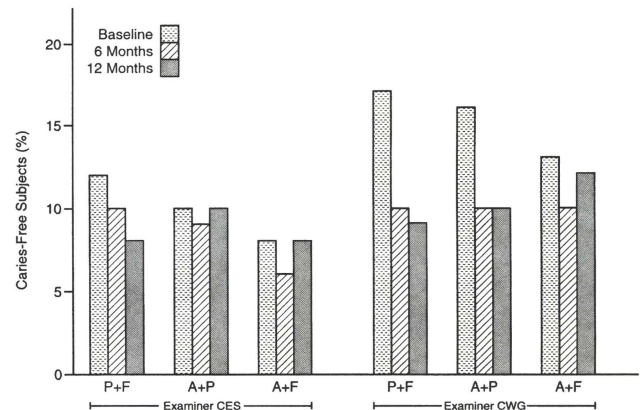


Figure 1. Subjects with caries-free permanent dentition. Note: these subjects were accepted into the trial based on carious lesions in the primary teeth. (P + F = placebo rinse and fluoride dentifrice, A + P = alum rinse + placebo dentifrice, A + F = alum rinse + fluoride dentifrice).

examiner CWG, however, approximately 60 percent of the subjects in all groups formed some new decay during the study. These data indicate the percentage of subjects who developed new caries during the study, but do not reflect the total amount of decay occurring per subject.

### Location of new caries formation

Figure 3 summarizes the number and location of newly decayed, missing, and filled tooth surfaces (ADMFS) for examiner CES after six and twelve months. The greatest increase occurred on occlusal surfaces of posterior teeth,

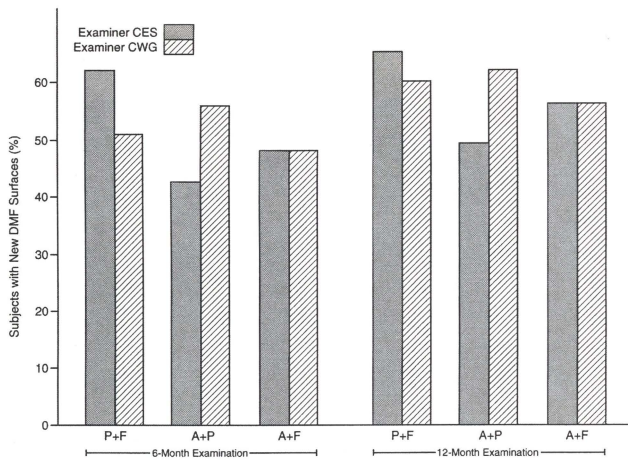


Figure 2. Percentage of subjects with an increase in caries. (P + F = placebo rinse and fluoride dentifrice, A + P = alum rinse + placebo dentifrice, A + F = alum rinse + fluoride dentifrice).

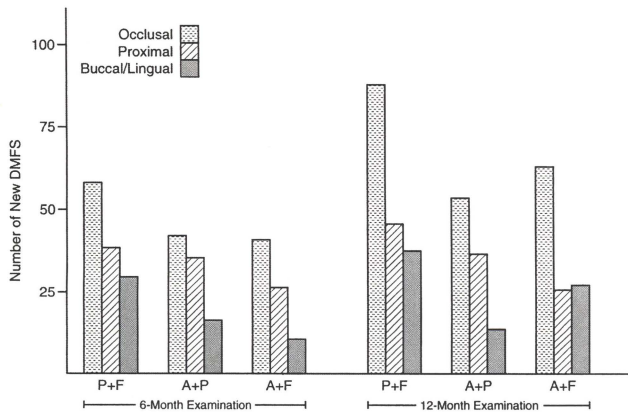


Figure 3. Number and location of newly decayed, missing and filled surfaces ( $\Delta$ DMFS). (P + F = placebo rinse and fluoride dentifrice, A + P = alum rinse + placebo dentifrice, A + F = alum rinse + fluoride dentifrice).

followed by proximal and buccal/lingual surfaces. At both examinations the P + F group had greater numbers of new carious areas in all three surface categories than the A + P and A + F groups.

### Newly-erupted teeth

Figure 4 compares by group the number of sound teeth that erupted during the study with those that became carious after six and twelve months. Approximately 1.7 teeth per subject erupted after six months with an additional new tooth per subject present after twelve months. Few newly-erupted teeth became carious: after twelve months 10 percent in the P + F group had de-

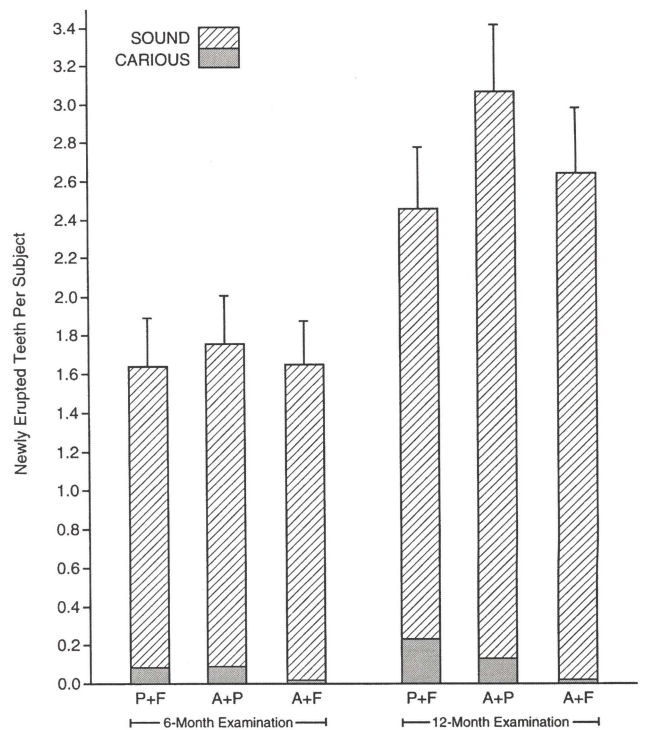


Figure 4. Mean number of sound and carious newly-erupted teeth. (P + F = placebo rinse and fluoride dentifrice, A + P = alum rinse + placebo dentifrice, A + F = alum rinse + fluoride dentifrice).

veloped decay, but less than 5 percent was observed for the two alum rinse groups. For caries development in the newly-erupted teeth, the predominate locations were the posterior occlusal surfaces.

### Caries reversals

The number of surfaces diagnosed as carious at baseline and sound after six and twelve months are presented in Figure 5. Both examiners observed that a greater number of reversals occurred in the A + P and A + F groups than the P + F group. Because reversals can be due to random error associated with tactile scoring by examiners, Figure 5 also includes columns showing the total number of reversals for which both examiners were in agreement. Again, the number of reversals was greater in the two alum mouthrinse groups than the placebo mouthrinse group.

### Soft tissue health

No adverse oral effects attributable to any treatment regimens were observed during the study. Due to the low incidence of soft tissue aberrations in this population, the soft tissue findings are not presented.



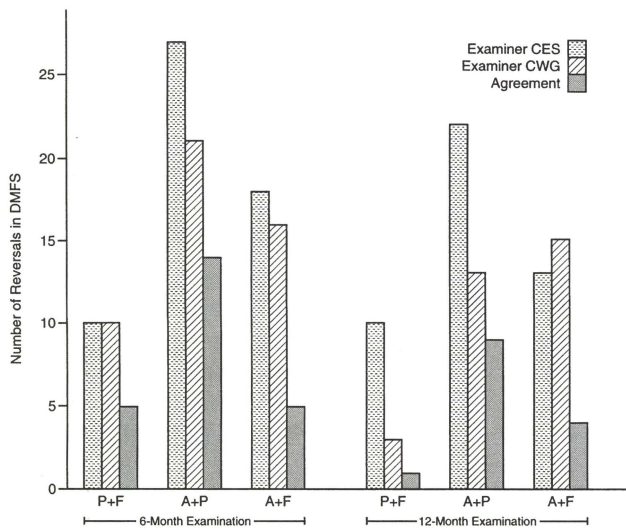


Figure 5. Reversals in caries. (P + F = placebo rinse and fluoride dentifrice, A + P = alum rinse + placebo dentifrice, A + F = alum rinse + fluoride dentifrice).

### Supervised usage

No compliance problems associated with the supervised mouthrinsing program were observed during the school year, which encompassed the first eight months of the trial. Rinsing records of the supervisors showed that few subjects missed the daily treatments. Missed treatments were due primarily to absences resulting from unrelated minor illnesses. Self-reported usage (from diaries) during vacation periods, in which subjects rinsed at home under parental supervision, indicated that approximately four treatments were performed per week.

### DISCUSSION

Before undertaking a clinical trial of a new cariostatic agent, a series of *in vitro* and animal studies was conducted to demonstrate the probable efficacy of solutions and mouthrinses containing Al.<sup>20,22,27,28</sup> The collective evidence from these investigations was considered sufficiently compelling to proceed with this pilot study. Because some investigators argue that it is unethical to withhold F, a proven caries prophylactic agent, from a subject, it is impossible to establish whether a new cariostatic agent is beneficial in its own right.<sup>38</sup> Thus, ethical considerations precluded the use of a true negative control. A compromise was used in the design of this trial, in which the test agent was incorporated in a mouthrinse, by providing a clinically proven NaF-silica dentifrice to subjects who were assigned a placebo mouth-

rinse.<sup>41</sup> Subjects who used the test mouthrinse were divided into two groups that used either the F dentifrice or a non-F placebo dentifrice. In this way subjects received the potential benefits of the alum mouthrinse or the known benefits of the F dentifrice.

The length of this trial was limited to twelve months and included an interim assessment of caries (i.e. after just six months of treatment) in order to reduce the risks associated with subjecting participants to a new agent that might confer little or no cariostatic protection.<sup>42</sup> Although a previous four-week plaque/gingivitis evaluation demonstrated that the same alum mouthrinse caused no side effects in children, an additional safety factor was built into the design of this trial by performing a soft tissue examination following the first month of treatment.<sup>30</sup> By means of this strategy, potential problems or adverse events could be detected early and, if necessary, the trial could be stopped before any subjects were exposed to undue risk.

Because this trial involved a new anticaries agent, bitewing radiographs were obtained during each examination session to detect proximal lesions and to supplement the tactile findings.<sup>43</sup> Although considered unnecessary by some clinical investigators, there is general agreement that additional information can be obtained radiographically.

Several additional precautions were taken to reduce potential risks associated with daily use of a new anticaries agent. Multiple approaches were taken for decreasing the study duration and for increasing the homogeneity of the population in order to improve the efficiency of the experimental clinical trial and to give the alum mouthrinse the best chance of demonstrating efficacy while maintaining minimal risks to participants. A caries-susceptible study population was identified in a rural area with fluoride-deficient drinking water and a relatively low socioeconomic status, which is associated with a greater caries risk.<sup>44</sup> In accordance with recommendations made by Downer *et al* preselection, was based on caries experience, in order to reduce sample size and shorten the study time.<sup>37</sup> Caries experience in primary teeth has been shown to be a useful predictor for subsequent caries formation in the permanent dentition.<sup>45,46</sup> By excluding subjects who are likely to experience little or no caries over the course of a trial, great gains in efficiency are possible and sample size can be reduced substantially.<sup>47</sup> This approach also reduced the risk associated with using a clinically-unproven caries-preventive agent with a larger number of subjects.

Age is a critical factor in subject selection, for many reasons, of which the most important is the number of

tooth surfaces at risk. Subjects with an initial age of approximately eleven years were chosen, since they were entering a period of high caries activity, as many permanent teeth erupted, and were also likely to remain at the same school during the trial period.<sup>48</sup> In addition to the double-blind study design, two examiners assessed every subject independently to help minimize examiner bias.<sup>49</sup>

Initial balance of demographic and caries prevalence data was retained at both six- and twelve-month examinations following the loss of 10 percent of the study population, primarily reflecting children moving out of the district or beginning orthodontic treatment. An attrition rate of 10 percent per year is considered normal for caries trials.<sup>50</sup>

Caries increments (DMFT and DMFS), as determined by both examiners after six and twelve months, were lower in the two groups that used an alum mouthrinse daily (supervised five days per week) than the group that rinsed daily with a placebo mouthwash and brushed at home with a F dentifrice. Furthermore, for one examiner these differences, which ranged from 32 percent to 45 percent, were significant in almost every case. This was an unanticipated result, since equivalence with the F dentifrice group was considered a very successful clinical outcome. An interesting finding is that the alum rinse group that used a non-F dentifrice at home achieved the same effect as the alum rinse group that used the F toothpaste. Thus, although deprived of the benefits of a F-containing dentifrice, the children who used the alum mouthrinse had less caries development than those who brushed with the F product. This F dentifrice has been shown to reduce caries by approximately 40 percent when used *ad libitum* by children residing in a low-F area similar to the area reflected in this study.<sup>41</sup>

Increased F uptake by enamel has been observed in laboratory and animal studies involving sequential treatments of Al and F (reviewed by Kleber and Putt), but the effect on caries in a rodent model was equivocal.<sup>12,27</sup> Nevertheless, it was assumed that if the alum rinse was found to inhibit caries in this study, the effect might be increased by using a F dentifrice. The alum rinse/F dentifrice combination failed, however, to produce a greater effect than the alum rinse/placebo dentifrice regimen. There are several possible explanations for this result. First, increased F uptake *in vitro* and in rodent models may not be predictive of anticaries activity in humans. This seems very possible in view of the tentative relationship between F uptake and caries inhibition. Second, other sources of F in the children's environment may

have been sufficient to react with Al-treated enamel, to produce additive or synergistic effects. Although the children resided in a low-F area, their exposure to F was by no means eliminated. Exposure to high levels of F was minimized by providing a non-F dentifrice and requesting that local dentists not apply topical F to children in the study population. F typically is present, however, in food and beverages that are often processed in and imported from fluoridated areas. As a result of the affinity of Al for F, even low levels of F from exogenous sources may be sufficient to provide a synergistic effect with Al. This explanation is supported by recent evidence that extremely low levels of Al and F (e.g. 0.02 ppm) can react with enamel and significantly inhibit its dissolution by acid.<sup>26</sup> Third, brushing habits at home may have been so poor that the subjects in the two groups assigned the F dentifrice did not obtain the benefits of this treatment. Although the children were selected for being caries-prone, probably due in part to inadequate oral hygiene, it seems unlikely that they brushed so infrequently that they did not derive any cariostatic benefits from the use of a F toothpaste. If this were true, the placebo mouthrinse/F dentifrice treatment would have represented a true negative control, and comparable reductions would have been anticipated for the alum rinse groups regardless of the dentifrice used. Nevertheless, for all these explanations, it still is evident that the alum mouthrinse inhibited caries formation.

Although caries-free subjects were not accepted into the trial, some subjects with caries of the primary teeth, but no decay of the permanent dentition, began the study. Over twelve months the number of subjects with caries-free permanent teeth declined by half in the placebo rinse/F dentifrice group, while essentially no change was observed in the two alum mouthrinse groups (Figure 1). Designation of the population as caries-susceptible was appropriate in that the control group, which used a placebo mouthrinse but still brushed with a F dentifrice, had an increase of more than two carious surfaces in just twelve months. Nevertheless, a substantial proportion of the children in all groups exhibited no change in dental caries during the course of the study (Figure 2). This may have been due, however, not only to the short duration but also to the treatment regimens. For example, a greater percentage of subjects in the placebo rinse group had a higher caries incidence than the two alum rinse groups at both the interim and final examinations.

As normally observed in caries clinical studies, the location of new carious lesions was greatest on occlusal

surfaces, followed by proximal, buccal and lingual surfaces (Figure 3). Effects resulting from alum mouthrinse treatment were largest on the occlusal and buccal surfaces. Cariostatic activity on the occlusal surfaces is particularly important since they are most susceptible to decay, and the protective effects of F are generally less on occlusal than smooth surfaces. For permanent teeth that erupted during the twelve-month trial, 10 percent of those in the placebo rinse/F dentifrice group became carious (Figure 4). Less than 5 percent of newly erupted teeth in the alum rinse/placebo dentifrice group and less than 1 percent in the alum rinse/F dentifrice group, however, developed lesions. The predominate location for new caries was the occlusal surfaces of molars. These results indicate that cariostatic effects of Al treatment may be greatest on newly erupting teeth.

Both examiners observed a decrease in caries incidence for children in the two groups that used the alum mouthrinse relative to the group that used a placebo mouthrinse and brushed with a F dentifrice. The decreases were statistically significant for one examiner, however, but not for the other. Differences between the two examiners appeared to be attributable to diagnosis of incipient lesions. The examiner who was more critical in diagnosing incipient caries also observed larger treatment effects. It should be noted, however, that he always examined second, and his higher scores may have been influenced, in part, by probing of the first examiner. Nevertheless, this examiner also observed slightly more caries reversals at both the interim and final examinations, which is consistent with a more critical diagnosis of nascent lesions.

The majority of reversals occurred on the occlusal surfaces of posterior teeth. The two alum rinse groups had approximately twice as many reversals as the placebo rinse/fluoride dentifrice group. In those cases where both examiners agreed (Figure 5), it is reasonable to assume that the reversals in carious lesions were probably due to remineralization (most likely from treatment effects) and not a result of misdiagnosis.

Benefits of a therapeutic agent cannot be assessed without also considering the associated risk. This pilot clinical study demonstrated no adverse experiences or meaningful changes with respect to oral soft tissue health, when an alum-containing mouthrinse was used daily for a year.

Both examiners observed that the caries incidence during the second six months of the study was less than half that of the first six months. In addition, the caries increments were approximately equivalent for all groups during the second half of the trial, so it appears that

most of the differences in treatment effects between groups occurred during the first six months. A possible reason for this effect is related to mouthrinsing compliance when school was not in session. During the first six months, mouthrinsing was performed under direct supervision at school five days per week and at home on weekends. On the other hand, because of summer vacation, all mouthrinsing was performed at home under parental supervision during the last four months of the trial. Participants in all groups recounted using the mouthrinses approximately four times per week during this time, but true use may have been only half the self-reported amount.<sup>51</sup>

In spite of public perception in industrialized countries that tooth decay has nearly been eliminated, dental caries is still a chronic health problem that continues throughout life. While the incidence of caries is declining in some subpopulations, prevalence of the disease remains very high overall. Although F is a highly effective cariostatic agent, it does not confer absolute protection against the disease, and with children there are concerns about over-exposure to F from multiple sources. Thus, it is important to continue the search for new treatments. This pilot investigation of an alum mouthrinse demonstrated clinically for the first time that daily topical applications of Al inhibited dental caries development in humans at least as effectively as home use of a F dentifrice. This benefit was obtained with no loss of safety, since adverse findings were not observed throughout the study. Thus, it is evident from this clinical trial that Al has promise as a cariostatic agent.

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# Damage to the primary dentition resulting from thumb and finger (digit) sucking

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**T**humb and finger-sucking are common habits among young children, being practiced by some 50 percent at one year of age.<sup>1-3</sup> The number decreases rapidly, however, by ages four to five years.<sup>1-3</sup> Traisman and Traisman reported the average age for spontaneous cessation of the thumb-sucking habit to be 3.8 years.<sup>2</sup> Many reports have related thumb and finger-sucking to malocclusions, particularly when continued for a long period of time.<sup>2,4-6</sup> Traisman and Traisman documented a highly significant difference in the number of malocclusions, 9.7 percent in thumb-suckers compared to 6.5 percent in non-thumb-suckers.<sup>2</sup> Johnson documented malocclusions in 989 patients and determined that 17.49 percent had sucked the thumb or finger.<sup>4</sup> Anterior open bite is the most frequent malocclusion reported with digit sucking.

Few studies have documented the influence of thumb and finger-sucking on both anterior and posterior components of the primary dentition. We investigated the influence of thumb and finger-sucking both in the anterior and posterior sections of the primary dentition in three age-groups (three, four and five years).

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## MATERIAL AND METHODS

This study consisted of a retrospective review of the charts of 2018 normal Japanese pediatric patients from three to five years of age, who had attended the Aichi-Gakuin University Pediatric Dental clinic. The respective nature of the oral habits was determined from the clinical records, which depended upon parent and patient answers as to the type of oral habit.

In order to investigate the relationship between thumb and/or finger-sucking and malocclusion, 930 subjects meeting the following inclusion criteria were selected from the original 2018 children:

- Those who only indulged in digit sucking.
- Those with no oral habits.
- Subjects with complete primary dentition and no permanent teeth erupting.
- Subjects with no dental caries, restorations and/or missing teeth.

The subjects were divided into two groups—those with no history of oral habits (671 children) and those who indulged in thumb or finger-sucking (259 children) (Table 1). Patients were categorized according to age, sex and presence or absence of the habit.

Data regarding anterior overjet, overbite and whether the second primary molars exhibited a mesial step, distal step or flush terminal plane were obtained from the clinical records and previously obtained study models

Table 1 □ Control and experimental subjects. (number of patients)

	Non-oral habits			Thumb and/or finger sucking			Total
	Male	Female	Total	Male	Female	Total	
3 yrs	175	141	316	56	79	135	451
4 yrs	106	99	205	40	51	91	296
5 yrs	74	76	150	13	20	33	183
Total	355	316	671	109	150	259	930

Table 2 □ Criteria for classification of primary occlusion.

Overjet	Normal
	Maxillary protrusion Mandibular protrusion
Overbite	Normal
	Open bite Deep overbite
Terminal plane	Normal range is defined as follows; Horizontal overlap distance between incisors is within 5 mm (including 0 mm)
	Normal range is defined as the vertical overlap distance approximately one-half of mandibular incisor, including edge to edge.
	Mesial step Flush terminal plane Distal step

Table 3 □ Types of oral habit of 2018 children.

	Number of children			Type of oral habit (Number of cases)				
	Total	Non-oral habits	Oral habits	Thumb & finger sucking	Nail biting	Bruxism	Lip sucking or biting	Others
3 years	918	561	357	195	74	59	14	47
4 years	622	360	262	129	59	57	21	23
5 years	478	285	193	76	50	51	12	23
Total	2018	1206	812	400	183	167	47	93
		(59.8%)	(40.2%)	(19.8%)	(9.1%)	(8.3%)	(2.3%)	(4.6%)

All figures represent the number of cases per 2018 subjects. Of 812 children who indulged some form of oral habit, 734 exhibited only one habit. However, 78 children actually indulged two oral habits. Thus there were 812 children exhibiting a total of 890 oral habits.

Table 4 □ Frequency of types of overjet. Number of patients (%)

		3 yrs	4 yrs	5 yrs
		Non-oral habits		
	Maxillary protrusion	30 (9.5)	20 (9.8)	15 (10.0)
	Normal	253 (80.1)	172 (83.9)	126 (84.0)
	Mandibular protrusion	33 (10.4)	13 (6.3)	9 (6.0)
Thumb and finger-sucking	Maxillary protrusion	32 (23.7)	15 (16.3)	8 (24.2)
	Normal	99 (73.3)	74 (80.4)	23 (69.7)
	Mandibular protrusion	4 (3.0)	3 (3.3)	2 (6.1)

mounted on hinged axis articulators. Mandibular protrusion was diagnosed, albeit somewhat arbitrarily, by what was considered to be an exaggerated mesial-step terminal plane relationship of the second primary molars. Occlusion details are depicted in Table 2.

Our hypothesis was that there would be a higher incidence of overjet and overbite in the thumb/finger-sucking group compared to age-matched controls who had no oral habit.

## STATISTICAL ANALYSIS

Data for the non-oral-habit group were compared with those for the thumb and/or finger-sucking group. Results were analyzed using the Chi-square test with  $p < 0.05$  being the level of significance.

## RESULTS

Of the original 2018 children, 1206 (59.8 percent) demonstrated no oral habits, while 812 (40.2 percent) indulged some form of oral habit. Of the 812 children who were determined to indulge an oral habit, 734 exhibited only one oral habit. Seventy-eight of the children, however, actually indulged two oral habits. Thus there were 812 children exhibiting a total of 890 oral habits; 400 (19.8 percent) indulged in thumb or finger-sucking. Other oral habits included nail biting (9.1

percent), bruxism (8.3 percent), lip sucking or biting (2.3 percent) (Table 3).

As previously documented, in order to investigate the relationship between digit sucking and malocclusion, 930 subjects meeting the investigative criteria were selected from the original 2018 children.

The frequencies of normal type overjet were 80.1 percent to 84.0 percent for the non-oral-habit group (depending on age) and 69.7 percent to 80.4 percent for the thumb and finger-sucking group. These were the highest frequencies for all ages in both groups. The fre-

## MAXILLARY PROTRUSION

quencies of maxillary protrusion of the non-oral-habit group were 9.5 percent in three-year-old children, 9.8 percent in four-year-old children and 10.0 percent in five-year-old children. For the thumb-sucking group the frequencies were 23.7 percent in three-year-old children, 16.3 percent in four-year-old children and 24.2 percent in five-year-old children. Comparing both groups, the frequencies of the thumb and finger-sucking group were higher at all ages than those of the non-oral-habit group, a particularly significant difference being noted in the three-year-old children ( $p < 0.05$ , chi-square test). In contrast with these results, the frequencies of mandibular protrusion for the thumb and finger-sucking group of

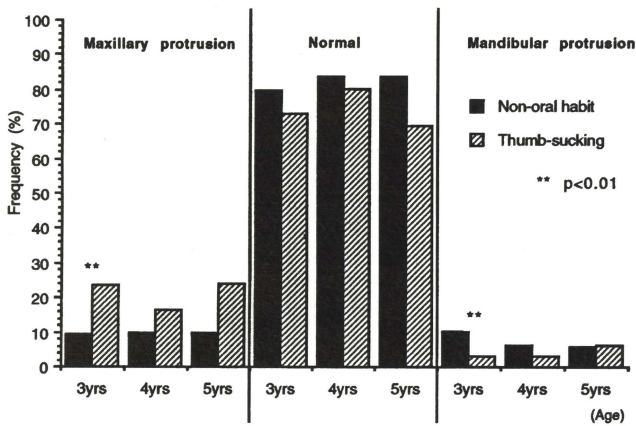


Figure 1. Comparison of types of overjet of thumb-sucking and non-oral habit groups.

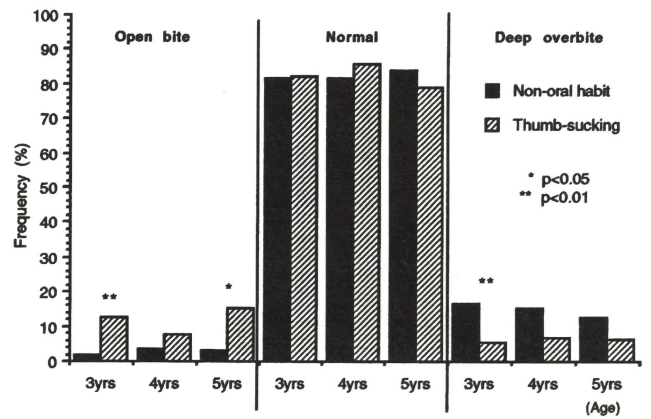


Figure 2. Comparison of types of overbite of thumb-sucking and non-oral habit groups.

three and four-year-old children were lower than those of the non-oral-habit group (Table 4, Figure 1).

Normal overbite frequencies were 81.5 percent to 84.0 percent for the non-oral-habit group, and 78.8 percent to 85.7 percent for the digit-sucking group. These frequencies were the highest for all ages in either group. The frequencies of open bite in the non-oral-habit group were approximately 2.0 percent to 3.0 percent in all age-ranges. For the digit-sucking group, the frequencies were 12.6 percent in three-year-old children, 7.7 percent in four-year-olds and 15.1 percent in five-year-olds. Comparing both groups, the digit-sucking group showed higher frequencies at all ages than the non-oral-habit group, a particularly significant difference being noted in the three and five-year-olds ( $p < 0.05$ , chi-square test). Contrasting with these results, the frequencies of deep overbite at all ages of the digit-sucking group were lower than those of the non-oral-habit group (Table 5, Figure 2).

Variations of terminal plane types in three and four-year-old children were not significant, when comparing the non-oral-habit group with the digit-sucking group. In the distal step type of four-year-old children, how-

ever, the frequency of the digit-sucking group (8.8 percent) was higher than that of the non-oral-habit group (2.9 percent). In five-year-old children, the mesial step terminal plane type of the digit-sucking group (27.3 percent) was less frequent than that of the non-oral-habit group (51.3 percent) and the distal step terminal plane of the digit-sucking group (12.1 percent) was noted more frequently than that of the non-oral-habit group (1.4 percent). Overall, these frequencies exhibited significant differences (Table 6, Figure 3).

## DISCUSSION

Without a doubt, thumb-sucking and finger-sucking are the most common of the numerous oral habits prac-

### OVERBITE AND OVERJET

ticed by children. This study examined the incidence of occlusal deformation, as demonstrated by overbite and overjet, in children who sucked their thumb or fin-

Table 5 □ Frequency of types of overbite. Number of patients (%)

		3 yrs	4 yrs	5 yrs
Non-oral habit	Open bite	6 (1.9)	7 (3.4)	5 (3.3)
	Normal	258 (81.5)	167 (81.5)	126 (84.0)
	Deep overbite	52 (16.5)	31 (15.1)	19 (12.7)
Thumb and finger-sucking	Open bite	17 (12.6)	7 (7.7)	5 (15.1)
	Normal	111 (82.2)	78 (85.7)	26 (78.8)
	Deep overbite	7 (5.2)	6 (6.6)	2 (6.1)

Table 6 □ Frequency of types of terminal plane. Number of patients (%)

		3 yrs	4 yrs	5 yrs
Non-oral habit	Mesial step	136 (43.0)	73 (35.6)	77 (51.3)
	Flush terminal plane	165 (52.2)	126 (61.5)	71 (47.3)
	Distal step	15 (4.8)	6 (2.9)	2 (1.4)
Thumb and finger-sucking	Mesial step	54 (40.0)	36 (39.6)	9 (27.3)
	Flush terminal plane	75 (55.6)	47 (51.6)	20 (60.6)
	Distal step	6 (4.4)	8 (8.8)	4 (12.1)

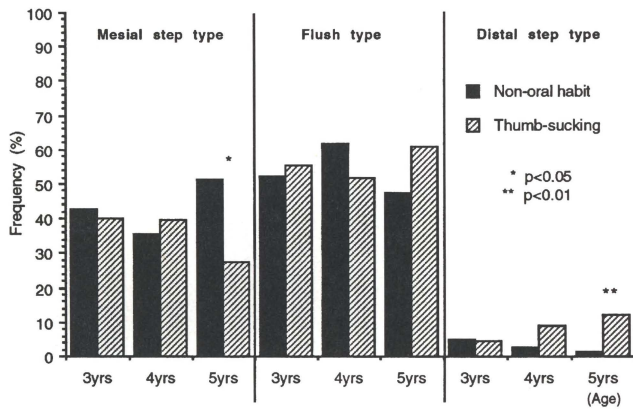


Figure 3. Comparison of types of terminal plane of thumb-sucking and non-oral habit groups.

ger, compared with those who did not indulge the habit. A secondary purpose of the study was to determine the most appropriate age for attempted elimination of the habit.

Numerous studies have reported on the perceived effects of digit sucking. Klackenberg studied 259 children between ages four and six years of age and reported that 50 percent had been thumb-suckers.<sup>1</sup> The number of those persisting with the habit gradually decreased with age, until only 21 percent were sucking their thumbs by age five years. Kurosu *et al*, reported an overall incidence of 13.8 percent in children between ages one and eleven years.<sup>3</sup> Our study reported the highest frequency of all documented oral habits with 40.2 percent of children exhibiting some type of oral habit, 19.8 percent indulging in thumb or finger sucking.

The frequency of thumb-sucking differs with each report. These differences may be due to many factors, including method and date of the investigation, age-range of subjects, race and social or nursing environment. The constant agreement of all these reports is that digit-sucking is the most common habit of young children.

Anterior open-bite and maxillary protrusion represent the most frequent malocclusion associated with digit-sucking. Traisman *et al* reported that 9.7 percent of thumb-suckers developed this malocclusion compared to 6.5 percent of non-thumb-suckers. Johnson *et al* reviewed 989 patients with malocclusion, ages ranging from two years and six months to nineteen years: 17.49 percent had a history of thumb or finger-sucking.<sup>4</sup>

Grabner, took the opposing view that some of the damaging consequences of the habit are related to hereditary type Class II, Division 1, malocclusion.<sup>5,6</sup> Clearly, accu-

rate investigation of damage to the occlusion resulting from thumb and finger-sucking requires careful comparisons between control and sucking groups. In order to exclude extraneous factors, the data in our study compared the digit-sucking group with the non-oral-habit group. We found a 23.7 percent incidence of maxillary protrusion in three-year-old children who sucked their thumbs. The figures were 16.3 percent for four-year olds and 24.2 percent for five-year olds. Open-bite frequencies for the digit-sucking group were 12.6 percent in three-year olds, 7.7 percent in four-year olds, and 15.1 percent in five-year olds. The frequency rates of open-bite and maxillary protrusion for the digit-sucking group were higher than the non-oral habit group at all ages.

## POSITIVE CAUSE

Clearly, thumb and finger-sucking in young children cause malocclusion of the anterior segments. In the present study, frequencies of open-bite and maxillary protrusion did not result in such a large difference at each age-group. It may be postulated, therefore, that damage to the anterior segment may result from thumb and finger-sucking at an early stage, before three years of age.

Studying the relationship between posterior malocclusion and digit-sucking, Johnson reviewed 153 patients between two and nineteen years of age and reported that 47.7 percent exhibited an Angle Class II malocclusion.<sup>4</sup> Unfortunately, this study did not include a control group, i.e. the non-oral-habit group.

In five-year-old children, the mesial step terminal plane occurred less frequently and the distal step terminal plane more frequently in the thumb-sucking group than in the non-oral-habit group. The frequencies in these groups showed significant differences. This increased tendency of the distal step type started with children age four-years. This led us to the conclusion that posterior damage, unlike anterior damage, is a late reaction and that changes in the terminal plane may be the result of a malocclusion intensified by protracted indulgence in the habit.

The most significant damage to the occlusion of the first permanent molars may occur shortly after this stage,

## CLASS II RELATIONSHIP

since the distal surfaces of the second primary molars guide the erupting first permanent molars into position. Arya *et al* and Nabeta *et al* noted, however, no case



exhibiting a distal step in the primary dentition in which the anteroposterior relationship was altered by eruption of the first permanent molar.<sup>7,8</sup> In every case the final occlusion of the permanent dentition was an Angle Class II relationship.

In this study, the influence of the terminal plane would appear to be in accordance with the opinions of Arya and Nabeta, supporting the view that thumb and finger-sucking should be eliminated before appearance of damage to the terminal plane.<sup>7,8</sup> Since the terminal plane begins to change at four years of age, the age of cessation should be three to four years. Graber held the view that the elimination age of thumb and finger-sucking should be three years of age.<sup>5,6</sup>

Clearly, natural correction of the malocclusion caused by thumb and finger-sucking is related not only to the degree of malocclusion, but also to lip and tongue function as well as that of other perioral musculature. It is our belief that the elimination age of thumb and finger-sucking is a most important factor. The evidence of this study points to three to four years of age as the most appropriate range, the period in which thumb and finger-sucking have been reported to stop spontaneously.<sup>2,3</sup>

## CONCLUSION

This study investigated the effects of thumb and finger-sucking on the anterior and posterior regions of the primary dentition of children three to five years of age: 400 (19.8 percent) of 2018 children were found to suck a finger or thumb.

At all ages, the frequencies of open-bite and maxillary protrusion for the thumb and finger-sucking group were

higher than the non-oral-habit group. The frequencies did not appear to be age-related. It was noted that the anterior region may be affected by thumb and finger-sucking at an early stage (before three years of age).

In five-year-old children, the mesial step terminal plane type of the thumb-sucking group demonstrated significantly lower malocclusion frequencies and the distal step terminal plane type significantly higher frequencies than those of the non-oral-habit group. There was an increased tendency to a permanent malocclusion in the distal step type in children who continued after four years of age.

The results of this study suggest that thumb and finger-sucking should be eliminated before damage is done to the terminal plane. This would appear to be between three and four years of age.

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## ADOLESCENT SMOKERS

Adolescents become addicted to cigarettes, with approximately one half attempting to quit and failing by the age of 17 years. This suggests that they may benefit from medical intervention to achieve abstinence, but there are no published studies of the risks and benefits of nicotine therapy in young patients. It would therefore be more important than in older patients to verify addictive smoking (e.g., by measurements of salivary cotinine or carbon monoxide in expired air) before treatment, to minimize the possibility that the medication would cause higher levels of tolerance and physical dependence than cigarette smoking.

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# Phenobarbital-induced gingival overgrowth? Report of two cases and complications in management

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**G**ingival overgrowth is a side-effect of the anticonvulsant medications, phenytoin, primidone, sodium valproate, mephenytoin, the immunosuppressant drug cyclosporine, and the calcium channel-blockers, nifedipine, verapamil and diltiazem.<sup>1-19</sup> Gingival overgrowth is not a reported side-effect of phenobarbital.<sup>20,21</sup> What follows are descriptions of two children with gingival overgrowth who had been treated with phenobarbital for control of seizures. Neither of these children had taken other seizure medications.

Phenobarbital, a barbiturate, is prescribed as a sedative hypnotic and anticonvulsant medication for generalized or partial seizures.<sup>20</sup> The usual initial anticonvulsant dose for children is 3-6 mg/kg/day and for adults 1-5 mg/kg/day.<sup>20</sup> Its most common side-effect is interference with cognition.<sup>20</sup> Other side-effects include, psychological and physical dependence; tolerance; confusion; poor judgement; irritability; hyperactivity; megaloblastic anemia, which responds to folate; and osteomalacia, which responds to high dosages of Vitamin D.<sup>20</sup> Prolonged use of a barbiturate also produces a nonspecific increase in the activity of the hepatic microsomal enzyme system, increasing the rate of metabolism of many drugs, Vitamin K, steroid hormones, cholesterol, bile salts, certain other endogenous substrates, and possibly Vitamin D.<sup>20,22</sup>

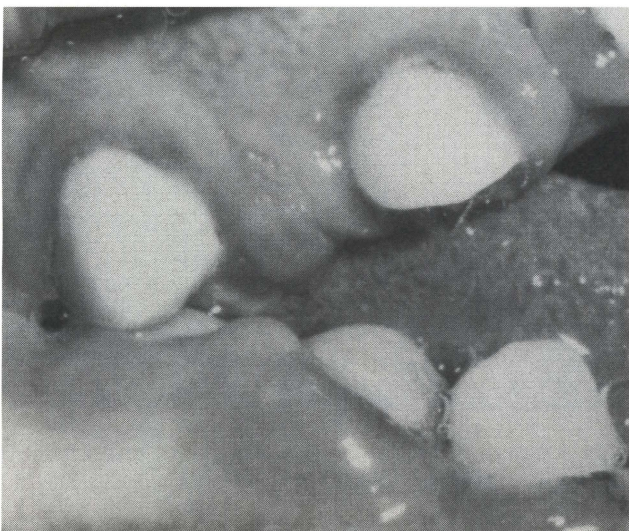
Panuska found a relationship between phenobarbital and gingival overgrowth in a study of 1048 patients who were undergoing anticonvulsant drug therapy.<sup>1,2</sup> Twenty-two percent of the patients receiving phenobarbital and 42 percent of the patients receiving phenytoin developed gingival overgrowth. He concluded that phenobarbital may be associated with gingival overgrowth. All patient histories, however, could not be confirmed and subjects may have received other anticonvulsants, including phenytoin.<sup>1,2</sup>

These case reports describe two black males with marked gingival overgrowth. Each had been medicated exclusively with phenobarbital for seizure disorders.

## CASE 1

DM, a fourteen-year-old black male, had a history of spastic quadriplegic cerebral palsy, profound mental retardation, generalized seizures, scoliosis, and asthma. The mother had been treated throughout pregnancy with steroids and aminophylline for asthma. Her pregnancy went full term, but delivery was prolonged resulting in perinatal asphyxia to the infant. DM, the third child born, had two healthy, normal, older siblings. DM was fed through a gastrostomy tube. He had no drug allergies and no bleeding disorders. Heart, liver, kidneys, and endocrine glands were normal. The patient had had several orthopedic surgeries for the correction of limb and digit deformities without complications. Since birth

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*Figures 1 and 2. Gingival overgrowth in a fourteen-year-old black male on phenobarbital therapy for fourteen years (Case 1). In the anterior areas the gingiva is uniformly enlarged without lobulation of the interdental papilla. In the posterior maxillary and mandibular areas the overgrown gingival tissues completely cover the teeth.*

DM had taken no seizure medication other than 140 mg/day of phenobarbital in divided doses but previously had received dosages ranging between 30-90 mg/day. Other medications that had been taken included proventil syrup, alupent, antibiotics, pain relievers and nutritional supplements.

Gingival overgrowth was noted at age four years and the first steps in the management consisted of prophylaxis, removal of calculus, and oral hygiene instructions at six-month intervals. Compliance was poor and at age fourteen, the chief complaint was "bleeding gums, halitosis, and difficulty in keeping the teeth clean."



*Figure 3. Palatal view of the overgrown gingival tissues in Case 1. In the anterior areas half of the palatal surfaces of the incisors is covered with gingiva. The gingival overgrowth is more severe in the posterior areas where the gingivae are totally covering the lingual surfaces of the teeth. The left second premolar and first molar are completely covered with gingiva.*

### Oral examination

The oral examination revealed coarse facial features, convex profile, lips that were full and strained upon closure, a 15 mm anterior openbite, and generalized spacing. There was gingival overgrowth in all quadrants, with complete overgrowth over twelve permanent teeth (Figure 1,2,3). The gingiva was firm, dense, red, moderately inflamed and bled upon probing. Heavy calculus deposits covered the teeth. No caries was present. Around the incisors the gingiva was uniformly enlarged, without lobulation of the papilla. The gingiva covered half the clinical crowns of the mandibular incisors, approximately one fourth of the facial and half of the lingual surfaces of the maxillary incisors (Figures 1,2,3). The posterior teeth were covered with a nonlobulated, diffused, severe enlargement of marginal and attached gingiva, which had impeded tooth eruption (Figures 1,2,3). The posterior gingiva was more severely affected than the anterior; the lingual tissue was more affected than the labial tissue; but the maxillary and the mandibular tissues appeared equally affected (Figures 1,2,3).

### Treatment

The gingival contour made oral hygiene difficult, and conservative measures failed to control the overgrowth. After consultation with the patient's neurologist and pediatrician, a gingivectomy using general anesthesia was

Table 1 □ Pre- and postsurgical blood tests of case 1\*.

Test	Normal value	24 hours presurgery	2 hours postsurgery	9 hours postsurgery	23 hours postsurgery
WBC	4,500-13,500/mm <sup>3</sup>	6,100	—	—	—
RBC	4.9 ± 0.4 million/mm <sup>3</sup>	4.6	—	—	—
Hgb	14.5 ± 1.5 g/100 ml	14	12.1	8.7	14.5
Htc	43 ± 6%/100 ml	43	37	25	43
PLT	150,000-350,000/ml	250,000	—	—	—
PT	10-14 sec	—	—	—	13.3
PTT	23-41 sec	—	—	—	29.6

\*Laboratory values used in Children's Hospital of New Orleans, LA.

completed. A month before surgery, calculus was removed, and the mother was instructed to brush the patient's teeth twice daily and to apply a topical antibacterial solution. The patient was admitted to the short-stay unit, and presurgical blood values were within normal limits (Table 1). General anesthesia was accomplished using halothane, isoflurane and nitrous oxide analgesia. The gingivectomy was completed using Kirkland and Orban gingivectomy knives. The overgrown gingival tissue was excised, the electro-surgical knife (bovie) was used for coagulation and the surgical sites were also packed with moist 4×4 gauzes to control bleeding.

### Postsurgical complications

Two hours postsurgery and while in the short stay unit, the patient's blood pressure, pulse and respiratory rate became unstable. Gingival bleeding (oozing) continued and the constantly maintained gauze pressure failed to control the postsurgical bleeding. The Hgb and Htc dropped from 14g/100ml to 12.1 g/100ml and from 43 percent to 37 percent, respectively (Table 1). The patient was admitted and 600 cc of intravenous saline were infused. Seven hours later the patient's vital signs remained unstable and the Hgb and Htc had continued to drop to 8.7 g/100ml and 25 percent, respectively. The patient was transfused with 250cc of cross-matched O positive blood and 1255cc plasmanate. Soon after the blood transfusion, the vital signs stabilized, and the Hgb and Htc returned to normal levels (14.5 g/100ml and 43 percent, respectively). Upon discharge, twenty-three hours after surgery, the PT and PTT were within normal limits (13.3 sec and 29.6 sec, respectively) (Table 1).

### Postoperative examination

The patient was reevaluated ten days after the surgery. The mother reported that no further bleeding had occurred after discharge. The healing of the gingival tissue was good (Figure 4,5). Mother was instructed to brush

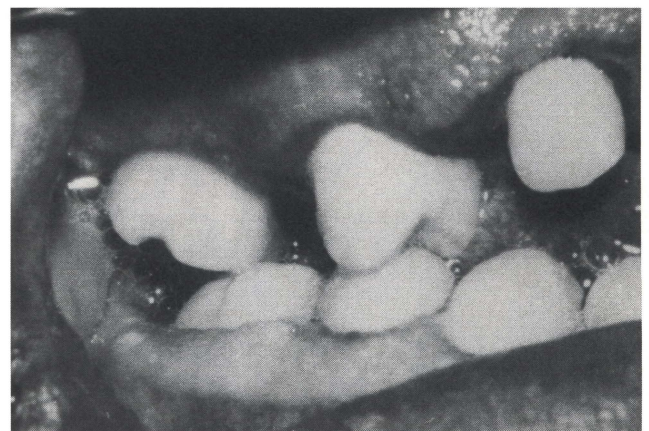


Figure 4. and Figure 5. Appearance of the gingival tissue ten days postsurgically in Case 1.

the child's teeth twice daily and to apply an antimicrobial agent after toothbrushing. Six months after surgery, the oral hygiene was excellent and no recurrence was noted.

### Oral pathology report

Gingival tissue from the maxillary and mandibular, anterior and posterior areas were received in formalin. All specimens had the same histologic appearance. The gingival tissue was predominantly fibrous, myxoid, fibromyxoid; and was associated with varying degrees of squamous epithelial proliferation and acute and chronic inflammation. There was acanthosis with irregular elongation of rete ridges.

### CASE 2

KH, a fifteen-year-old black male, had a history of spastic quadriplegic cerebral palsy, microcephaly, profound



Figure 6. Photomicrograph of phenobarbital induced gingival overgrowth. The epithelium is thickened and characterized by acanthosis and long rete pegs. The connective tissue is prominently fibrous (Hematoxylin and Eosin, original magnification  $\times 100$ ).

mental retardation, and grand mal seizures. The patient had no allergies or bleeding disorders, and normal heart, liver, kidneys, and endocrine glands. He was the product of an uncomplicated full-term pregnancy, labor and delivery. Mother denied any maternal illnesses or pharmacotherapy during pregnancy. Two older and one younger sibling had negative medical histories. The first seizures that occurred at age eleven months were controlled with phenobarbital. The initial dosages of phenobarbital were 40mg/day. Through the course of the illness, dosages were increased to 60mg/day and later to 90mg/day. The patient continued taking phenobarbital, 90mg/day, in divided dosages. Other medications that had been taken included antibiotics, tylenol, analgesics, and nutritional supplements. The patient had had multiple surgeries including bilateral submaxillary ganglionectomy (due to excessive drooling), mandibular lingual frenectomy, four corrections of limb and digit deformities, dental restorations using general anesthesia, recontouring of the parotid gland and gastrostomy. No complications were reported with any of the surgeries.

The patient had his first dental visit at age three years and gingival overgrowth was first noted at age six years. The patient had six recall appointments in ten years. Oral hygiene maintenance was poor and heavy calculus was present at each recall. At the last examination, at

Table 2 □ Pre- and postsurgical blood tests of case 2\*.

Test	Normal value	24 hours presurgical	7 hours postsurgical
WBC	4,500-13,500/mm <sup>3</sup>	8,500	11,600
RBC	4.9 $\pm$ 0.4 million/mm <sup>3</sup>	5.6	4.8
Hgb	14.5 $\pm$ 1.5 g/100 ml	15.1	12.8
Htc	43 $\pm$ 1%/100 ml	47.5	38.7
PLT	150,000-450,000/ml	375,000	218,000
PT	10-14 sec	—	14.1
PTT	23-41 sec	—	34.3
Bleeding Time	2.5-9.5 min	—	10

\*Laboratory values used in Children's Hospital of New Orleans, LA.

age fifteen years the chief complaint of the mother was "bad breath, bleeding gums and big gums."

### Oral examination

Oral examination revealed coarse facial features, a convex profile, lips apart upon closure, a 15mm openbite, and generalized spacing. Gingival overgrowth was observed in all quadrants with complete overgrowth of the gingiva over the maxillary and mandibular permanent second molars and the four mandibular premolars. The gingiva was firm, dense, dark pink, moderately inflamed and bled upon probing. There were heavy calculus deposits, especially on the posterior teeth. No cavities were present. The pattern of overgrowth was the same as that reported in Case 1.

### Treatment

For the reasons stated in the previous case, a full-mouth gingivectomy was elected. The calculus was removed and the mother was instructed in oral hygiene practices. A month later a full-mouth gingivectomy was completed after clearance from the patient's neurologist and pediatrician. The presurgical blood tests were normal (Table 2). The gingivectomy was similar to that of the previous case except that the electrosurgical knife was not used. The fresh surgical sites were packed with moist 4 $\times$ 4 gauzes to control bleeding.

### Postsurgical complications

Constant gauze pressure had been applied but bleeding (oozing) continued for three hours after gingivectomy. The patient was admitted and a CBC and bleeding screen performed. The CBC count had dropped, the PT and PTT were normal, and the bleeding time was prolonged (Table 2). The patient's vital signs were stable.

The hemostatic agent thrombin powder (Topical USP, Thrombogen, Johnson & Johnson, Gentrac Inc., Middleton, WI) was used topically to achieve hemostasis. Sixty thousand units of thrombin powder were needed to control bleeding. The gingiva was sponged free of blood and increments of thrombin powder were placed on a 2×2 gauze and applied to the bleeding sites. Additional applications of thrombin were necessary to control bleeding. Twenty minutes after thrombin application, the bleeding was controlled. The patient was discharged after twenty-three hours stay.

### Postoperative examination

At the two-week postoperative examination, the mother reported that no further bleeding had occurred. The healing was adequate even though the oral hygiene was poor and the gingiva inflamed. Mother was instructed on preventive techniques (as in previous case).

At one-year recall, the oral hygiene was excellent and no recurrence was noted.

### DISCUSSION

These patients had taken antibiotics, bronchodilators, hypnotics and nutritional supplements. None of these medications is associated with gingival overgrowth. Phenobarbital was the only medication used to control seizure activity.

Clinically and histologically, the gingival tissue in these cases was different from that seen in patients with endocrine imbalance or vitamin C deficiency.<sup>23</sup> These patients were receiving nutritional supplements and had no apparent hormonal imbalance.

Clinically and histologically, the gingival tissues in these cases were similar to *fibromatosis gingivae*.<sup>23</sup> In the majority of cases, *fibromatosis gingivae* is transmitted by an autosomal gene.<sup>23</sup> In the absence of a family history, this rare condition was an unlikely etiology.

Phenobarbital has been used for the treatment of epilepsy for decades, but other than Panuska's study, no report in the literature that associates this medication with gingival overgrowth was found.<sup>1,2</sup> Most epileptic patients are treated with several antiseizure medications during the course of their disease, making it unclear as to which medications are causative agents of gingival overgrowth. Polypharmacia may be a reason, therefore, why phenobarbital has not been associated with gingival overgrowth.

Similarities and differences between phenobarbital (PBIGO) and phenytoin (PICO) induced gingival over-

growth were noted. Histologically, the pattern of PIGO is similar to that seen in Case 1.<sup>5,24,25</sup> Clinically, the onset of PIGO ranges from two weeks to three months, reaching maximum severity between twelve to eighteen months.<sup>24</sup> No information as to the exact onset of the gingival overgrowth is available for the PBIGO. In PIGO, the gingival overgrowth is first observed in the interdental papilla, which results in the formation of lobulation extending across tooth surfaces.<sup>5</sup> In PBIGO there is a uniform circular enlargement of the gingiva without lobulation of the papillae. PIGO is usually more severe in the anterior than in the posterior and in the labial than in the lingual areas.<sup>5</sup> The opposite was true in these cases. The consistency and color of the overgrown gingiva in these cases was in accordance with that reported for the PIGO.<sup>5</sup> Most studies have demonstrated a positive relationship between plaque score, calculus, gingival inflammation, and the occurrence of PIGO.<sup>1,3,5-7</sup> In our cases, heavy plaque and calculus deposits and moderate gingival inflammation were present, but a positive relationship between local factors and gingival overgrowth cannot be established until further research is done.

Interference with eruption is a consequence of PIGO.<sup>5,24</sup> In these cases the crowns of the teeth were fully erupted with respect to the alveolar bone, but completely covered by the gingival tissue. Mandibular premolars and second molars but not the anterior teeth were affected. This may be attributed to the greater degree of overgrowth of the posterior gingiva.

Prolonged bleeding has not been reported as a major complication after gingivectomy in PIGO cases. Jones reported twenty-four moderate to severe PIGO cases that underwent gingivectomy and none of them presented with prolonged postoperative bleeding.<sup>26</sup> Prolonged bleeding, however, was encountered with these cases. Based on the medical and family histories and preoperative blood tests, excessive bleeding was not anticipated. Liver function was considered to be normal and previous surgeries had not resulted in bleeding complications. In therapeutic doses phenobarbital is not known to impair hepatic function or to affect adversely the platelet count or clotting factors.<sup>20,22</sup> In these cases, the preoperative platelet count (PLT) and PT and PTT were normal. Only bleeding time on Case 2 was slightly prolonged. Bleeding time represents a gross evaluation of vascular integrity, platelet adhesiveness and aggregation.<sup>27</sup> There may be a relationship between chronic phenobarbital intake and these factors. These postoperative bleeding complications, which are not frequently encountered with PIGO, suggest that there may be a cause-effect relationship between extended phenobar-

bital therapy and postoperative bleeding. The severe bleeding encountered after tonsillectomy in Case 2 supports this suggestion.

Conservative hemostatic measures failed to control the bleeding. The use of the electrocautery was not advantageous over the use of gauze pressure alone. Thrombin powder was very effective for bleeding control. In this case thrombin was an aid to hemostasis, because capillaries and venules were accessible.<sup>21</sup> When the primary clotting defect is the absence of fibrinogen, thrombin fails to clot blood.<sup>21</sup> Thrombin is more effective when applied to the bleeding sites as a powder.<sup>21</sup> The powder's light weight, however, made its application somewhat difficult. In this case, lost thrombin powder during its transportation to the bleeding site resulted in the use of an excessive amount of thrombin (60,000 units) in order to achieve hemostasis. Thrombin is more easily applied to tissues when in a liquid vehicle.<sup>21</sup>

## CONCLUSION

Poor oral hygiene, oral habits, diet and medical problems may contribute to gingival overgrowth. These two cases suggest a link, however, between phenobarbital and gingival overgrowth. Further research in animal models and clinical research, using large human populations will help in enlightening this premise.

In the management of a patient taking phenobarbital for a gingivectomy, the surgeon should

- Obtain a preoperative bleeding screen (PT, PTT BT).
- Expect an overnight admission.
- Make preparation to minimize postoperative bleeding.

It is suggested that a liquid thrombin preparation be sprayed on the gingival tissue immediately following gingivectomy. Other indicated hemostatic aids are the vacuum form stents lined with denture tissue conditioner and purified bovine collagen preparation.<sup>25</sup>

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# Electronic apex locator: A useful tool for root canal treatment in the primary dentition

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A major objective of modern dentistry is to maintain the integrity of the primary dentition until normal exfoliation.<sup>1,2</sup> Strict methodological rules are essential for successful endodontic therapy in permanent teeth. Compact condensation and apical seal with solid core are imperative factors, and maintaining the working length 1 mm short of the anatomical apex is crucial. In primary teeth, it is recommended to fill the canals with a resorbable paste, 2-3 mm short of the apex.<sup>3</sup> The location of the actual apical aperture in a primary molar that has begun its physiological resorption and is occasionally involved in a pathological resorption process, remains a puzzle to the clinician. There are no strict rules for exact measurement of the tooth length. The ideal method used to determine the length is controversial.<sup>2,4-12</sup> The suggested methods are not always applicable due to continuous resorption. To minimize periapical damage and avoid injury to the succedaneous tooth bud, however, the tooth length should be carefully determined and should not be exceeded.<sup>13,14</sup>

The electronic method for tooth length determination proposed by Sunada has gained wide popularity.<sup>15</sup> The first generation of electronic apex locators, the resistance-type, was based on the electrical resistance exist-

ing between the tooth and the periodontal ligament.<sup>16</sup> These devices had many shortcomings that restricted their use.<sup>17</sup>

The new generation of electronic apex locators, the impedance-type, is based on different electrical principles that can detect the narrowest diameter of the root canal.<sup>18-20</sup> This is considered as the ideal point to terminate endodontic procedures, even in moisture and conductive fluids.

The newest electronic apex locator, *Root ZX*, is unique in its ability to detect effectively the apex in dry, as well as in wet, environments. The purpose of this study was to test this device and its ability to detect the tooth length in mature primary teeth with different degrees of root resorption.

## MATERIALS AND METHODS

For the study, twenty freshly extracted primary molars preserved in saline and refrigerated ( $-4^{\circ}\text{C}$ ) were used. After access cavity preparation, the pulp was removed using nerve broaches (Zipperer, VDW, Munich, Germany). The teeth were embedded in alginate using a model developed by Katz *et al*, namely, a plastic box that fits the dimensions of an occlusal film.<sup>17</sup> Alginate (Blueprint, Dentsply Ltd, De Trey Div, Weybridge, Surrey, England), prepared according to the manufacturer's instructions, was poured into the box, short of its rim. The roots were embedded in the alginate just before final

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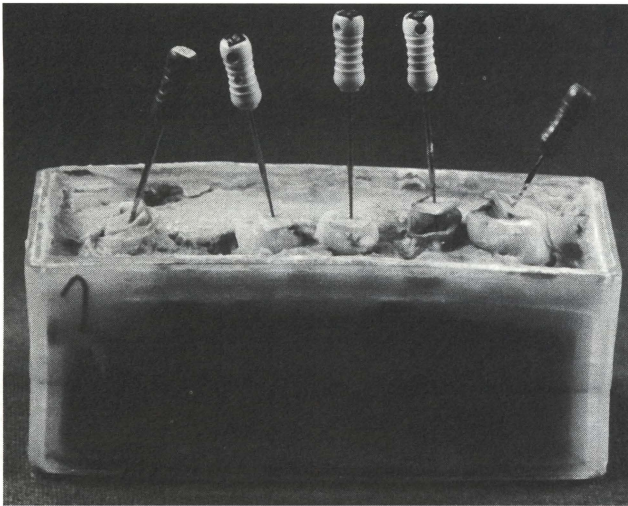


Figure 1. Model of five teeth embedded in alginate.

setting, up to the cementoenamel junction. Each box contained five teeth (Figure 1). The model was covered with saturated saline gauze and refrigerated.

The actual length of each tooth was measured before embedding by inserting a No. 20 file (Zipperer, VDW, Munich, Germany) until it emerged at the root end. This was verified using a binocular (Olympus, Tokyo, Japan) magnification  $\times 6.3$ . *Root ZX* (Morita Corp, Tokyo, Japan) (Figure 2) was used as calibrated by the manufacturer to measure the tooth length minus 0.5 mm (it can be calibrated in the range of 0 to  $-1$  mm). Each tooth was measured in three different environments: dry, saline and 2.6 percent sodium hypochlorite. Three repeated measurements were made for each tooth in each environment and the mean value calculated.

After the third measurement, the file was fixed to the tooth according to the average value and radiographed on an occlusal film (Kodak Ektaspeed, Safety EO-41 film, Eastman Kodak Co, Rochester, NY) with an exposure time of 0.32 s (Philips Secondent E - timer, OraliX 65 S - cone, Gendex Dental System, S.R.L., Monza, Italy). The film was manually developed for 5 min (Zahnfilm Developer-konzentrat, ADEFO, Nuremberg, Germany), fixed for 30 min (Zahnfilm Fixer-konzentrat, ADEFO, Nuremberg, Germany) and washed for 15 min in running water.

The radiographs were photographed and converted to black and white positive films (Kodak) (Figure 3). Millimetric paper was photographed at the same magnification and served as a calibration slide. Each slide was

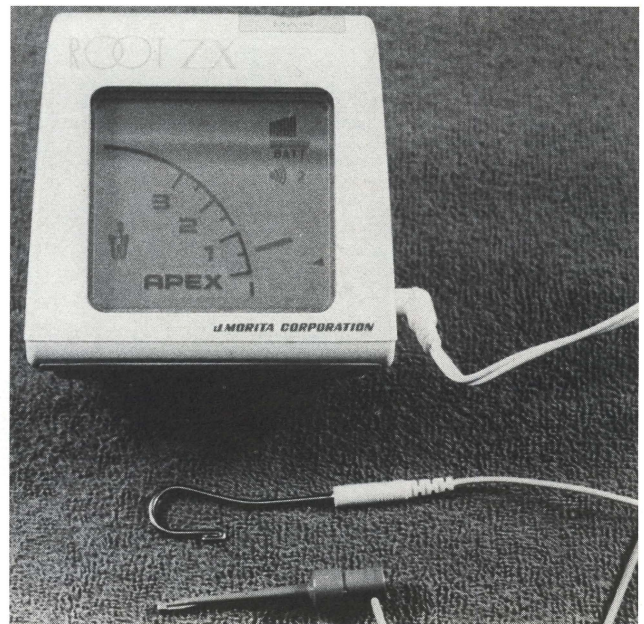


Figure 2. Picture of electronic apex locator.



Figure 3. Radiograph of tooth length as measured by Root ZX.

projected on a white sheet of paper and the contour of each tooth with the file in it was drawn onto the paper. The tooth length and the distance between the tip of the file and the radiographic root end were measured. The radiographic calculated working length was determined using Ingle's method.<sup>21</sup>

One tooth was discarded for technical reasons. The mean values of the actual tooth length were compared with the measurements of *Root ZX* and the radiographic calculated length, for each environment. Statistical evaluation was completed using the Mann-Witney test.

Table □ "Root ZX" measurements obtained in each environment compared to real tooth length and radiographic tooth length.

Case	Actual tooth length	"Root ZX" measurement			Radiographic calculated tooth length		
		Dry	Saline	NaOCl	Dry	Saline	NaOCl
1	14.5	14.5	13.3	11.7	13.5	12.5	12.0
2	11.0	10.2	9.8	9.9	9.5	12.0	10.0
3	11.0	10.5	11.0	10.8	11.5	13.0	12.5
4	12.0	11.3	11.8	11.8	10.5	12.0	11.5
5	12.0	10.3	10.5	10.7	9.5	10.0	10.5
6	12.0	10.8	11.7	11.2	12.0	12.5	14.0
7	7.0	7.5	7.0	8.2	8.0	9.5	10.0
8	15.0	13.5	14.2	13.7	14.0	13.0	13.0
9	12.0	12.0	12.0	12.0	14.0	11.5	14.0
10	11.0	9.0	9.8	10.7	9.5	10.5	12.5
11	10.5	10.2	9.8	10.2	10.5	10.0	10.0
12	11.0	10.8	10.2	10.2	12.5	12.0	10.0
13	14.0	13.8	14.0	14.0	16.0	13.5	15.0
14	14.0	12.3	12.5	12.3	13.5	15.0	13.5
15	13.0	13.7	13.7	13.8	14.5	13.5	13.5
16	9.5	9.0	9.8	9.2	10.0	13.0	11.5
17	14.0	13.0	13.0	13.5	12.5	14.0	16.0
18	12.0	12.0	12.0	12.0	12.5	11.5	11.5
19	13.0	13.5	13.0	13.0	13.5	13.0	12.5
Mean	12.0	11.4	11.5	11.5	11.9	12.2	12.2
SD	1.87	1.86	1.81	1.58	2.06	1.41	1.72

## RESULTS

The results are presented in Table. No statistical significance was found between measurements in each environment comparing the three tested methods.

## DISCUSSION

Determination of the root canal length in permanent teeth is well-established by the radiographic method and more recently by electronic means. This is the first report of the use of electronic methods in primary dentition. Suggestions have been made, such as measuring the canal length on the diagnostic radiograph: using the file as a measuring device by inserting it into the canal until encountering a resistance point, due to apical constriction; or using an average length of 10-15 mm in root canal preparations of primary molars.<sup>8-12</sup> It is obvious that methods for measuring root canal lengths in primary teeth are controversial.

The use of electronic apex locators in endodontic treatment in permanent teeth is an accepted procedure.<sup>22</sup> The former electronic devices had technical limitations, however, enabling accurate measurements only in dry conditions. *Root ZX* is a new device, that detects the apical constriction in dry, as well as in conductive environments, making this device more accurate and reliable.

Measurements obtained by *Root ZX* were similar to the actual tooth length ( $-0.5$  mm) and the radiographic measurements were longer (0.4 mm to 0.7 mm) than

*Root ZX* measurements. No statistical differences were found when compared to actual tooth length. Stein and Corcoran report that the tooth length measurement obtained by the radiographic method is always longer than the real length.<sup>23</sup>

The use of *Root ZX* was quick, comfortable and accurate and is preferred over the radiographic method, since it is more convenient for the patient and the clinician. Although root canals of primary molars are complex in their anatomic morphology and are mostly in a state of uneven resorption, *Root ZX* was able to detect the real state of the root canal length. Since electronic apex locators are safe, painless, and avoid unnecessary radiation, it is recommended for use in primary teeth. Further evaluation of the accuracy of this electronic method in clinical conditions is indicated and should be conducted in future *in vivo* studies.

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### NITROUS OXIDE FOR TREATING ANXIOUS CHILDREN

The use of nitrous oxide undoubtedly has positive long-term effects on a child's dental anxiety. Nevertheless, it remains unclear how the child will react when invasive treatment is carried out without its use after a period of several years. Research results on the subject conflict: after being treated with the aid of nitrous oxide, children are less anxious during biannual check-ups, although these are carried out without the support of the compound gas. When the subsequent curative treatment, however, is also carried out without nitrous oxide, the results are not promising, and thus additional long-term research on the subject is certainly required. In any case, since it seems to be unwise to just wait and see whether a child develops sufficient coping skills, the results of this study clearly indicate that the use of nitrous oxide is advisable as an extra support for the dental treatment of children with a dental anxiety level that exceeds their coping abilities, since behavioural management alone does not suffice.

Veerkamp, J.S.J.: *Nitrous Oxide*. From a thesis presented in partial fulfillment of the requirements for a doctorate degree from the University of Amsterdam, October 1994.

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## BEHAVIOR

# The use of hypnosis in a sedation clinic for dental extractions in children: Report of 20 cases

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**G**eneral anesthesia is still commonly used in the United Kingdom for extractions in anxious children unable to accept local anesthetic.<sup>1</sup> In recent years the potential morbidity and mortality associated with general anesthesia have been recognized and alternatives are now recommended wherever possible.<sup>2</sup>

An alternative is inhalation sedation, where a controlled mixture of nitrous oxide and oxygen inhaled through a small nasal mask is used to sedate the child. This technique has been shown to be safe and effective in children for restorative treatment and minor oral surgery procedures.<sup>3-5</sup> Some dental hospitals offer a regular sedation service for dental extractions in children as an alternative to general anesthesia, and report good success rates.<sup>6</sup> Unfortunately, not all children are able to accept sedation and still require a general anesthetic for treatment.

Although not commonly used, hypnosis has been shown to be effective in reducing anxiety in children receiving dental treatment.<sup>7-10</sup> Preliminary reports suggest there may be a beneficial effect from hypnosis, used in conjunction with inhalation sedation.<sup>11,12</sup> This single operator study aimed to:

- Target those children who would normally fail to complete treatment on a sedation clinic.

- Select those who might benefit from the use of hypnosis.
- Assess the clinical success of informal hypnotic imagery.
- Assess the resulting increase in appointment length.

### METHODS

#### Patient selection

Over the last two and a half years, one hundred and seventy-nine children have been seen in the sedation clinic at Newcastle Dental Hospital for dental extractions. Children were referred to the sedation clinic from clinicians working within the Department of Child Dental Health, General Dental Practice and the Community Dental Service. In thirty-four cases it was necessary to stop treatment. From this group of children those who could at least accept a dental examination were considered for hypnosis.

#### Hypnotic selection criteria

The selection procedure involved two stages, a five-minute informal hypnotic induction, followed by a further ten minutes spent developing imagery. Children were selected if eye closure was attained, the imagery could be clinician led, and the child gave permission for treatment to be continued during successful imagery.

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Table □ Informal hypnotic imagery techniques.

Hypnotic themes	Number of patients
A favorite holiday	1
Horseback riding	1
A balloon ride	7
Watching television	3
Playing a favorite computer game	4

### Clinical regimen

A standardized clinical regimen was followed and inhalation sedation administered, following the fifteen-point code outlined by Roberts in 1979.<sup>13,14</sup>

### Hypnotic regimen

A five-minute informal hypnotic induction was used to relax the child and focus his awareness inwardly. The child was asked to close his eyes and the five senses were used to create appropriate imagery, based on hobbies, stories and holiday experiences elicited from the child and parents, at the start of treatment. Examples include imagination of a colorful balloon or ball (*vision*), the warm feeling of the sun on the face on a summer day (*temperature*), the feeling of sand between the toes on a beach (*touch*), the noise of friends playing a favorite game (*hearing*) or the taste of ice cream (*taste*).

Once accepted, the imagery was developed for a further ten minutes using the senses the child found most comfortable. Five imagery topics were used: a favorite holiday, horseback riding, a balloon ride, television watching, and playing a computer game. Each approach was tailored to the individual, the clinician leading the imagery by simple questioning and suggestion. Suggestions of warmth and comfort were linked to the imagery to develop relaxation. Examples include, *as you splash around in the swimming pool feel the warm relaxing water around you; as you walk down the beach, feel the warm sun on your face and the warm sand between your toes, feel yourself relax with every step you take; as you watch the television, feel yourself sinking into the warm, "comfy" sofa*. The idea of continuing treatment was introduced by suggesting that the warm "comfy" feelings could remain with them during treatment and make treatment easier. The clinician asked the child whether he could have a look around the child's mouth. If this was undertaken without disrupting the imagery and with the maintenance of eye closure, the child was selected and treatment continued.

The treatment and hypnotic imagery were continued simultaneously until placement of the gauze pack to achieve hemostasis. The child was then praised and the

posthypnotic suggestion given that the warm "comfy" feelings would remain on opening his eyes. Alerting examples included, asking the child to count from one to five and feel his eye lids getting lighter and lighter with every count and opening on the count of five; or asking the child in their own time to switch off their imaginary television or computer game. Any child who was unable to complete the treatment had a general anesthetic arranged for a subsequent visit.

### Assessment of clinical success and parental views

A child completing treatment, using the imagery, was considered a clinical success. Parental views were assessed by means of a postal questionnaire. Parents were asked whether they were satisfied with their child's treatment; and if their child required a further extraction in the future, whether they would prefer local anesthesia, similar treatment under sedation and hypnosis, or general anesthesia.

### Documentation and consent

Hospital clinicians completed a full medical and dental history, identified the teeth to be extracted, and gave a simple explanation of the sedation technique, before referring children to the sedation clinic. Parents were given a written information sheet to take home. On attending the sedation clinic, the child's medical and dental histories were checked; and their age, gender, and the number of teeth requiring extraction documented. A simple explanation of treatment was given again, any questions from the parent or child were answered, and a written consent form was completed.

## RESULTS

### Sample characteristics

One hundred and seventy-nine children have been seen in the sedation clinic for dental extractions, over the last two and a half years. It was necessary to stop treatment in thirty-four cases. From this group twenty children (eight males and twelve females) fulfilled the selection criteria for continuation of treatment under hypnosis. The average age for the children was ten years with the range from six to fourteen years.

### Clinical success and parental views

Treatment was successfully completed in sixteen children (six males and ten females) with a total of fifty-one

teeth (twenty-one primary and thirty permanent) extracted. The distribution of imagery themes is given in Table. In the four children who failed to complete treatment, one was unable to accept topical local anesthetic paste, two were unable to accept the sedation mask and one the administration of local anesthetic.

Fifteen parents were given questionnaires and twelve were completed and returned. All parents recorded they were satisfied with their child's dental treatment and all stated they would prefer that their child have the same treatment regimen again for a dental extraction in the future, rather than a general anesthetic or treatment under local anesthetic alone.

### Length of appointment

Data were available for twelve children who completed treatment. The average appointment length recorded was fifty-one minutes (thirty to eighty minutes range), compared to thirty-four minutes (thirteen to eighty minutes range) in the one hundred and forty-five children who completed treatment under sedation alone.

### DISCUSSION

Although the number of children treated with hypnosis was relatively small, sixteen out of twenty patients successfully completing treatment was thought to be a good outcome. Parents were satisfied with the treatment and all stated they would prefer that their child have dental extractions using a similar regimen again, if necessary, in the future. The appointment length was noted to be increased by 50 percent in the hypnotic group (fifty-one vs. thirty-four minutes). This was thought to be an acceptable increase, however, considering it included the fifteen-minute hypnotic selection procedure.

One theoretical problem with the imagery used in this study was that it was necessary for children to have their eyes closed, thus removing one of the signs used to monitor for over-sedation. With the clinician being involved in constant rapport with the child throughout treatment, this was not found to be a practical problem.

Hypnosis will not work in all children and there will always be a need for general anesthesia. Likewise for a large proportion of children, hypnosis will not be necessary, because they can be treated satisfactorily with sedation. Hypnosis does offer a simple noninvasive approach to helping those children, however, where simple inhalation sedation alone is not enough. The mode of action of hypnosis is open to debate. Focusing a child on pleasant imagery and feelings is thought to promote relaxation and lessen his awareness of external events.

Critical faculties are also blunted, making them more likely to accept proposed treatment.

### CONCLUSION

Our preliminary findings suggest that hypnosis can be used successfully as an adjunct to inhalation sedation and conventional management skills for dental extractions in children. To justify the increased appointment length when using hypnosis, those children who are most likely to benefit should be targeted and effectively screened. Semihypnotic suggestion is often stressed as important in the success of sedation, but rarely explained. It is hoped this report will stimulate more operators to investigate further the use of informal hypnosis in their clinical practices.

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# The effectiveness of midazolam and hydroxyzine as sedative agents for young pediatric dental patients

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**P**roviding comprehensive dental treatment for fearful and uncooperative young children is a challenge for the pediatric dentist. Pharmacologic sedation is frequently employed, therefore, as an adjunct to behavior management techniques. Inhalation of nitrous-oxide alone or in conjunction with the oral administration of hydroxyzine are among the most popular sedation modalities used by pediatric dentists. Both are remarkably safe and have no serious side effects.<sup>1,2</sup> Many children tend to refuse taking the drug orally, however, spitting or regurgitating it, when administered. Recently the nasal route has received a great deal of attention as a convenient, noninvasive and reliable alternative for drug administration.<sup>3</sup> Intranasal midazolam has been reported to be an effective premedication agent for infants and preschool children before general anesthesia, and a good anxiolytic and sedative medicament during short surgical procedures or dental treatment.<sup>4-12</sup> Its rapid onset is particularly useful in the dental setting, since administration

occurs just ten minutes before treatment. It is simple and painless and requires less patient cooperation.<sup>11</sup> Midazolam also has hypnotic, muscle relaxant and anterograde amnesic effects, but has no analgesic properties.<sup>13,14</sup> The addition of a benzodiazepine to nitrous oxide potentiates its analgesic effect, providing us with an almost ideally relaxed patient.<sup>15-17</sup>

For many years hydroxyzine was administered to pediatric dental patients in a single dose of 50 mg, or in two doses of 50 mg each, without taking into consideration the patient's weight.<sup>2,18-21</sup> Shapira *et al* reported a higher number of failures in heavier children receiving a standard 50 mg dose of hydroxyzine, and concluded that the mg/kg ratio might have influence on the child's behavior.<sup>2</sup> Based on these data, a dose of 3.7 mg/kg of hydroxyzine supplemented by 50 percent nitrous-oxide analgesia was found to be adequate to sedate pediatric dental patients.

In a recent study Fuks *et al* found no difference when two doses of midazolam (0.2 mg/kg and 0.3 mg/kg) were used intranasally to sedate young pediatric patients.<sup>11</sup> The purpose of the present study was to investigate the efficacy of 3.7mg/kg of oral hydroxyzine for sedating young children during dental treatment, and to compare it with 0.2mg/kg intranasal midazolam.

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**METHODOLOGY**

The study material consisted of twenty-nine infants selected from patients who visited the emergency clinic in the Department of Pediatric Dentistry of the Hadassah School of Dental Medicine in Jerusalem shortly before the study was conducted. In order to participate in the study children had to be two to four years of age, in good health (ASA 1), no previous exposure to a dental procedure, and in need of at least two restorative visits. A treatment plan was prepared by a senior pediatric dentist for each patient, based on clinical and radiographic examination. The Frank's behavior rating scale was used to evaluate the patients' behavior at the initial examination.<sup>22</sup> Seven patients were rated 3 or 4 and the other twenty-two patients were rated 1 or 2 according to this scale. The procedure, possible discomfort or risks, as well as possible benefits, were explained fully to the parents of the children involved, and their informed consent was obtained before the investigation started. Two different drug regimens were compared: 3.7 mg/Kg oral hydroxyzine and 0.2mg/Kg nasal midazolam. The hydroxyzine was administered one hour before treatment and the midazolam was dripped into the patient's nostrils ten minutes before starting the dental procedure.

Half of the patients were randomly selected to receive midazolam on their first restorative visit and hydroxyzine on the second, and the other half received the alternative. Thus, patients served as their own controls. The patients were defined as HYD group, when treated under the influence of hydroxyzine; the same patients were defined MDZ group, when premedicated with midazolam. The patients were kept NPO at least four hours before treatment. After drug administration, they were kept in a quiet area with the parents. At the appropriate time the children taken to the operatory and placed in a restraint device (Papoose Board, Olympic Medical Group, Seattle, WA) with head restraint, and a pulse oximeter was attached to the patients' toes. A face mask was then placed starting with 100 percent oxygen for about one minute, then switched to equal flows of nitrous oxide and oxygen until the end of the dental procedure. The face mask was replaced after about two minutes by a nasal mask. Two-percent lidocaine with epinephrine 1:100,000 was injected following application of a topical anesthetic. A mouth prop was placed and rubber dam adapted. Following this preparatory phase, which lasted approximately ten minutes, the dental procedure was performed. The patients' crying, alertness, movement and general behavior were assessed following

Table 1 □ Rating scale to evaluate behavior.

score	crying	alertness	movement
1	hysterical crying	awake - struggle	violent movement interrupting treatment
2	continuous or strong crying	awake - quiet	strong movement treatment difficult
3	drowsy / asleep	intermittent or mild crying	mild movement treatment not interfered
4	-----	no crying	no movement

Table 2 □ Rating scale to evaluate general behavior.

1 - Aborted	- No treatment rendered.
2 - Poor	- Treatment interrupted, only partial treatment rendered.
3 - Fair	- Treatment interrupted, but eventually all completed.
4 - Good	- Difficult, but all treatment performed.
5 - Very good	- Some limited crying or movement, e.g. during anesthesia or movement.
6 - Excellent	- No crying and movement.

Table 3 □ General behavior scores by drug regimens.

General behavior rating	Drug regimens		Totals
	Midazolam	Hydroxyzine	
1 - Aborted	1	0	1
2 - Poor	3	3	6
3 - Fair	3	3	6
4 - Good	6	7	13
5 - Very good	7	5	12
6 - Excellent	9	11	20
TOTAL	29	29	58

a modified scale developed by Houpt *et al* (Tables 1 and 2).<sup>23</sup> In addition, pulse rate and oxygen saturation were recorded during the treatment. These factors were recorded at baseline (when the child was placed in the dental chair), at every stage of the preparatory phase, and every five minutes thereafter until the end of the treatment. The patients were discharged after full consciousness was regained, and the parents provided with suitable postoperative instructions. The dental treatment was performed by senior residents and the patients' behavior was evaluated by a senior pediatric dentist. Neither the operator nor the evaluator were aware of the drug regimen used, as the administration of the drugs was done by a third person.

The results were statistically analyzed, using the t-test for paired samples and the Mann-Whitney U - Wilcoxon Rank Sum W Test with a significance level of  $p < 0.05$ .



**RESULTS**

The general behavior of the patients of both groups is presented in Table 3. No differences were observed between the mean general behavior evaluation scores of the HYD and the MDZ groups ( $4.44 \pm 1.47$  and  $4.62 + 1.37$ , respectively). Similarly, no difference was found between the mean general behavior scores for the first and second visits in both HYD ( $p > 0.583$ ) and the MDZ groups ( $p > 0.835$ ). There was a significant difference ( $p < 0.02$ ), however, in the acceptance of the face and nasal masks by children of the MDZ group, between the first and second appointments. None of the children of this group cried or moved (mean score 4.0) at the first visit, as opposed to their reaction at the second appointment (mean  $3.5 \pm 0.81$ ). No such difference was found in the HYD group ( $p < 0.52$ ).

**CRYING, MOVEMENT, ALERTNESS**

The mean scores for crying, movement, and alertness of the patients during the dental treatment are graphically presented in Figures 1, 2 and 3. During the preparatory phase of the treatment (placement of face mask, nasal mask, local anesthesia and rubber dam), which lasted approximately ten minutes, the scores for crying (Figure 1), were higher in the MDZ group than in the HYD group. The scores for movement during the preparatory phase were inconsistent in regard to the two regimens (Figure 2), while the scores for patient alertness were similar in both groups (Figure 3). Toward the restorative phase a clear trend has been observed: the scores for crying, movement, and alertness were consistently higher in the HYD group than in the MDZ group. This trend lasted till the end of the treatment. These differences were not statistically significant, except for the scores of movement. From the fifteenth minute on, the mean scores for movement of patients sedated with hydroxyzine were significantly higher than of those sedated with midazolam.

**DISCUSSION**

The results of the present study indicated that the two regimens were similarly effective, and no differences were found between the mean general behavior scores of both groups. Differences were observed, however, between the effects of the two regimens on the patients' crying, movement, and alertness in some stages of the dental treatment. These differences might be explained

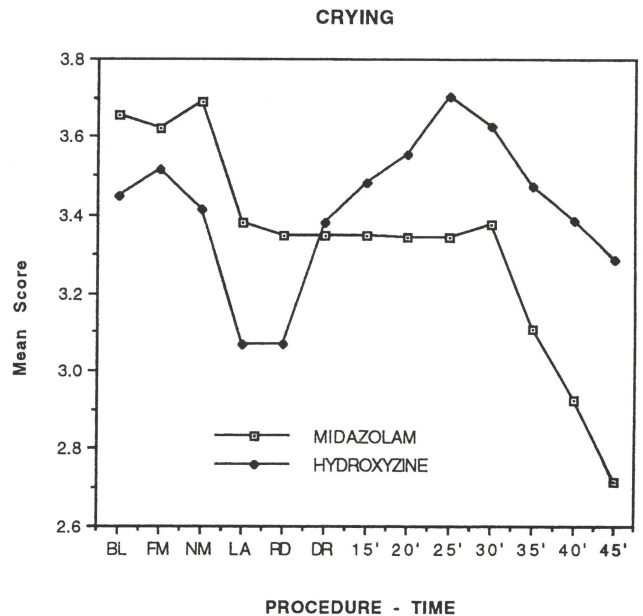


Figure 1. A graphic presentation comparing the mean scores of CRYING of patient sedated with hydroxyzine or midazolam, during the various steps of the preparatory phase (BL = Baseline; FM = Face mask; NM = Nasal mask; LA = Local anesthesia; RD = rubber dam; DR = start of drilling), and every 5 minutes thereafter.

by the difference between the two drugs. Walbergh, Allonen, and Persson based on pharmacokinetic and pharmacodynamic data, proposed that the therapeutic concentration threshold for sedation with midazolam in adults should be  $40\mu\text{g/ml}$  of plasma.<sup>5,24,25</sup> This level is achieved 3 min. after nasal administration of midazolam, and is maintained for thirty minutes. Saint-Maurice suggested that the threshold for children should be at least double that of the adult ( $80\mu\text{g/ml}$ ), in order to achieve "a satisfactory sedative level."<sup>26</sup> In another clinical trial, Rey *et al.*, studied the kinetics of  $0.2\text{mg/kg}$  of nasal midazolam in children, and observed that the plasma concentration reached  $80\mu\text{g/ml}$ , approximately 6 min. after administration of the drug; the maximal concentration ( $104\mu\text{g/ml}$ ) was achieved after 12 min., and then it was slowly reduced to  $80\mu\text{g/ml}$  after another 18 min.<sup>27</sup> We are left, therefore, with about 24 min. in which the plasma concentration is at least  $80\mu\text{g/ml}$ , regarded as a minimal level for sedation. In the present study, utilizing the same  $0.2\text{ mg/kg}$  concentration, an average of twenty minutes had passed from the time of midazolam administration, until the operatory phase had started, leaving only a few minutes for the active operative procedures

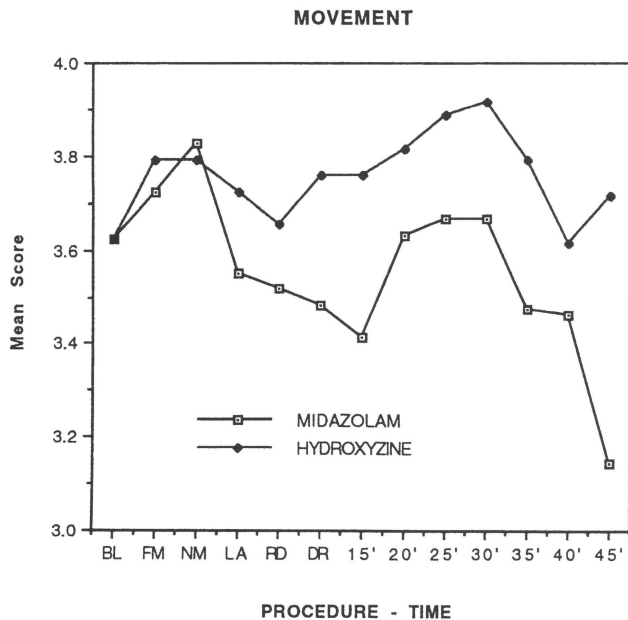


Figure 2. A graphic presentation comparing the mean scores of MOVEMENT of patients sedated with hydroxyzine or midazolam, during the various steps of the preparatory phase (BL = Baseline; FM = Face mask; NM = Nasal mask; LA = Local anesthesia; RD = Rubber dam; DR = Start of drilling), and every 5 minutes thereafter.

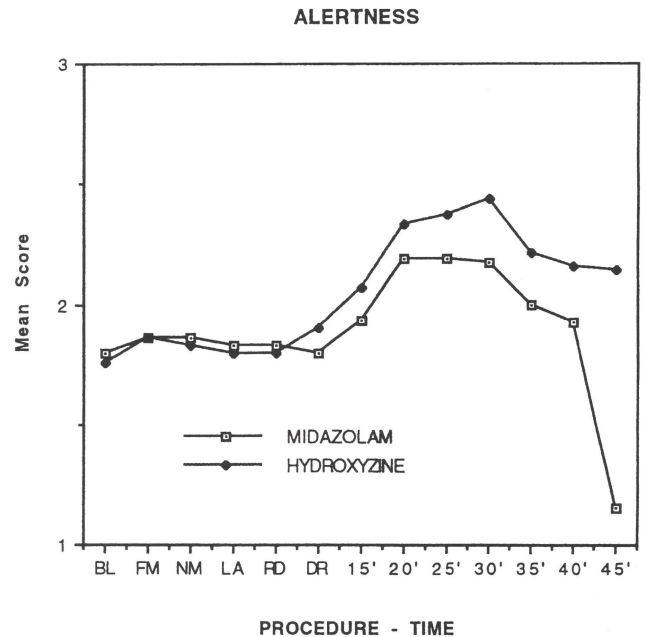


Figure 3. A graphic presentation comparing the mean scores of ALERTNESS of patients sedated with hydroxyzine or midazolam, during the various steps of the preparatory phase (BL = Baseline; FM = Face mask; NM = Nasal mask; LA = Local anesthesia; RD = Rubber dam; DR = Start of drilling), and every 5 minutes thereafter.

of the treatment session. This could probably be explained by the fact that the operators were less experienced postgraduate students. In general, during the preparatory phase, midazolam showed a better effect on the patient's behavior; this trend was reversed, however, thereafter, with higher scores for the HYD group, since most of the sedative effect of midazolam had worn off.<sup>25</sup>

No differences were observed in the two drug regimens when administered in the first or second appointment. In the MDZ group, however, a significant difference ( $p < 0.02$ ) was seen in the acceptance of the facial and nasal masks, when midazolam was used in the first visit. None of the children cried nor moved during the induction, and were quiet until the administration of the local anesthetic. This did not occur when midazolam was used in the second appointment, when crying and movement were observed even before that stage. This might be due to the good sedative effect of MDZ when the children had not been exposed to a previous unpleasant experience. Conversely, this did not occur with hydroxyzine; no difference was found between visits with this drug regimen.

Despite the fact that hydroxyzine was available in medical practice for nearly thirty years, therapeutic and toxic drug concentrations have not yet been established. Several pediatric dentists recommended the oral administration of 50 mg of this drug one hour before treatment.<sup>18-20</sup> In a previous study, a single dose of 50mg hydroxyzine was administered to all patients regardless of their weight.<sup>2</sup> The results of this study revealed poorer behavior rates of the heavier children, concluding that the mg/kg ratio of hydroxyzine might have influenced the child's behavior. In the present study, therefore, a dose of 3.7 mg/kg was administered to all the children. This dose was calculated from the study just mentioned, after excluding the heaviest patients whose treatment had been considered a "failure."<sup>2</sup>

Contrary to previous studies seven patients with good behavior at the initial examination (3 and 4 according to Frankl's rating scale) were also included in the present report.<sup>2,11</sup> These children presented overall behavior scores similar to those that were rated poor at the initial examination. We feel that not only children presenting disruptive behavior might benefit from sedative pre-

medication at this early age. Eventual behavior deterioration can also be prevented in infants whose behavior is good at the initial examination, by using a sedative agent.

Both drug regimens employed in this study present some drawbacks. The oral hydroxyzine might be spat or regurgitated by the child, and the waiting time for its onset is definitely a disadvantage. Nasal midazolam causes a transient burning discomfort and cannot be adequately used in children with upper respiratory tract infection and copious nasal secretion. Moreover, its sedative effect is limited to about twenty minutes from the time of administration. For these reasons, we feel that midazolam could be recommended for short procedures, while hydroxyzine should be employed for more extensive restorative sessions. A combination of the two drugs has been suggested, associating the rapid onset of midazolam with the prolonged sedative effect of hydroxyzine.<sup>29</sup> Further research should be promoted to verify this hypothesis.

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# EPIDEMIOLOGY

## Epidemiologic study of 19-month-old Edmonton, Alberta children: Caries rates and risk factors

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**C**hildren are not at equal risk for dental disease. Early childhood caries, commonly called Baby Bottle Tooth Decay (BBTD) or nursing caries, is a disease of very young children that devastates the dentitions of children in the third world and in ethnic minority populations, i.e., Native Americans (First Nation in Canada), and recent immigrant populations in North America. Traditionally, access to very young children is limited. Most dentists are not trained to see children under age three. In addition, there will never be a sufficient number of public health dentists to treat all the disease in these high-risk populations.<sup>1</sup>

Baby Bottle Tooth Decay appears to have consequences for the general and dental health of the child. BBTD causes pain and dysfunction and leads to future caries in children.<sup>2,3</sup> Moreover, there are social, economic and psychological costs that have not been adequately quantified. Treatment of severe BBTD in very young children often requires the use of general anesthetic. Recently, compared to control patients, evidence has been presented that a significantly greater proportion of BBTD children weighed less than 80 percent of

ideal weight, possibly indicating failure to thrive.<sup>4</sup>

Many articles have identified the clinical appearance and etiology of the disorder.<sup>5,6</sup> Epidemiological studies from predominately western-type cultures found with few exceptions the BBTD prevalence to be approximately 5 percent or less.<sup>6</sup> Disadvantaged children, however, are much more vulnerable. Infant feeding patterns that are etiologic risk factors are influenced, moreover, by cultural and ethnic factors; results of studies of children within a given culture may not generalize.<sup>7</sup> Before developing and testing interventions for BBTD within a given community, the prevalence and risk factors associated with the disease must be identified.

This study attempts to take initial steps in controlling BBTD in Edmonton, Alberta, a fluoridated Canadian city of over 600,000 with a diverse immigrant population. Dental decay has declined significantly for children in Edmonton over the last twenty-five years; 60 percent of children ages four to six years are caries free. Dental disease remains a significant problem, however, for approximately 13 percent of this age-group; these children have, on average, more than seven decayed teeth. The number of children requesting emergency treatment at the Edmonton Board of Health centers for pain, infection, or swelling has increased by 35 percent per year over the past five years, resulting in much time and many resources dedicated to emergency treatment.<sup>8</sup>

We would like to acknowledge the support of the Edmonton Board of Health and its chairman of the board, Dr. R. LaReche. We also would like to thank Peggy Clarke, RDH, and Denise Barton, RDA for their commitment to the project.

At present the prevalence of the caries process in very young children in Edmonton is unknown, as are risk factors associated with the disease. It is believed that by study of the prevalence and risk factors, targeted interventions can be developed to prevent subsequent decay. It is believed, furthermore, that the number of children requiring emergency treatment, comprehensive restorative treatment, and sedation will be reduced.

## PROCEDURE

### Subjects

The names of all the children born during the months of September, 1991 through April, 1992 were obtained from health center records. By selecting children born in these months, the study population was about eighteen months of age for the study period from April to December 1993. From the list of approximately 2500 children, 1862 were randomly chosen for inclusion in the study. After the study sample was identified, identifying information (parent name, address, telephone number, etc.) was obtained from the health record.

The parent or caretaker of each child selected for the study was sent a letter informing her about the study, encouraging her to participate, and informing her that she will be contacted by telephone to learn whether she is interested in participating. The parent/caretaker was given the choice of either making an appointment at one of the local dental health clinics or having the researcher come to the home.

### Measures

The appointment consisted of two components:

- A structured interview for the parent/caretaker.
- A dental examination of the child, including the collection of plaque for a caries activity test. The examination was made, using a mirror, and included visual assessment of all erupted teeth. A modification of the recording form used by the Indian Health Service was used on which to record the examination.

After the dental examination, the caries activity test, the Cariostat, was administered to all participating children. The Cariostat (Sankin, Japan) assesses the acid production of microorganisms in dental plaque. The Cariostat medium contains 20 percent sucrose as a source of carbohydrate, 2 percent tryptose as a source of nitrogen, 0.5 percent NaCl as an inorganic matter, 0.02 percent  $\text{NaN}_3$  to control gram negative bacteria and

also bromocresol purple and bromocresol green as pH color indicators. The test is based on the rationale that acids are involved in the etiology of dental caries and that acids are produced in dental plaque, and have the ability to demineralize enamel. Matsumura studied infants, twenty-four to thirty months old, in Japan and reported the results of Cariostat were significantly correlated with *S. mutans* counts and *deft*.<sup>9</sup> Tsubouchi and colleagues investigated the predictive value of Cariostat in young children, ages eighteen to thirty-six months, in Japan, and reported that the Cariostat test predicted the occurrence of dental caries and should be considered a valid and reliable test.<sup>10</sup>

The method for using the Cariostat follows: dental plaque is collected from the buccal surfaces of maxillary teeth with a cotton swab. The swab is then inserted in the Cariostat medium and incubated at 37 degrees centigrade for forty-eight hours. After the incubation, seven grades of colorimetric change are estimated, using a color standard sample. Each of these colors is evaluated as follows: blue(pH7.0)=0, green(pH5.4)=1.0, green-yellow(pH4.7)=2.0 and yellow(pH4.0)=3.0. Intervals between criteria (0-1, 1-2 and 2-3) are divided into halves.

The interview instrument was a slightly modified version of the instrument used by Weinstein and colleagues and Lopez del Valle and colleagues.<sup>11,12</sup> The instrument was used to assess demographic variables, child caretaking variables relevant to feeding, sleeping, and hygiene; and knowledge, beliefs, and assessment of the presence of BBTD. Psychological questions concerning self-regulation and items from the Parental Stress Inventory were included, but will not be presented in this paper.

### Response

Of the 1862 children randomly selected for the study, almost a quarter (24.2 percent) had moved from Edmonton; 8 percent were unable to be reached by telephone; and 12.5 percent refused to participate. The remaining parents/caretakers ( $n=1,029$ ) agreed to participate in the study. One hundred and six did not show up at the appointment, however, resulting in a study population of 938.

## RESULTS

### Demographics

Of the 938 children studied, 742 (79.1 percent) were Caucasian; eighty (8.5 percent) Asian; twenty-four (2.6

percent) First Nations; eleven (1.1 percent) Hispanic; and eighty-one (8.6 percent) others, including Indo-Asians, Arabs, Caribes, and Pacific Islanders. Almost all children (99 percent) were born in Canada. The average age of the children was nineteen months; the range was from eighteen to twenty-three months, with 77 percent of the population at nineteen months and 11 percent at twenty months. Fifty-one and a half percent of the children were female; 48.5 percent were male.

Of the respondents, 86.9 percent were mothers; 11.4 percent were fathers. Over three quarters of the examinations and interviews were conducted at the Health Centers; 22.7 percent were at the homes of the children.

Almost three quarters (72.7 percent) of the mothers in the study were born in Canada. The others were from sixty countries. The most frequent non-Canadian place of maternal birth was India (27), followed by Hong Kong (21), Vietnam (18), Philippines (18), Poland (15), China (15), England (15), and USA (13).

In response to the questions concerning living arrangements, 6.3 percent of the children live with one adult, 81.0 percent with two adults, 8.3 percent with three adults and 4.4 percent with four or more adults. Respondents indicated 34.9 percent of the households had only one child, 40.7 percent had two children, 17.6 percent had three children, and 6.9 percent had four or more children. Over 90 percent (92.2) of the mothers of the children were reported to reside with a spouse or partner. Forty-three percent of the respondents indicated no one helped the mother with the baby.

The education level of the mothers was high: 34 percent completed high school and 49.9 percent reported posthigh-school education. The average age of the mothers was 30.4 years (s.d.=5.2). The average age of the fathers was 33.1 (s.d.=5.8). Fifty-four percent of the mothers were said to work outside of the home: 24 percent worked twenty to thirty-nine hours; 17 percent, forty or more hours per week.

Table 1 □ Caries and caries activity status of the sample.

Variable	
Caries prevalence	4.58% (43/938)
Children with only decalcified teeth	3.41% (32/938)
Children with decalcified and decayed teeth	1.17% (11/938)
Average number of carious teeth per child (deft)*	0.136 (128/938)
Caries activity (low activity)**	76.1% (697/938)

\*The indicator of deft means total number of decayed teeth, missing teeth caused by caries and filled teeth. Decayed teeth includes decalcified teeth.

\*\*Subjects who had a Cariostat score of 0, 0.5, 1.0 and 1.5 were designated as having low caries activity; those with a score of 2.0, 2.5 and 3.0 were designated as having high caries activity. When the pH of the Cariostat medium falls below 5.5 (score=1.5), the critical pH for enamel demineralization, it is believed the child is at high risk for caries formation.

## Dental health and caries activity

Table 1 presents caries status and caries activity test results. Caries prevalence of 4.6 percent (43/938) was obtained. The overall dental health of the children was as follows: 91.6 percent had no dental problems; 3.8 percent, hypoplasia; 3.4 percent, decalcification; 1.2 percent, decay. Approximately three quarters of children with caries had only decalcified teeth (32/43). The average number of carious teeth per child (deft) was 0.14. Regarding the caries activity assessed by Cariostat, approximately 25 percent of children were designated as having moderate to high caries activity.

Table 2 presents the number of carious teeth by each tooth location. Decalcified and decayed teeth were found most frequently in maxillary anteriors (100/107, 17/20, respectively). Mandibular posterior and anterior teeth were seldom affected.

## Dental health behaviors

In response to the question "Do you or another adult clean your child's teeth?" and, if "yes," "how often?" the

Table 2 □ Number of carious teeth by each tooth location.

Tooth#	decalcified	decayed	filled	Tooth#	decalcified	decayed	filled
A	0	0	0	K	0	0	0
B	0	1	0	L	1	0	0
C	2	0	0	M	0	0	0
D	21	3	0	N	0	0	0
E	23	8	1	O	0	1	0
F	29	6	0	P	0	1	0
G	27	0	0	Q	0	0	0
H	2	0	0	R	0	0	0
I	1	0	0	S	1	0	0
J	0	0	0	T	0	0	0

following were reported: 25.8 percent were not cleaning yet; 6.4 percent cleaning once a week or less; 11.6 percent oftener than once a week, but less than almost every day; 56.3 percent almost everyday or oftener; and .3 percent do not know or missing.

Caretakers reported that 12.7 percent of their children sucked their fingers or thumbs and that 24.3 percent use a pacifier. When asked when the first tooth came in, the mean response was 7.0 months, *s.d.*=2.4.

When asked an open-ended question concerning the cause of "decay—holes in the baby teeth," the most frequent initial responses were as follows: sugar (38.8 percent), bottle use (27.0 percent), juice (16.0 percent), oral hygiene (6.4 percent), milk (4.7 percent), not sure (4.1 percent), and developmental (3.0 percent). Caretakers learned about decay from common sense (39.5 percent), reading (36.8 percent), health workers (10.5 percent), friends (7.9 percent), and relatives (5.3 percent). Forty-one caretakers with children with caries were asked what they believed caused the cavities. Responses were as follows: bottle use (12), juice (8), sugar (6), oral hygiene (5), not sure (4), milk and development (2), and nursing (1). When caretakers with children without caries were asked why the child has "good teeth," the following were cited: development (35.3 percent), oral hygiene (26.3 percent), nutrition (23.5 percent), bottle (6.1 percent), environment (5.2 percent), parental awareness (1.2 percent), and nursing (1.2 percent). While 73.0 percent of these caretakers indicated that they never heard about children under age three getting cavities, 83.6 percent remember being talked to about putting the baby down to sleep with a baby bottle, and 94.8 percent of those who remember being talked to recall the possible effect on the teeth. In response to the question "who told you," 36.2 percent were informed by a public health nurse, 26.1 percent by a nurse, 27.5 percent by a doctor or pediatrician, and 10.1 percent by dental personnel. The age of the child when told about the effects of putting the baby down to sleep with a bottle was as follows: 77 percent before birth, 21.3 percent before one year, 1.4 percent one to two years.

Very few caretakers (3.2 percent), when asked whether their baby had any tooth or mouth problem aside from teething, answered "yes." Of those who believed there was a problem (*N*=26), 69.2 percent indicated it was not serious, while the remainder reported perceiving some level of seriousness.

In response to the question "has your child had ear infections treated with antibiotics or had pus drain from the ears, 54.4 percent indicated yes. Very few caretakers reported tubes in the eardrums (*N*=8).

In response to the question about the caretaker's own dental health, 78.1 percent indicated they believed they had no dental problems. Ten percent noted one or two problems; 8.7 percent few problems; and 3.2 percent many problems.

Caretakers reported their last dental visit as follows: 49.4 percent within the last six months; 23.4 percent within the last year; 12.5 percent within the last two years; 7.3 percent within the last five years; 5.6 percent greater than five years; and 1.9 percent had never gone to the dentist. Over forty percent (40.9 percent) indicated they never had a toothache.

### Nutritional and sleep-related parenting practices

In response to the question "who puts baby to sleep workdays?" caretakers indicated that mothers provided 90.0 percent of this care; fathers 9.0 percent; others 1 percent. The pattern was virtually identical for weekends. Responses to the question regarding who feeds the baby indicate a similar pattern, with 92.6 percent of mothers, 6.1 percent of fathers, and 1.2 percent others feeding at bed time. Feeding at other times varied; while mothers and fathers feeding were reduced (86.1 percent and 3.7 percent, respectively), the percentage of others feeding the child increased. Grandparents, relatives, and friends fed the baby 3.5 percent, daycare 3.0 percent and sitters 3.6 percent.

Caretakers reported that the child this age sleeps an average of 10.0 hours (*s.d.*=2.2) before waking. While 43.6 percent indicate that they allow the child to cry longer than two minutes in the middle of the night, 55.8 percent are not willing to do so. When given an open-ended scenario of a crying child, when you want the child to be quiet, the following initial choices were given: hold the child, 34.1 percent; give a bottle, 24.5 percent; find out what the child wants, 13.6 percent; soothe the child, 5.6 percent; leave, 5.6 percent.

In response to the question "Is the child now using a bottle containing other than plain water?" 43.6 percent indicated "yes." Alternatively, only 4.2 percent reported that their children were still being breastfed. When asked, given present bottle use, what was contained in the bottle at nighttime feeding, 77.9 percent of the respondents indicated milk of some sort; 7.8 percent, juice; 5.8 percent, water; and 2.2 percent, formula. When asked, if no longer on the bottle, what was in the bottle at nighttime when it was stopped, 43.0 percent indicated milk; 38 percent water; 5.1 percent, diluted juice; 5.1 percent, cereal; 2.5 percent, formula; and miscellaneous low frequency responses.

When asked about propping the bottle at night so that the child could suck the nursing bottle without assistance, only 13.7 percent indicated any bottle propping. A slightly higher percentage of caretakers (15 percent) reported bottle propping at day feedings. On the other hand, when asked about leaving the baby unattended with a bottle to help him fall asleep, only 37 percent of the caretakers denied the practice. Over half (56.9 percent) did so at night and naps, 5.1 percent at night only, and 1.0 percent only at nap time.

Responses to a breastfeeding question indicate that about a third of mothers use this feeding practice to help the child fall asleep (32.5 percent night and naps, 2.7 percent nights only, and .4 percent naps only).

When caretakers were asked what was the best age to stop the bottle or nursing altogether, the average age was 20.6 months, with s.d.=6.8 and a range from seven to seventy-two months.

### Fathering practices

Fathers reported some parenting practices different from the others interviewed, predominately mothers. Fathers noted greater current bottle use (80.4 percent vs. 66.9 percent,  $\chi^2=8.0$ ,  $p=.005$ ), more bottle propping ( $\chi^2=9.5$ ,  $p=.009$ ), and less ability to ignore child crying (44.9 percent vs. 34.4 percent,  $\chi^2=4.5$ ,  $p=.03$ ).

### Likelihood of following preventive recommendations

Caretakers were asked what they would do in response to eight recommendations for dental health for twelve-month-old children. The results are presented in Table 3. Comparison between the responses to the recom-

mendation to gradually vs. immediately wean the child from the bottle is dramatic; while less than half of the caretakers indicated they cease immediately, over 90 percent said they would follow a gradual weaning recommendation. Putting less and less liquid in the extra night feeding bottle, bringing the child in twice a year for fluoride varnish applications, and slowly watering down night bottles were strategies the majority of caretakers believed they could follow. Alternatively, use of sugar substitutes, putting fluoride in the bottle on daily basis, stopping extra night feedings in the face of a crying baby, and immediate replacement of cup for bottle are recommendations that less than half the caretakers believed they would follow.

### Caries activity, parenting practices, and early caries

Table 4 presents results of cross-tabulation analyses of caries activity and parenting practices that may prove to be risk factors. The children in the caries group had a greater proportion of children with high caries activity than the noncaries group (22.1 percent vs. 55.3 percent,  $p=.00$ ). Eighty-seven percent of those in the caries group are using a bottle now, in comparison with 67 percent of subjects without caries ( $p=.01$ ). The parents/caregivers with caries children more often have propped up the bottle both at night time and at day time than the noncaries group (23.1 percent vs. 13.4 percent,  $p=.09$ ; 25.6 percent vs 15.0 percent,  $p=.07$ , respectively). Seventy-seven percent of children with caries were left unattended with a bottle in comparison with 62 percent of children without caries ( $p=.07$ ). Not allowing the child to cry longer than two minutes at night was associated with caries ( $p=.02$ ). Other questions, i.e.,

Table 3 □ Ratings of unlikely/likely to follow specific recommendations (1 = definitely would not do it, 5 = definitely would do it).

Recommendation	Definitely and probably would not do it	Definitely and probably would do it
A. Substitute cup for bottle in all feedings	51.8%	46.5%
B. Gradual substitution	4.4%	94.9%
C. Slowly water down night bottles	28.5%	68.0%
D. For a month, use sugar substitute in bottle	93.2%	6.2%
E. Stop extra night feedings, even if baby cries	46.9%	46.3%
F. Put less and less liquid in bottle as extra night feeding	26.6%	71.1%
G. Put fluoride drop in water bottle, once a day for 6 months	49.6%	44.2%
H. Bring child to dentist once every 6 mos. for fluoride coating on teeth	24.3%	70.7%

Table 4 □ Crosstabulation analyses by caries status (noncaries/caries).

Variables	caries n=43	noncaries n=895	test statistics
Caries activity (high)*	55.3%	22.1%	$\chi^2=22.2$ , $p=.00$
Bottle use current/not current	87.2%	67.7%	$\chi^2=6.56$ , $p=.01$
Breast feed current/not current	0%	4.3%	$\chi^2=1.74$ , $p=.19$
Bottle propping-night	23.1%	13.4%	$\chi^2=2.91$ , $p=.09$
Bottle propping-day	25.6%	15.0%	$\chi^2=3.22$ , $p=.07$
Unattended/attended with bottle	76.9%	62.3%	$\chi^2=3.39$ , $p=.07$
Not allow/allow night crying	74.4%	25.6%	$\chi^2=.00$ , $p=.02$

\*Subjects who had a Cariostat score of 0, 0.5, 1.0 and 1.5 were designated as having low caries activity; those with a score of 2.0, 2.5 and 3.0 were designated as having high caries activity. When the pH of the Cariostat medium falls below 5.5 (score=1.5), the critical pH for enamel demineralization, it is believed the child is at high risk for caries formation.



oral hygiene practices, did not show definite differences between caries-free and caries groups.

Table 5 presents comparison of caries status and risk factors by Cariostat level (low/high). Subjects who had a Cariostat score of 0, 0.5, 1.0, and 1.5 were designated as a low caries activity group. Subjects with a Cariostat score of 2.0, 2.5, and 3.0 were designated as a high caries activity. The caries prevalence of high activity subjects was over four times higher than low activity subjects (2.4 percent vs. 9.8 percent). These children with high activity had significantly higher *deft* than low activity children (0.06 vs. 0.34). Statistically significant findings were not found when the relationship between caries activity and risk factors was examined.

**Ethnicity, dental disease, and parenting practices**

Both race and whether or not the child's mother was born in Canada were related to the status of the child's teeth. First Nation, Oriental, and those in the Other category (Indo-Asian, Arabic, Caribbean and Pacific Islanders) were found to have a higher rate of caries ( $\chi^2=18.9, p=.0008$ ). The distribution of mothers of different races was not equal across Health Centers ( $\chi^2=106.7, p=.00000$ ).

Mother being foreign-born was associated with a higher rate of caries ( $\chi^2=3.5, p=.06$ ). Table 6 presents the prevalence of dental disease for mothers' countries of origin. While the numbers of foreign-born mothers was small, it appears that a child of a mother born in the Orient, Latin America, or the Caribbean is at much greater risk for early dental disease. While caries was not found to be directly related to the Health Center variable, Health Center was related to foreign-born status ( $\chi^2=32.6, p=.00007$ ).

Foreign-born status was associated with various parenting practices. Sixty-two percent of Canadian-born

and 85 percent foreign-born reported current bottle use ( $\chi^2=42.6, p=.00000$ ). Foreign-born indicated more bottle propping ( $\chi^2=14.2, p=.0008$ ), a greater percent leaving the baby unattended with a bottle to fall asleep (77.0 percent vs. 57.5 percent,  $\chi^2=28.3, p=.00000$ ), less ability to ignore baby crying ( $\chi^2=13.9, p=.0002$ ), and lower percent cleaning the child's teeth (65.9 vs. 77.3 percent,  $\chi^2=.0004$ ).

**DISCUSSION**

**Ethnicity**

Most studies do not present the true prevalence of this earliest form of dental caries; access to very young children is often a problem and studies often examine older children at a preschool setting or take a convenience sample at a medical or other setting. Given the random sampling of children it is believed this study establishes the true prevalence of the disease in Edmonton.

An agreed upon definition of the earliest form of caries does not exist, however; moreover, most investigations have been retrospective and have not controlled for child age. Comparisons among studies, therefore, are difficult and fraught with risk. Given these caveats, how should a 4-5 percent prevalence of decalcification and caries in a population of nineteen-month olds be interpreted?

First, the multicultural nature of the population must be acknowledged. Studies of various ethnic, cultural, or socioeconomic segments of North American society have revealed major differences in prevalence rates of early caries. While the true prevalence rate is useful in determining whether or not population-based interventions are needed, that statistic itself may be detrimental to efforts to control the disease in segments of population

Table 5 □ Crosstabulation analyses by caries activity (low/high).

Variable	high activity n=219	low activity n=697	test statistics
Caries prevalence (%)	9.81%	2.44%	$\chi^2=22.2, p=.00$
Average <i>deft</i> per child	0.338	0.059	$t=-5.78, p=.00$
Bottle use current/not current	72.1%	67.4%	$\chi^2=1.71, p=.19$
Breast feed current/not current	2.3%	4.6%	$\chi^2=2.28, p=.13$
Bottle propping-night	14.5%	13.5%	$\chi^2=0.14, p=.71$
Bottle propping-day	15.0%	15.7%	$\chi^2=0.06, p=.81$
Unattended/attended with bottle	66.7%	61.5%	$\chi^2=1.80, p=.18$
Cleaning/not cleaning	22.9%	26.3%	$\chi^2=1.00, p=.32$

\*Subjects who had a Cariostat score of 0, 0.5, 1.0 and 1.5 were designated as having low caries activity; those with a score of 2.0, 2.5 and 3.0 were designated as having high caries activity. When the pH of the Cariostat medium falls below 5.5 (score=1.5), the critical pH for enamel demineralization, it is believed the child is at high risk for caries formation.

Table 6 □ Mother's country of origin and child's dental disease at 18 mos.

Country	N	% and Number
Africa	13	7.7 (1)
Australia/New Zealand	4	0 (0)
Eastern Europe	19	0 (0)
Indonesia/Pakistan	34	2.9 (1)
Latin America/Caribbean	26	15.3 (4)
Middle East	8	0 (0)
Orient	87	9.2 (8)
Pacific Islands	11	0 (0)
U.S.A.	13	0 (0)
Western Europe	38	5.3 (2)
Canada	676	3.4 (23)

with much higher risk. Given the multiethnic nature of Canadian society, it is reasonable to focus on ethnic differences; if differences in disease rate are found for various groups, targeting of limited resources is possible to prevent the disease.

Though numbers were not great, mother being foreign-born was related to a higher rate of caries. It appears that the variable of race is itself nested within the ethnic origins of the child. While numbers were rather small, children of Oriental and Latin American or Caribbean immigrants appear to be at greater risk for early caries. Moreover, because of the small numbers and the early screening, with the exception of immigrants from the U.S., it would not be unreasonable to consider the entire population of children of immigrants to be at risk. These results are supported by the findings of others in Scandinavia and North America that children of immigrants are at high risk for caries.<sup>7,13-15</sup>

It is important to note that there are important differences in parenting practices between foreign and native born mothers. These differences center in two areas: feeding practices associated with sleep and oral hygiene. Foreign-born mothers are more likely to leave the baby unattended with a bottle and to prop the bottle. Moreover, given a lesser ability to tolerate baby crying, they are less likely to follow professionally recommended strategies that anger or frustrate the child. A similar explanation probably accounts for the lower percent of children of foreign-born mothers having their teeth cleaned on a daily basis. Health education and counseling strategies should make use of this information. Strategies such as spontaneous cessation of weaning from the bottle at twelve months, banning the bottle when the child awakens in the middle of the night, replacing cariogenic agent in the bottle with water, probably will not be adhered to by foreign-born caretakers.

Targeting the use of scarce dental dollars for the primary and secondary prevention of early caries in children of foreign born mothers is a reasonable outcome of this study. Teaching these mothers to look in their babies' mouths for early signs of caries in high risk teeth is a feasible, reliable and low cost strategy, as is the use of fluoride varnish and other easily applied chemotherapeutic agents.<sup>16,17</sup> Noninvasive treatments such as the placement of glass ionomer fillings are available when the tooth is carious. Moreover given the successful experiences of the faculty of the University of Washington in training public health and private practice dentists to use these techniques to treat children from one to three years of age, we would like to encourage additional colleagues to begin to screen and treat high-risk children at a younger age.

## Dental health behaviors

Over half of the caretakers report that they clean their child's teeth on a more or less daily basis. Such efforts, especially as part of normal hygiene activities that involve bathing, hair brushing, and the like, can be more easily integrated into the family's lifestyle. Instruction on toothcleaning technique that focuses on the at-risk surfaces may be extremely successful and should be encouraged when the first maxillary incisor begins to erupt. For some individuals, the preventive message may be framed in terms of alleviating teething difficulties, a comorbid condition with unknown etiology.

Dental health information was not as effective as possible. Caretaker responses indicated a fair knowledge of the dental disease process. Caretakers of children with caries, however, seemed to implicate fermentable carbohydrates and bottle use without much appreciation that there is sugar in milk and that the amount of time these sugars are in the mouth are crucial to the disease process.

## Nutrition/sleep parenting

Providing a bottle to a crying baby appears to be a likely response for about a fourth of the population. The use of very cariogenic agents in the bottle, e.g., juice, is limited to between 5-10 percent of the population. Alternatives to the above practices are available and should be routinely discussed when counseling caretakers.

Interesting differences were found for questions that asked about bottle propping behaviors and leaving the child unattended with a bottle. While few caretakers reported bottle propping, the majority acknowledged leaving the child unattended with a bottle. Most year-and-a-half-old children do not need the bottle to be propped, they can hold onto the bottle themselves. Bottle propping may not be the only question assessing time of exposure for bottlefed babies. Additional questions concerning caretaker behavior, i.e., presence or absence, seem warranted.

Along these lines it was interesting that fathers seemed to differ from other caretakers in their response to some nutrition/sleep questions (greater bottle use, propping, less ignoring of crying). Two types of not mutually exclusive interpretations are possible: the first, that fathers have less experience and are less skilled in parenting; the second, that fathers are more naive and are less likely to give the socially acceptable answer to the interviewer.

### Likelihood of following recommendations

The results of the questions asking the likelihood of following recommendations for dental health for a twelve-month-old were clear. Some practices were very likely to be followed; others were not. Results were very similar to those found in Mexican-American farm worker population.<sup>18</sup> It is unfortunate that the recommendation most made by health professionals and educators, immediate weaning at twelve months, was rejected by over half of the caretakers. Alternative recommendations such as gradual weaning, putting less and less liquid in the bottle, and regular professional application of a fluoride varnish, should be considered. It may make some sense to recommend beginning to wean by at least twelve months, with completion of weaning at around eighteen months. Moreover, it appears that giving health information itself is insufficient to induce change in the majority of caretakers, especially those who may be foreign-born or otherwise not oriented to preventive activities. Brief counseling is strongly recommended; such counseling is interactive and occurs over more than one visit. As such, effectiveness of a given preventive strategy can be monitored and the strategy modified, if needed, to suit the circumstances of the family.

### Caries activity

Cariostat scores indicate that about 25 percent of the children had high caries activity. Clearly, the results of the Cariostat were related to current caries status and to current dietary risk factors. Given that the children were not reexamined at a later point in time, it is impossible to establish the predictive validity of the measure. Sudtadi *et al*, in a study of Indonesian one to four-year-olds with higher rates of caries, found increases in caries, however, from year one to year two to be associated with Cariostat scores.<sup>19</sup> They reported a sensitivity of .63 and a specificity of .54. Given the low cost and ease of administration and analysis of the Cariostat, it may have some utility in predicting those who will develop caries. The measure is probably best administered, however, in a higher risk, targeted population, i.e., children of foreign-born mothers.

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# Are you treating youngsters who are or should be receiving mental health services?

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

"Thirteen percent of children age 3-17 years old have had an emotional or behavioral problem lasting 3 or more months or that required psychological treatment."<sup>1</sup>

"...60 percent to 80 percent of children in need of mental health treatment do not receive any help."<sup>2†</sup>

**C**hildhood is recognized in psychiatry as a period of vulnerability and progressive development toward adult personality and character. Psychiatrists now recognize that the disorders of children are serious, treatable conditions and as precursors of adult psychopathology.

As pediatric dentists provide services to the youngsters in their practices they face any number of difficulties in patient management. More often than not, the dentist assumes that these problems are related directly to the very nature of dental services, rather than particular underlying personality characteristics of preschool and school-age children. But for some children, personality difficulties (not necessarily recognized by the family) must be understood as practitioners attempt to meet the dental needs of their young patients.

The following presentation will provide a general introduction into the extent and nature of childhood and

adolescent mental health difficulties—difficulties that involve some of your current patients.

## PREVALENCE AND NEED FOR SERVICES

No national epidemiological studies have been conducted in this country that would provide valid indicators of either the prevalence or incidence of mental disorders among children. Local studies or studies conducted outside the United States, however, indicate that the number of children with diagnosable disorders range from 17.6 percent to 22 percent, including 3 percent to 5 percent who have severe emotional or behavioral problems that significantly interfere with their daily functioning.

- About 600,000 adolescents suffer from mental disorders; 115,000 adolescents were admitted annually to psychiatric facilities in the mid 1980s.<sup>3</sup>
- Estimates of the prevalence of disorders among children seen in the child protective system (for having been abused, neglected or for being delinquent) suggest that between 43 and 70 percent have mental health problems severe enough to want mental health intervention.
- Although reviewers use conservative estimates to measure behavioral problems, they report more than one half of children in various custodial settings exhibit levels of mental disturbance. Despite this level of need, less than one third of these children are receiving any services from mental health agencies. (See below for further discussion of the use of services)

†Unless otherwise specified, material for this presentation was drawn from an extended commentary and literature review in the annual report from the Center for Mental Health Services of the U.S. Department of Health and Human Services.<sup>2</sup>

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- Educational estimates suggest that 3 percent to 5 percent of all school children may have serious behavioral or emotional disorders, with less than one third of the children receiving appropriate mental health services.

About 15 percent of males and 11 percent of females between three and seventeen years of age (with progressive increases with age) exhibit emotional or behavioral problems.

- A greater percent of white and Native American children exhibit emotional and behavioral problems than African-American and Asian-Pacific Islander children, with particularly lower prevalence in the latter population.
- The prevalence of emotional and behavioral problems is lower for children 1) in families above the poverty line, 2) in families with two biological parents, 3) where the mother's age at first birth was older and 4) where the children's birth weight was not low level, as compared to their respective counterparts (Table 1).

Multiple psychiatric disorders are typical in a single child psychiatric patient. A primary psychiatric disorder in childhood can lead to secondary developmental complications such as conduct disorder or school failure. Certain disorders move in "clusters" through families and individuals and interact with each other to produce more virulent forms of the disorder.<sup>4</sup> For example: 10 percent of boys and 2 percent of girls of school age have reported attention deficit/hyperactive disorders (ADHD) (Table 2). ADHD often appears in combination with other psychiatric disorders and is present in 30 percent to 50 percent of childhood psychiatric outpatients and 40 percent to 70 percent of psychiatric inpatients. About 17 percent ADHD children are extrafamilial adoptees, compared with 4 percent of child psychiatric patients and 1 percent of the general population.<sup>4</sup>

The prevalence of many mental disorders is greater in males than females, ranging from a ratio of 2:1 to 9:1. Lifetime prevalence of mental disorders first diagnosed in infancy, childhood and adolescence range as high as 15,000 cases per 100,000 persons (Table 3).

Results from the National Adolescent Student Health Survey in the mid-1980s indicated that:

- 34 percent of 8th and 10th graders had thought of suicide.
- 14 percent attempted suicide at least once.
- 61 percent of students reported feeling depressed and hopeless.
- 45 percent reported having trouble coping with stress situations at home and school.<sup>3</sup>

Table 1 □ Percent of children 3-17 years of age with an emotional or behavioral problem by age of child and selected family characteristics: 1988.<sup>1</sup>

	All ages	3-4 years	5-11 years	12-17 years
<b>Gender</b>				
Male	15.4%	4.6%	14.5%	20.4%
Female	11.3	3.4	9.3	16.5
<b>Race</b>				
White	14.2	4.1	12.9	19.4
African-American	10.3	2.9	8.1	15.0
Asian-Pacific Islander	7.5	6.4	7.5	7.9
Native American	13.2	9.2*	10.9	17.2
<b>Hispanic origin</b>				
Mexican-American	10.5	—	11.3	14.8
All other Hispanic	13.4	10.8	13.0	14.8
Total Hispanic	12.0	5.2	12.1	14.8
Non Hispanic	13.6	3.8	11.9	18.9
<b>Poverty status</b>				
Below poverty level	16.4	5.2	15.4	23.0
At or above poverty level	12.7	3.7	11.0	17.6
<b>Family structure</b>				
Both biological parents	8.3	2.7	7.8	11.6
Biological mother only	19.6	6.9	17.7	16.3
Adoptive parents	26.6	15.4	26.9	29.8
<b>Mother's age at first birth</b>				
17 yrs or younger	15.1	3.5	15.0	18.7
30 yrs or older	11.1	3.8	11.0	17.6
<b>Child's birth weight</b>				
Very low < 1,500 grams	17.7	—	14.7	24.9
Non-low birthweight	13.2	3.7	11.9	18.3

\*Figure does not meet standard of reliability or precision

A review of data from the National Center for Justice indicated that between 14 percent and 22 percent of almost 850,000 youngsters who had contact with the juvenile court system met diagnostic criteria for at least one mental disorder.

Summary: Given the prevalence rates of the wide range mental disorders affecting youngsters, it would seem to be all but impossible for the average pediatric dental practitioner never to have provided care to a child or adolescent with one or more of these conditions.

## USE OF SERVICES

Children enter the mental health service sector at various ages and levels of development. Entry may vary depending upon a variety of factors, including demographic or clinical characteristics of the child or family, stigma associated with the very act of seeking psychiatric aid, rural or urban living conditions, the general fragmentation of the system or the actual availability of the particular services in a community.

Unfortunately, "...little is known about the organizational structure of children's services systems, nor about the effect of different structures on the costs of services

Table 2 □ Mental disorders usually first diagnosed in infancy, childhood or adolescence.<sup>4,5</sup>

<b>Mental retardation:</b> approximately 1 percent of all children
<b>Learning disorders:</b> 5 percent of students in public schools
Reading: 4 percent
Mathematics: 1 percent
Disorder of written expressions
<b>Motor skills disorder:</b> 6 percent of 5–11 year old children
Developmental coordination
<b>Pervasive developmental disorders</b>
Autistic: 2–5 cases per 100,000 children
<b>Attention deficit and hyperactive disorders:</b> 3–5 percent of school age children
Attention disorders
Disruptive behaviors
Oppositional defiant disorder: 6–16 percent of boys, 3–5 percent of girls
Conduct disorder
<b>Feeding and eating disorders of infancy or early childhood</b>
Pica: increases with severity of retardation
Feeding disorder: 1–5 percent of all pediatric hospital admissions
<b>Tic disorders</b>
Tourette's disorder: 4–5 per 100,000 children
Chronic motor or vocal tic disorder
<b>Communication disorders</b>
Expressive language disorders: 3–5 percent of children
Stuttering: 1 percent prepubertal, 0.8 percent in adolescence
Mixed receptive-expressive language disorder: 3 percent of all children
<b>Elimination disorders</b>
Encopresis (incontinence of feces not due to organic defect or illness): 1 percent of 5 year olds, boys > girls
Enuresis: at age 5 years – 7 percent of boys, 3 percent of girls at age 10 years – 3 percent of boys, 2 percent of girls
<b>Other disorders</b>
Separation anxiety disorder: 4 percent of children and adolescents
Selective mutism

Note: The listing of disorder examples is not all inclusive

Table 3 □ Estimates of epidemiological characteristics of some disorders usually first diagnosed in infancy, childhood or adolescence.<sup>2</sup>

Diagnosis	Gender ratio (male:female)	Lifetime prevalence (per 100,000)
Conduct disorder	3:1 to 5:1	3,000–15,000
Reading disorder	3:1 to 4:1	3,000–15,000
Oppositional defiant disorder	2:1 to 3:1	2,000–15,000
Attention-deficit/hyperactivity disorder	3:1 to 10:1	3,000–10,000
Phonological disorder	?	3,000–10,000
Expressive language disorder	3:1 to 4:1	3,000–10,000
Mathematics disorder	2:1	3,000–10,000
Motor skills disorder	?	4,000–8,000
Separation anxiety disorder	1:1 to 2:1	600–6,000
Stuttering	3:1 to 4:1	1,000–4,000
Mental retardation	1:1 to 3:1	1,000–3,000
Tic disorder	3:1 to 9:1	1,000–2,000
Functional enuresis	2:1 to 3:1	1,000 males at 18 yrs
Functional encopresis	4:1	1,000–1,500 at age 5 yrs
Selective mutism	1:1 to 2:1	30–500
Tourette's disorder	3:1 to 9:1	40–80
Autistic disorder	3:1 to 4:1	30–50
Disease of written expression	3:1 to 4:1	?

Note: "These estimates are based on current and often preliminary data from a variety of sources using different methods and diagnostic criteria."<sup>4</sup>

and the clinical outcomes for youth."<sup>2</sup>

Approximately, 23 percent of children ages nine through seventeen have received some type of mental health service in the past year. Use of services increases to 33 percent, if only children with a diagnosable mental disorder are included.

Receipt of services vary widely across different components of the service system. Only 11 percent of children at risk of mental health problems receive services in a mental health setting. One third of children receive some services through their school. Schools are reported frequently to be the major provider of mental health services. In some studies, as high as 50 percent of children who saw a mental health professional saw a school counselor.

In local studies, less than 20 percent of children in foster care are being served by the mental health system, despite the fact that it is estimated that 50 percent of children in various custodial programs have profound level of mental disorders. Comparable data on mental service use in the juvenile justice or substance abuse sectors are not available.

Youngsters represent:

- 7 percent of the state and county mental hospital population.
- 41 percent of the private psychiatric hospital population. Children less than thirteen years of age accounted for 11 percent of the in-patient population.
- 17 percent of the non-federal general hospital population.
- 76 percent of the private psychiatric hospital residential treatment population.
- One-quarter of the private psychiatric and non-federal hospital outpatient population (Table 4).

### COSTS OF SERVICES

Approximately \$4.8 billion was spent for child and adolescent mental health services in 1990—7.1 percent of the total mental health expenditures for the year.

- 46 percent of the mental health service costs for adolescents (age ten to eighteen) was spent for hospital inpatient care, 28 percent for ambulatory

Table 4 □ Number and percent of persons less than age 18 on rolls of mental health organizations: 1988.<sup>2</sup>

	State & county mental hospitals	Private psychiatric hospitals	Non-federal general hospital
<b>Inpatient services</b>			
Number	7,449	11,612	5,962
Percent of all patients	7%	41%	17%
<b>Residential treatment</b>			
Number	168	1,263	na
Percent of all patients	20%	76%	
<b>Outpatient services</b>			
Number	12,229	28,350	76,653
Percent of all patients	13%	26%	24%
<b>Partial care*</b>			
Number	1,607	2,200	2,391
Percent of all patients	9%	28%	15%

\*A mental health program that is a free-standing facility that offers only day or night partial care.

(outpatient) care.

To date, no systematic data collection has been undertaken to understand the distribution of child and adolescent mental health expenditures by payment source.

## MANY UNANSWERED QUESTIONS

Efforts are underway at the National Institute of Mental Health to study child and adolescent service use, need, outcomes and costs of care in an attempt to answer some of the following questions.

What is the extent of the unmet need for services by children, adolescents and their families? What are the major types of services provided to youth across the major service sectors? What are the patterns of service use across the system? What socioeconomic, ethnic, family, community or service system characteristics influence the use of services? What are the consequences for children, adolescents and families who do and who do not receive care? What are the costs of care across program elements? How are mental health services for children and adolescents financed?

## FROM THE PERSPECTIVE OF THE PEDIATRIC DENTIST

“‘But these children come from a good family,’ is probably the comment that many of us (both lay and professional) (sic) have made about most children.”<sup>6</sup>

The conclusion in an earlier presentation in the *Journal of Dentistry for Children* was that problems develop even in the “best of families”—even in the families of pediatric practitioners.<sup>6</sup> But all too often we are reluctant to categorize or to somehow infer that a youngster is having some mental health difficulties. We are far from overcoming the stigma associated with the use of the services of a “shrink”. (I am reminded of the “Peanuts” cartoon by Charles Schultz in which Lucy is offering psychiatric help for 5 cents and Charlie Brown comments, “Doctor, does this mean I can never run for president?”)

The need is to recognize that 1) even the youngest of children seen in a dental practice may well be in need of mental health services, 2) management problems you are having with a particular child may not just be associated with the dental services and 3) that families are unaware or unwilling to accept the fact that their child needs help.

The challenge faced by a pediatric dentist is that in all probability, “you are treating youngsters who are or should be receiving mental health services.” How prepared are you to work with the child’s family to assist them as they seek the needed care for their youngster? How prepared are you to care for a child who is receiving mental health supportive services? Who ever said it would be easy?

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## DEMOGRAPHICS

# Yes, overall crime statistics are down, but juveniles are committing more criminal offenses

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

“**T**he (National) Crime Index total dropped 1 percent to less than 14 million offenses, the third consecutive year of decline.”<sup>1</sup>

The opening statement in the 1995 report by the U.S. Department of Justice heralds the continued improving national statistics in our efforts to combat crime in our nation. Any number of politicians are more than happy to claim credit for the supposed improving quality of life.

“...the 1994 national total (of crime) was 3 percent lower than the 1990 level...”<sup>1</sup>

Unfortunately subsequent comments in the report indicated that, “the smallest cities in the country...recorded a 1 percent increase (in crime). Serious crime also increased in the Nation’s counties (both rural and suburban).”<sup>1</sup> For example, in 1994:

- One criminal offense occurred every two seconds.
- One violent crime occurred every seventeen seconds.
- One murder every twenty-three minutes.
- One forcible rape every five minutes.
- One robbery every fifty-one seconds.
- One aggravated assault every twenty-eight seconds.
- One property crime occurred every three seconds.
- One burglary every twelve seconds.
- One larceny-theft every four seconds.
- One motor vehicle theft every twenty seconds.<sup>1</sup>

While the report emphasizes the changing nature of crime in our country, it does not emphasize sufficiently

the fact that juveniles are committing more criminal offenses.

“While there has been a significant decrease in violent crimes nationally, there continues to be a steady increase in criminal violence committed by juveniles. For example, the rate of known homicide offenders aged 14 to 17 had climbed from 16.2 per 100,000 youngsters in 1990 to 19.1 in 1994.”<sup>2</sup>

A previous review in the *Journal of Dentistry for Children* focused on the reality “...that pediatric patients are not divorced from the tragedies and (criminal) events that fill our daily newspapers.”<sup>3</sup>

The following presentation is offered to acquaint pediatric dentists with Federal Bureau of Investigation reports that indicate that during the 1990s, despite national decreases in criminal activities, youngsters in our cities, suburbs and rural areas (maybe, even youngsters in our dental practices) increasingly are involved in violent crimes, (murder, forcible rape, robbery and aggravated assault) property crimes (burglary, larceny-theft, motor vehicle theft and arson) and delinquency crimes (assault, vandalism, drug abuse, liquor law violation, disorderly conduct, etc.).

(Note: a delinquency offense is an act committed by a juvenile for which an adult could be prosecuted in a criminal court. Disposition of a case could involve a definite action such as referring case to juvenile courts, transferring the case to a criminal court, dismissing the case, placing the youth on probation, placing the youth in a facility for delinquents, or such actions as fines, restitution, and community service.<sup>1</sup>)

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Table 1 □ Number of known crimes by individuals of all ages in 1994 and changes in the number and rate between 1990 and 1994.<sup>1</sup>

Type of crime	Number in 1994 (in 000s)	Percent change between 1990-94	
		Number of known offenses	Rate per 100,000 inhabitants
Total crime index	13,991.7	-3.3%	-7.7%
Violent crimes	1,864.2	2.4*	-2.2
Murder & non negligent homicide	23.3	-0.6	-4.3
Rape (forceable)	102.1	-0.4	-4.9
Robbery	618.8	-3.2	-7.5
Aggravated assault	1,119.9	6.2*	1.4*
Property crimes	12,127.5	-4.2	-8.5
Burglary	2,712.1	-11.8	-15.7
Larceny-theft	7,876.2	-0.9	-5.3
Motor vehicle theft	1,539.1	-5.9	-10.1
Arson	83.9	na**	na**

\*Decreases occurred from higher numbers and rates in 1992 and 1993

\*\*Between 1993 and 1994, adult arrests for arson decreased by 7 percent, juvenile arrests increased by 18 percent.

## NATIONAL OVERVIEW OF CRIMINAL ACTIVITIES

Between 1990 and 1994, there was a 3.3 percent decrease in the overall number of known criminal offenses and a 7.7 percent decrease in the rate per 100,000 population. The decreases occurred in all forms of violent and property crimes (Table 1).

## INCREASES IN JUVENILE ARRESTS

During the 1990s, (except for delinquency crimes and criminal acts against property by children less than ten years of age) there was a general increase in the number of arrests of juveniles of all ages for each category of violent

and property criminal offenses and delinquency actions.

For juveniles less than 10 years of age:

□ Arrests for violent criminal acts increased by 52 percent.

□ Arrests for property criminal acts increased by 10 percent.

□ Arrests for delinquency criminal acts increased by 45 percent.

For juveniles less than 18 years of age:

□ Arrests for violent criminal acts increased by 37 percent.

□ Arrests for property criminal acts increased by 8 percent.

□ Arrests for delinquency criminal acts increased by 34 percent (Table 2).

## ARRESTS OF JUVENILES BY GENDER

During the 1990s, in each age-group, males represented 72 percent or more of the children arrested for criminal offenses. Except for decreases in the number of arrests of both sexes less than ten years of age, there were increases in the arrests of males and females in other age-groups. Females represented an increasing proportion of arrests.

Juveniles less than 15 years of age

□ Arrests of females increased by 46 percent, compared to a 26 percent increase in the number of males arrested.

□ Arrests of females for violent and delinquency crimes increased, respectively, by 71 percent and 51 percent.

Juveniles less than 18 years of age

□ Arrests of females increased by 37 percent, com-

Table 2 □ Juvenile arrests by age: 1990, 1994.<sup>1</sup>

	Ages Under 10		Ages Under 15		Ages Under 18	
	1990	1994	1990	1994	1990	1994
Total arrests	42,782	37,130	593,869	780,979	1,754,542	2,209,675
Violent crimes	1,270	1,394	25,622	38,975	91,317	125,085
Murder & non negligent homicide	5	3	283	379	2,555	3,102
Rape (forceable)	89	103	1,605	1,863	4,628	4,859
Robbery	209	245	8,874	13,543	32,967	47,094
Aggravated assault	967	1,043	14,860	23,190	51,167	70,030
Property crimes	18,204	13,639	236,649	261,448	564,060	610,563
Burglary	3,674	3,135	44,466	47,481	112,437	115,681
Larceny-theft	13,278	9,145	167,741	185,811	372,133	412,349
Motor vehicle theft	227	206	20,146	21,867	72,930	73,265
Arson	1,025	1,153	4,296	6,289	6,560	9,268
Delinquency crimes (including assaults, vandalism, drug abuse, liquor laws, disorderly conduct, etc.)	23,308	22,097	331,598	480,556	1,099,196	1,474,027

Table 3 □ Total arrests of juvenile by age and gender: 1990, 1994.<sup>1</sup>

Age	Total arrests	Percent distribution	Type of crime		
			Violent	Property	Delinquency
<b>Under 10</b>					
Male					
1990	36,060	84.3%	1,165	15,280	19,615
1994	31,057	83.6	1,264	11,365	18,428
Female					
1990	6,722	15.7	105	2,924	3,693
1994	6,073	16.4	130	2,274	3,669
<b>Under 15</b>					
Male					
1990	442,954	74.6	21,723	182,717	238,514
1994	559,942	71.7	32,308	193,055	334,579
Female					
1990	150,915	25.4	3,899	53,932	93,084
1994	221,037	28.3	6,667	68,393	145,977
<b>Under 18</b>					
Male					
1990	1,355,638	77.3	80,591	441,199	833,848
1994	1,660,549	75.1	107,473	456,325	1,096,751
Female					
1990	398,904	22.7	10,726	122,861	265,317
1994	549,126	24.9	17,612	154,238	377,276

Note: Includes only those individuals identified by gender

Table 4 □ Total arrests by race for children less than 18 years of age: 1990, 1994.<sup>1</sup>

Race	Number		Percent distribution	
	1990	1994	1990	1994
White	1,239,241	1,512,265	71.3%	68.6%
African-American	455,164	631,816	26.2	28.6
Native-American	18,416	23,246	1.1	1.1
Asian/Pacific Isl.	25,859	38,066	1.5	1.7
Total	1,738,680	2,205,393	100%	100%

Note: Includes only those individuals identified by race

pared to an 18 percent increase in the number of males arrested.

- Arrests of females for violent, property and delinquency crimes increased, respectively, by 64 percent, 25 percent and 42 percent (Table 3).

### ARRESTS OF JUVENILES BY RACE

For all races during the 1990s, there were increases in the number of children arrested. The greatest percent

increases in arrests were of Asian/Pacific Islanders and African-American youths (47 percent and 39 percent, respectively).

The smallest increases were reported for white children (22 percent).

In 1994, 68.6 percent of juvenile arrests were of white youngsters and 28.6 percent were of African-American youngsters (Table 4).

### ARRESTS OF JUVENILES BY RESIDENCE

During the 1990s, there was "only" about a 25 percent increase in the number of arrests of juveniles who lived in cities. By contrast:

- There was a 59 percent increase in the arrests of youngsters less than 15 years of age and a 46 percent increase in youngsters less than 18 years of age who were residents of suburban counties.
- There was a 37 percent increase in the arrests of juveniles less than 15 years of age who were residents of rural counties (Table 5).

### CRIMES BY AND AGAINST CHILDREN

- Murder: The number of children murdered increased during the 1990s. Between 1990 and 1994 there was a 35 percent increase in the number of children less than 15 years of age and a 28 percent increase in the number of children less than 18 years of age who were murdered.†
- In 1993, 731 children less than five years of age and 560 children between five and fourteen years were murdered. Forty (40) percent of the children who were murdered were white, and 56 percent were African-American. This represented a progressive increase in African-American share of

†Does not include the numbers who died as a result of negligent homicide.

Table 5 □ Arrests of juveniles by age and residence: 1990, 1994.<sup>1</sup>

Residence	Less than 15 years				Less than 18 years			
	Number		Percent		Number		Percent	
	1990	1994	1990	1994	1990	1994	1990	1994
City	509,432	651,927	85.8%	83.5%	1,471,431	1,816,604	83.9%	82.2%
Suburban counties	61,369	97,525	10.3	12.5	197,257	287,923	11.3	13.0
Rural counties	23,068	31,527	3.9	4.0	85,854	105,148	4.9	4.8
Total	593,869	780,979	100%	100%	1,754,542	2,209,675	100%	100%

Table 6  Murder victims by age and race: 1990, 1993, 1994.<sup>1</sup>

Age	White		African-American		Other		Total*	
	1990	1993	1990	1993	1990	1993	1990	1993
< 1 yr	159	135	98	118	5	10	264	272
1-4 yrs	169	217	136	225	10	16	317	459
5-9 yrs	61	101	51	61	2	10	118	173
10-14 yrs	138	185	125	194	7	8	270	387
15-19 yrs	918	1,125	1,376	1,857	28	81	2,348	3,084
Totals								
< 20 yrs								
Number	1,445	1,763	1,786	2,455	52	125	3,317	4,375
Percent	43.5%	40.3%	53.8%	56.1%	1.6%	2.8%	100%	100%
< 18 yrs								
1990	942		971		38		1,970	
1994**		1,115		1,311		84		2,521

\*Includes victims of unknown race

\*\*Changes in age cohorts preclude comparisons with earlier years

Table 7  Substantiated child abuse and neglect cases by type, gender, age and race/ethnic group of victim: 1990, 1993.<sup>5</sup>

Type of maltreatment	1990 (000s)	1993
Neglect	358.8	492.2
Physical abuse	205.1	232.1
Sexual abuse	127.9	139.3
Emotional maltreatment	47.7	47.7
Other & unknown	61.7	145.9
Total	801.1	1,057.3
Gender		
Male	360.5	413.2
Female	409.3	470.5
Age		
Less than 2 yrs	107.2	121.7
2-5 yrs	194.5	236.9
6-9 yrs	177.4	209.2
10-13 yrs	151.9	177.5
14-17 yrs	117.3	133.9
Race/ethnicity		
White	424.5	497.9
African-American	197.4	229.6
Asian & Pacific Isl.	6.4	7.8
Native American	10.3	13.7
Other races	11.7	13.7
Hispanic origin*	73.1	85.0

Note: Includes only those individuals identified in particular demographic categories.

\*Some states were unable to report on the number of Hispanic victims.

Table 8  Delinquency cases disposed of by juvenile courts: selected years 1975-1992.<sup>5</sup>

Year	Total (000s)	Case rate*
1975	1,050	33.8
1980	1,093	38.3
1985	1,112	42.2
1990	1,300	51.0
1992	1,471	55.0

\*Number of cases per 1,000 youths ages 10 to 17 at risk

murdered youngsters (from 53.8 percent to 56.1 percent) (Table 6).

In 1994:

- Seventy-three percent of the murdered victims less than eighteen years of age were males.
- Ninety-four percent of the murderers who were less than eighteen years were male.
- Thirty-six percent of the murderers who were less than eighteen years of age were whites, 61 percent were African-Americans.
- Thirty-nine murders were committed by children less than thirteen years of age.
- Two-thirds of the murders committed by juveniles were of persons over eighteen years of age.<sup>1</sup>
- Child abuse and neglect: "Two-thirds of sex offenders in state prisons say their victims were children, and a third of those victims were off-spring or stepchildren of their attackers."<sup>4</sup>

"...(It is) estimated that state prisons held 43,552 inmates in 1991 who had raped or sexually assaulted children under 18."<sup>4</sup>

In 1993 there were more than one million substantiated cases of child abuse and neglect, an almost one-third increase (31.9 percent) over 1990.

- Neglect accounted for about one half (47 percent) of all forms of maltreatment.
- One half million white and a quarter million African-American children were abused and/or neglected.
- More females (53 percent) than males were maltreated.

In the early 1990s:

- There was a 19 percent increase in the number of children less than six years of age who were maltreated.
- There was a 17 percent increase in the number of white and African-American children who were maltreated.
- There was a 15 percent increase in the number of male and female children that were maltreated (Table 7).

## OUTCOME OF CRIMINAL OFFENSES BY CHILDREN

Between 1975 and 1992, there was a 40 percent increase in the total number of juvenile delinquency cases disposed of by juvenile courts. In 1992, almost 1.5 million cases were handled by juvenile courts, representing a 63 percent increase in the number of cases per 1,000 youngsters ten to seventeen years of age (from 33.8 cases to 55.0 cases per 1,000) (Table 8).

Table 9 □ Juveniles held in public juvenile facilities: 1975, 1985, 1991.<sup>6</sup>

Region & State	1975	1985	1991
<b>Northeast</b>	<b>5,482</b>	<b>5,015</b>	<b>6,661</b>
Connecticut	176	202	290
Maine	245	242	249
Massachusetts	130	187	180
New Hampshire	204	152	108
New Jersey	1,102	1,508	1,719
New York	1,950	1,516	2,648
Pennsylvania	1,441	1,060	1,289
Rhode Island	124	148	161
Vermont	110	*	17
<b>South</b>	<b>16,397</b>	<b>14,905</b>	<b>15,701</b>
Alabama	478	680	846
Arkansas	335	274	285
Delaware	209	190	130
Dis. of Columbia	654	281	380
Florida	2,937	2,179	2,008
Georgia	1,425	1,053	1,566
Kentucky	569	609	666
Louisiana	1,228	1,188	1,122
Maryland	1,058	1,377	831
Mississippi	632	410	418
North Carolina	996	798	893
Oklahoma	464	314	336
South Carolina	788	647	926
Tennessee	1,233	1,128	755
Texas	1,520	2,209	2,661
Virginia	1,434	1,456	1,712
West Virginia	437	112	166
<b>Midwest</b>	<b>11,539</b>	<b>11,382</b>	<b>13,359</b>
Illinois	1,197	1,534	2,029
Indiana	1,028	1,334	1,395
Iowa	369	399	418
Kansas	592	651	667
Michigan	1,655	1,733	1,968
Minnesota	619	634	645
Missouri	1,124	815	1,060
Nebraska	290	269	293
North Dakota	117	94	75
Ohio	3,529	3,058	3,696
South Dakota	141	193	217
Wisconsin	878	668	896
<b>West</b>	<b>13,562</b>	<b>18,020</b>	<b>21,821</b>
Alaska	122	201	217
Arizona	637	905	947
California	8,720	12,524	15,904
Colorado	527	581	687
Hawaii	128	149	84
Idaho	193	118	143
Montana	231	204	230
Nevada	375	451	555
New Mexico	353	511	527
Oregon	543	702	723
Utah	292	170	273
Washington	1,302	1,342	1,418
Wyoming	139	162	113
<b>United States</b>	<b>46,980</b>	<b>49,322</b>	<b>57,542</b>

\*No public juvenile institutions

From the mid 1970s to the early 1990s, there was a 22 percent increase in the number of youngsters held in public juvenile facilities (57,500 in 1991). In 1991:

- In 15 states, more than one thousand youngsters were held in public juvenile facilities.
- California held almost 16,000 youngsters in public juvenile facilities, followed by Ohio (with 3,700 youngsters) and New York and Texas (with approximately 2,650 youngsters). (Table 9).

## WHY ARTICLES ON JUVENILE CRIMINALS IN A DENTAL JOURNAL?

“...the reality is that pediatric patients are not divorced from the tragedies and events that fill our daily newspapers...”<sup>3</sup>

“...one of your patients may be the center of tomorrow’s headline and story.”<sup>3</sup>

When I wrote these words five years ago, the intent was to develop an awareness that juvenile crimes could and do involve ordinary children in most any dental practice. If anything, U.S. Department of Justice data for the 1990s indicate that the increasing plague of crime carried out by (and on) children is not reserved for one particular group, but has “infected” all our neighborhoods.

The National Center for Juvenile Justice released a study at the end of 1995 showing that the peak hours for juvenile crime are between 3 PM and 6 PM, the period immediately after school. “If adults saw to it that youngsters were constructively engaged in that period, crime would go down. Instead, for a variety of reasons, including relentless budget cuts, we are giving youngsters less and less to do after school.”<sup>2</sup>

Airport style metal detectors at the entrance to our schools have become common place. By now many of us pass over the repeated newspaper articles detailing the theft and even killings over the latest clothing-fad items. Could it be that we are becoming immuned to the increasing horrors of juvenile crimes unless they affect members of our own families?

Those of us who spend our professional lives ministering to the needs of children must not be lulled into complacency when we read that crime rates are declining, when in reality increasing numbers of children are involved in criminal activities. Or do our interests in children involve only their teeth and the associated supporting tissues?

“...president of the national Urban League, noted...that the rate of violent juvenile crime has doubled in the last decade and is likely to double again in the next.”<sup>2</sup>

“Tom Brokaw, who hosted a panel...asked a teen-ager how easy it would be to get a gun if he had \$100. The teen saw no need to spend that much money. He said he could give a 10-year old \$40 and feel assured that the youngster would return in 20 minutes ‘with a loaded .22.’”<sup>2</sup>

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## Report of Cases

# Rehabilitation of young patients with amelogenesis imperfecta: A report of two cases

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**A**melogenesis imperfecta is a hereditary disorder that affects enamel on primary and permanent teeth. It is reported to have an incidence of one person in every 14,000.<sup>1</sup>

Historically, patients with amelogenesis imperfecta have been treated with multiple extractions. Recently, several studies have illustrated the use of composite resin veneers, stainless steel crowns, adhesive castings, overdenture, porcelain veneers, and ceramics to restore dentitions mutilated by severe attrition.<sup>2-7</sup>

When amelogenesis imperfecta is diagnosed in young children, rehabilitation becomes complex, due to the presence of primary as well as permanent teeth, and to the ongoing development of the teeth and jaws. Frequently there are also orthodontic problems such as vertical overbite and open bite.<sup>8</sup>

The treatment, which we have illustrated with two cases, attempts to take all these factors into account. It comprises two phases, a temporary phase undertaken during primary or mixed dentition; and a transitional phase, which starts when all the permanent teeth have erupted and continues until adulthood.

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### FIRST CASE

#### Temporary treatment

A diagnosis of amelogenesis imperfecta hypoplasia was established for a ten-year-old girl brought to the pediatric dentistry department of our university.

Clinical and radiographic examinations were conducted (Figures 1 and 2). The dentition was in the mixed phase: the primary second molars, first permanent molars, and permanent canines and incisors were present.

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### **ALL TEETH AFFECTED**

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All primary and permanent teeth were affected. The enamel layer was very thin and hard with fine ridges and pits. Teeth were very small, yellow, and widely spaced in the arch. The patient complained of dental sensitivity. Posterior teeth were attrited.

Root canal therapy had been performed on the maxillary left central incisor after traumatic injury to the tooth, and an occlusal amalgam was present in the mandibular left second primary molar; but otherwise the teeth were in satisfactory condition and caries-free. Oral hygiene was satisfactory and there were no traces of gingivitis. Classification of occlusion at this time was Class II, Division 1 malocclusion.

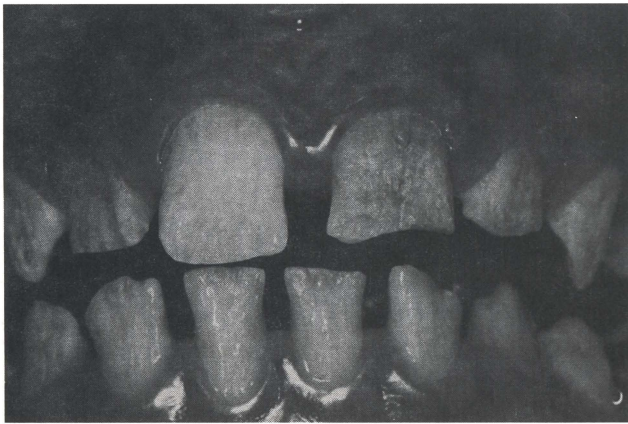


Figure 1. First case: View of the dentition before treatment.

The parents revealed their hereditary antecedents and we learned that the girl's father and one cousin of the same age were amelogenesis imperfecta cases.

The first stage of the treatment consisted in the crowning of the mandibular first molars, using pre-

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### **CROWNS ARE PLACED**

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formed NiCr crowns (3M dental products, St Paul, MN); and the first mandibular premolars, using polycarboxylate resin crowns (3M dental products). The first permanent molars and the maxillary first premolars were similarly treated at a second sitting. The primary molars were extracted during the two sittings. The eight crowns were positioned so as to entail a raising of the anterior and intermediary occlusion (25 mm) with no resulting discomfort for the patient.

After endodontic treatment of the maxillary left central incisor, the four maxillary incisors were crowned at one sitting, using polycarboxylate resin crowns (3M dental products). The mandibular incisors were crowned next, and finally the permanent canines (Figure 3). Preparation of the teeth for crowning was minimal, so as to preserve maximum pulpal vitality, and was subgingival in order to increase the adhesive properties of the crowns. Glass ionomer cement (Fuji I, GC Corporation, Tokyo, Japan) was used in all cases.

When all the teeth had been crowned, the patient's dental sensitivity disappeared completely, and normal eating habits were established. The shy and taciturn ten-year-old girl first brought forcefully to the department, became a willing and talkative patient. The psychological

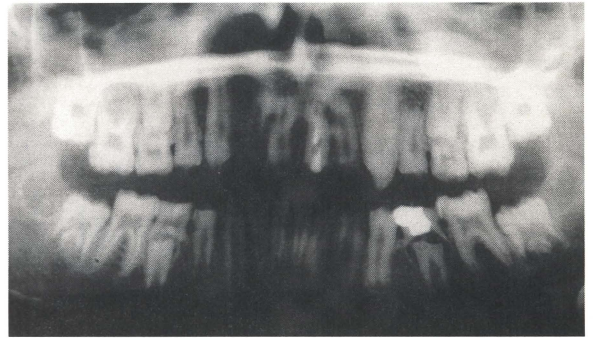


Figure 2. First case: Panorex before treatment.

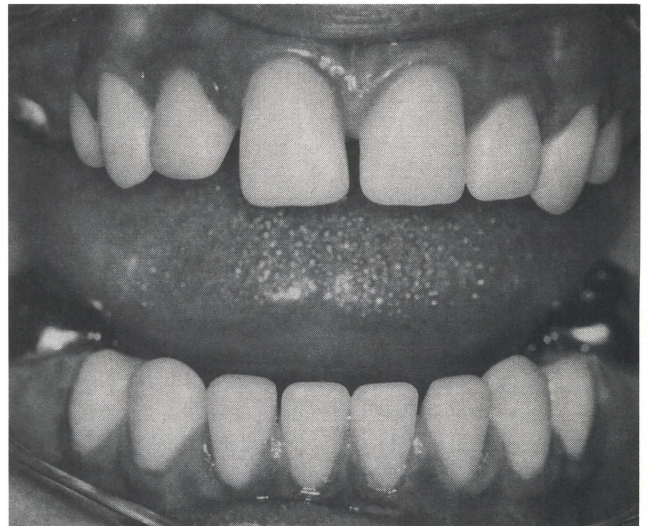


Figure 3. First case: General view of the dentition after temporary treatment.

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### **POSITIVE IMPROVEMENTS**

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transformation was spectacular, as was the physiological change, evidenced by a weight gain within weeks.

At this stage, orthodontic treatment was begun, and brackets were cemented to the NiCr and polycarboxylate resin crowns.

The second premolars were crowned as soon as possible after eruption. The results of the orthodontic treatment on occlusion were very positive, and there were no traces of gingivitis.

The patient is presently undergoing treatment, and the second molars will be crowned on eruption.



Figure 4. Second case: Panorex before treatment.

## SECOND CASE

### Temporary and transitory treatments

The second case is that of an eight-year-old girl brought to the pediatric dentistry department by her parents for esthetic reasons and also because of considerable dental sensitivity.

Clinical and radiographic examinations confirmed amelogenesis imperfecta hypoplasia. No family antecedents were established from the questioning of the parents. It would appear that this is a rare case of genetic mutation.

The granular appearance of the front teeth and the jagged posterior teeth provided clinical evidence of amelogenesis imperfecta. Radiographic examination enabled us to establish agenesis of 44, 45, 35, 25, and 15 (Figure 4).

There was no trace of caries, and yet the patient was skeletal class II with open bite.

From a psychological point of view, the eight-year-old patient was shy and burdened with emotional and psychological problems. She never smiled and refused permission to take photos during the first stages of the treatment.

During the first sessions, the posterior teeth (first permanent molars, and the second primary molars) were crowned using preformed NiCr crowns (3M dental products, St Paul, MN). The first primary molars were removed. Then polycarboxylate resin crowns (3M dental products) were fitted on the permanent incisors.

At age ten, the primary incisors and the permanent canines were crowned with the exception of the maxillary left canine, which appeared to be blocked by the developing first premolar.

At age twelve, the maxillary left canine erupted, but the entire crown was already carious. Endodontic treatment was undertaken to fit a polycarboxylate resin crown

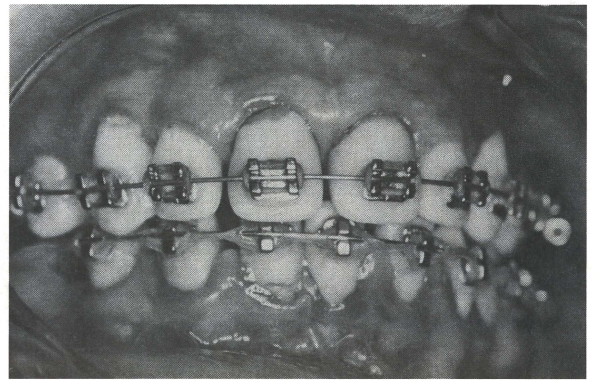


Figure 5. Second case: General view of resin crowns with brackets.

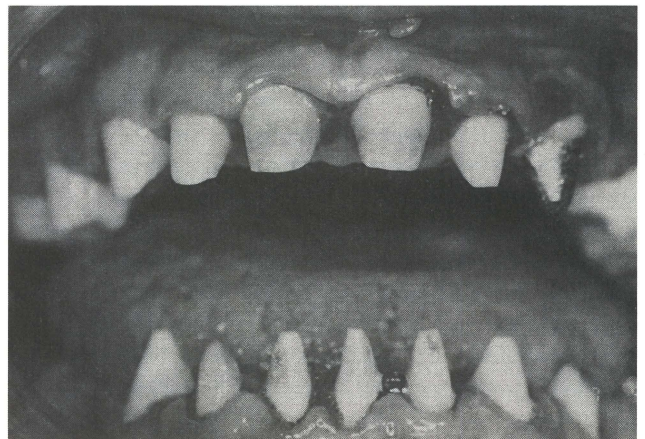


Figure 6. Second case: General view of prepared teeth before placement of the transitional bridges.

(3M dental products) with a pivotal support. The second molars were crowned on eruption.

Throughout the period of treatment, the gingival condition was poor because of insufficient brushing, in spite of repeated advice on oral hygiene, and also because of inflammation caused by the temporary crowns.

The orthodontic treatment aimed at correcting the class II malocclusion and at reducing the interdental spaces due to agenesis was started one year later and was to last for eighteen months. No problems arose from the fixing of brackets on the preformed NiCr crowns (3M dental products, St Paul, MN) and polycarboxylate resin crowns (3M dental products) (Figure 5).

After completion of the orthodontic treatment, the second phase of transitory restoration was undertaken,

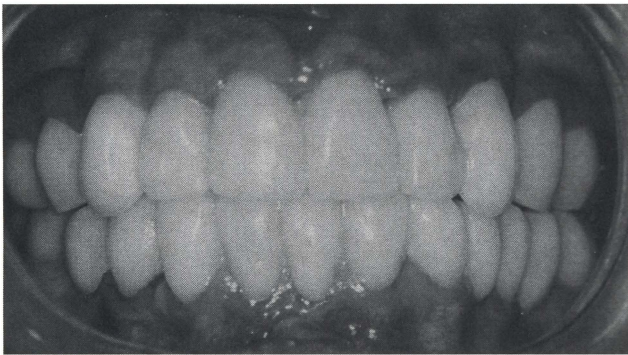


Figure 7. General view of the transitional bridges.

in the hope of ensuring esthetic and functional rehabilitation until such time as the patient, in early adulthood, could assume the cost of porcelain restorations.

In the second phase, the temporary crowns were removed after six years, without ever requiring recementation. All the teeth were vital, except the left maxillary canine, which had been destroyed before its eruption. The teeth were shaped to ensure parallelism of the stumps, and an inlay core was fitted on the root of the left maxillary canine (Figure 6).

Two bridges were made, using a composite (Triad, Dentsply International Inc., York, PA, USA), which was photopolymerized in an oven (Triad II of Dentsply International Inc.). This material was chosen because of a cost lower than that for ceramic. Its lower hardness factor as compared to ceramic, means that occlusion can, to some extent, be self-adjusting over a long period of time. After adjustment, the two bridges were cemented, using glass ionomer cement (Fuji I, GC Corporation, Tokyo, Japan) (Figure 6).

At the present time, one year after completion of treatment, no deterioration is visible. The gingivae are slightly inflamed, due to poor quality of tissue and insufficient brushing.

## DISCUSSION

Amelogenesis imperfecta is a severe hereditary morbidity affecting the structure of the enamel of the primary and permanent teeth. The three types of amelogenesis imperfecta are hypoplastic, hypomature and hypocalcified.<sup>1</sup>

All the teeth are misshapen, and spotted. Occlusion and vertical opening are rapidly affected by attrition. The insufficiency of the enamel makes the teeth extremely sensitive to contact and thermal stimuli.

These problems combine to make early diagnosis essential and immediate treatment a necessity, even for the youngest patients.<sup>3,9,10</sup>

The treatment comprises three major phases:

- Temporary emergency treatment of primary or permanent teeth.
- Interim or transitory treatment of permanent teeth.
- Permanent treatment in adulthood.

The first stage of temporary emergency treatment should be performed as soon as amelogenesis imperfecta is diagnosed and the patient is old enough to cooperate during the treatment. Depending on the age of the patient, it is performed on primary or permanent teeth.

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## TREATMENT OBJECTIVES

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The aim is to reduce dental sensitivity, to restore esthetics, and to correct vertical alignment.<sup>3,9</sup> The treatment necessitates motivation and involvement on the part of the young patients in maintaining satisfactory oral hygiene, because there is considerable plaque retention, due to the structure, shape, and surface features of the teeth. Moreover, because of the poor appearance of the teeth and their sensitivity, the young patient is reluctant to brush properly. This often results in gingivitis, but rarely in caries.

The second stage consists of an attempt to maintain correct vertical dimension or to improve them, if affected by attrition. Children rapidly adjust to any change in height.<sup>2,4,9</sup> In order to modify occlusion, preformed NiCr crowns are placed on the primary molars, and on the permanent molars as they erupt. These crowns also protect the dentin from chemical and thermal attacks, and, therefore, reduce sensitivity and pain. Preparation of the teeth should be minimal, in order to preserve the vitality of the pulp and often has to be extended below the gingiva because of the short crowns of many teeth affected by amelogenesis imperfecta.<sup>3</sup>

The aim of the third stage is to improve appearance by crowning the permanent incisors and premolars, using polycarboxylate resin crowns.

The three stages of this first temporary emergency treatment phase are progressive and easily accomplished, because the teeth are crowned as they erupt. It enables even the youngest patients to become familiar with the techniques involved in dental care, and to get accustomed to long sessions, thus preparing them for the long and difficult treatment that awaits them in adulthood. It is very important in that it prevents the development of psychological problems arising from the appearance of teeth affected by amelogenesis imperfecta.<sup>2</sup> These tem-



porary restorations provide satisfactory esthetic and protective features with minimum preparation and allow orthodontic treatment, made difficult by crown height and lack of enamel in untreated amelogenesis imperfecta, to be performed under excellent conditions. This temporary treatment allows the normal development of the dentition to continue unimpaired and, last but not least, is affordable for the parents.

The transitory stage is performed when all the permanent teeth, except the third molars, have erupted, and when the orthodontic treatment is complete. It enables the child to lead a normal life until a final permanent and more sophisticated treatment can be accomplished in adulthood.

The acrylic resin or composite anterior crowns are sufficiently esthetic and strong, and less expensive than ceramic prostheses. Composite or nonprecious alloy crowns, usually NiCr, are preferred for the posterior crowns.

After removal of the temporary crowns, the teeth are trimmed if necessary. Complete casts are made and the intermaxillary relationship is recorded. The prostheses are then laboratory produced in a semiadjustable articulator. Balanced occlusion is necessary in order to prevent any interference in protrusion or in lateral movement. After a fitting session, during which occlusion can be adjusted, the final session is devoted to the cementing of the prostheses.

The major advantage of the transitory treatment lies in the fact that it provides the patient with a functional, esthetic and relatively affordable restoration, which will

last until adulthood. The laboratory-produced prostheses are anatomically more authentic and less traumatic for tissue at the neck of the tooth. Precise and lasting occlusal properties can be ensured, because the prostheses were constructed to harmonize with the entire oral mechanism and the temporomandibular articulation. During this transitory stage, periodontal surgery can be performed if necessary.

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#### RESIN-MODIFIED GLASS IONOMER AS SEALANT

In general, the resin-modified glass ionomer appeared to wear markedly; however, its retention was not significantly less than the resin sealant until the one-year recall. At both recall examinations, evaluators recorded significantly fewer marginal discrepancies for the resin-modified glass ionomer than they did for the light-cured resin. No significant differences were found in caries development or marginal discoloration at either evaluation. These results suggest that there is no significant advantage at one year in using the resin-modified glass ionomer sealant used in this study and that replacement of this sealant will be required more frequently compared with a resin sealant to maintain a complete seal of the occlusal surface. Other brands of resin-modified glass ionomer may exhibit a different clinical performance than found in this study.

Winkler, M.M.; Deschepper, E.J.; Dean, J.A. *et al*: Using a resin-modified glass ionomer as an occlusal sealant: a one-year clinical study. *JADA*, 127:1508-1514, October 1996.

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# Fibrodysplasia ossificans progressiva: Report of a case with guidelines for pediatric dental and anesthetic management

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**F**ibrodysplasia ossificans progressiva (FOP) is a rare and progressively disabling genetic disorder characterized by congenital malformation of the great toes and by progressive heterotopic ossification in characteristic anatomic and temporal patterns.<sup>1</sup> Most cases arise by spontaneous mutation, but autosomal dominant transmission has been documented.<sup>2</sup> Reproductive fitness is low due to severe disability that is invariably present by early adulthood.<sup>1,2</sup>

Progressive heterotopic ossification begins during the first decade of life and becomes more severe and widespread with time.<sup>3</sup> Painful masses of noninflammatory fibroproliferative lesions involving tendons, ligaments, and the connective tissue of skeletal muscle are the first sign of impending ossification.<sup>4</sup> These fibroproliferative lesions mature through an endochondral pathway to form heterotopic bone that immobilizes the joints of the axial and appendicular skeleton, rendering movement impossible.<sup>4,5</sup> The most common sites of early heterotopic ossification are the neck, spine, and shoulder-girdle.<sup>6</sup> The diaphragm, extraocular muscles, cardiac and

smooth muscles are spared from ossification.<sup>1</sup> Premature death may result from respiratory failure caused by restrictive chest wall disease.<sup>1</sup> Ankylosis of the jaw may lead to severe inanition.<sup>1,7</sup> Attempts to remove heterotopic bone are unsuccessful as more robust heterotopic ossification occurs secondary to surgical trauma.<sup>1,7</sup> The genetic mutation and pathogenesis of FOP are unknown, although the genes coding for the bone morphogenetic proteins are plausible candidate genes based on their ability to regulate embryonic pattern formation in the developing limb and to induce postnatal heterotopic ossification.<sup>8</sup> At present there is no effective treatment or prevention.

Ectopic bone may form spontaneously or secondary to minimal trauma.<sup>1</sup> Lanchoney *et al* showed recently that intramuscular childhood immunizations caused severe and disabling heterotopic ossification at the injection site in 27 percent of fibrodysplasia ossificans progressiva patients.<sup>9</sup> In a similar study, injections for dental procedures led to severe heterotopic ossification and permanent ankylosis of the jaw in 24 percent of fibrodysplasia ossificans progressiva patients.<sup>10</sup> Assiduous precautions are necessary, therefore, to prevent trauma-induced heterotopic ossification at any site, but especially the jaw in this group of high risk patients.<sup>11</sup> We present the case of a young child whose dental care exemplifies the range of extraordinary precautions that are recommended in the care of these patients.

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## CASE REPORT

A four-year-old girl was diagnosed with fibrodysplasia ossificans progressiva on the basis of congenital malformations of the great toes and progressive heterotopic ossification, which began at two years of age following minor trauma and involved the neck and shoulder-girdle. She was the product of a normal pregnancy and delivery; there was no family history of fibrodysplasia ossificans progressiva.

She was brought to the pediatric dental office at four years of age for evaluation of a "toothache." She had no prior dental care. She was well-nourished but timid, and unable to cooperate for a dental examination. She had an ankylosed cervical spine, minimal movement of the shoulders, and normal movement of her elbows, wrists, hips, knees, ankles and feet. She was able to open her mouth long enough to permit us to observe two decayed, mandibular, second primary molars. The presence of fibrodysplasia ossificans progressiva and the necessity for minimally atraumatic dental work prompted a plan for hospitalization and general anesthesia.

The child was admitted to The Day Surgery Unit of The Children's Hospital of Philadelphia. After successful sedation with oral midazolam and atropine, the child was transferred to the operating room. Standard monitors were placed. An inhalation induction of general anesthesia using oxygen, nitrous oxide, and halothane proceeded without difficulty after the neck was placed in neutral position. Vecuronium, morphine sulfate, and ondansetron were administered intravenously and the nares were vasoconstricted with oxymetazoline spray. The child was intubated nasally with a fiberoptic laryngoscope to avoid stretching of the mouth and neck. Atraumatic jaw opening was measured to a maximum of 23 millimeters and a Molt mouth-gag was placed at this opening to prevent further stretching.

A thorough dental examination was conducted using general anesthesia, and eight dental radiographs were obtained. Small pit-and-fissure caries was noted on the maxillary right and left first and second primary molars and on the mandibular right and left first primary molars. Extensive caries was noted on the mandibular right secondary primary molar. The mandibular left second primary molar had a deep and extensive carious lesion and also had buccal swelling with a fistula. The radiographs showed surface lesions on six molars with no interproximal decay. The right molar was proximate to the pulp, and the left molar had a large radiolucency in the furcation area.

The formulated treatment plan began with preventive resin restorations on the surface carious teeth. Utilizing

a No. 2 round burr on a slow-speed contra-angle handpiece, the six carious teeth were prepared. Caries was removed to a hard and decay-free surface. The restorations were completed, and the occlusal surfaces sealed. The restorations were completed using APH (Caulk) followed by Delton fissure sealant. The mandibular right molar tooth was prepared, using a high-speed handpiece for the outline form. Decay was removed, using a No. 6 round burr on a slow-speed handpiece. The pinkish deep area had a lining of Dycal followed by a glass ionomer liner (Ketac Bond, Premier). The enamel was etched, the dentin and enamel were coated with 3M Multipurpose liner, and the tooth restored with a composite resin (APH, Caulk). Finally, the surface was coated with Fortify by Bisco.

Attention was turned to the nonrestorable tooth. Two-percent lidocaine (0.2 ccs) with epinephrine was injected into the periodontal ligament using a 30-gauge needle on a tuberculin syringe. A periosteal elevator was used to cut the periodontal ligament and a small straight elevator was used to gently elevate the tooth from its socket. A surgical curette was used to remove any affected tissue. Gelfoam was placed in the socket for hemostasis and the socket was sutured with a 3-0 chromic suture. At the conclusion of surgery, the neuromuscular blockade was reversed with neostigmine and atropine. The child was extubated, transported to the postanesthesia care unit, and discharged to home in a timely fashion.

She returned to the dental office eight days later in good spirits, and cooperated fully for an awake examination in the dental chair. She felt better since her decayed tooth had been extracted. She also demonstrated that she could open her mouth without discomfort. Good healing of the extraction-site was noted. Three months following the dental procedure, she was doing well without any intercurrent exacerbation of the fibrodysplasia ossificans progressiva.

## DISCUSSION

Surgery is rarely indicated in a patient who has fibrodysplasia ossificans progressiva, due to the high probability that exacerbation of the disease will occur, following surgical trauma. At times the controlled setting of the operating room may be the least traumatic venue, however, for accomplishing a needed procedure in a child with fibrodysplasia ossificans progressiva. This is especially true in the management of difficult dental problems where assiduous precautions are needed to prevent untimely heterotopic ossification of the jaw. Intramuscular injections, dental blocks, severe stretching

of the jaw and struggling against passive restraints are all contraindicated in children who have this disease.<sup>1,7,10</sup> The management of this child's dental problems highlights many important and desired features in the care of a child who has fibrodysplasia ossificans progressiva. These features include the allaying of the child's fears and the avoidance of struggling, the use of preoperative sedation, the atraumatic removal of clothing, the padding of the operating table, the control of airway access, the measured opening of the mouth, avoiding passive stretching, avoiding intramuscular injections, and avoiding any trauma to the neck, or stretching of the temporomandibular joint.

All intramuscular injections and blocks should be avoided in patients who have fibrodysplasia ossificans progressiva.<sup>1,9,10</sup> Infiltration of local anesthetic should be as atraumatic as possible and limited to subcutaneous sites or interligamentary routes.<sup>10</sup> Overstretching of the jaw should be assiduously avoided, and extreme precautions are necessary to prevent trauma-induced heterotopic ossification of the jaw, a site which normally does not become involved spontaneously until the third or fourth decades of life.<sup>3,6,11</sup>

Oral premedications are preferred by children because the risk of administering an intramuscular premedication to a child with fibrodysplasia ossificans progressiva is unacceptable.<sup>1,9,10</sup> Oral sedation allays the child's fears, including parental separation, and provides some drying of oral secretions, without inducing respiratory depression. Although the child may have been easily intubated using direct laryngoscopy, the risk of trauma-induced heterotopic ossification of the retropharyngeal tissues exceeded the benefit of saving time by using this method.

When dental procedures are unavoidable in children with fibrodysplasia ossificans progressiva, the least traumatic approach should be custom-designed for the child at risk. Preventive resin restorations were performed in the child discussed here, because it required the least amount of tooth structure to be removed. With a slow speed bur, these can often be performed on a child in the dental office.<sup>12</sup> A composite restoration was chosen for the severely carious molar, to avoid the gingival trauma created by a steel crown preparation.<sup>13-15</sup> In a tooth with a deep carious lesion, affected dentin is treated with a base to stimulate healing. In general, subcutaneous and intravenous injections are not problematic in patients who have fibrodysplasia ossificans progressiva, whereas deep intramuscular injections of any type are more likely to cause a flare-up.<sup>9</sup> We strongly recommend, therefore, the avoidance of any intramuscular or buccal injections during dental work in patients

with fibrodysplasia ossificans progressiva.<sup>10</sup> Interligamentary injections, when possible, provide a relatively atraumatic method of anesthesia for dental procedures. We also recommend that assiduous attention be directed to the prevention of dental caries, as prevention would decrease the need for invasive dental procedures, as in the child discussed here. Preventive measures should include early, regular, and periodic dental visits, oral hygiene instruction, nutritional counseling, fluoride supplementation, home fluorides, and dental sealants.<sup>10</sup>

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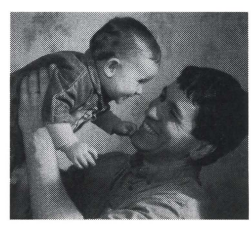
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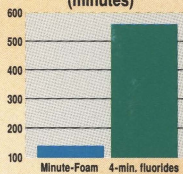
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