


JANUARY-FEBRUARY 1992



What most parents need is a constructive way to think about the process of discipline. They often equate it with punishment. They tend to think of discipline as a form of crisis intervention.

The problem is that with children who frequently misbehave, the crisis is never-ending.

Discipline is a two-decade-long teaching process. So much of the time, we seem to take the short view:

if we just say this clever thing or try that smart trick, the whole problem will be solved.

But this is not true: the war will not be over in a week; the troops will not

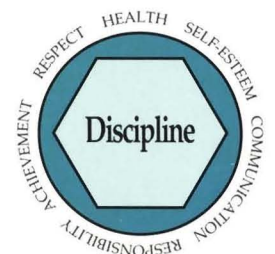
be home by Christmas. Children do obnoxious things and misbehave because they are

supposed to—it is the natural way in which children learn. Discipline is not akin to calling out the National Guard in a state of crisis, but is something woven into every aspect of the child's daily life.

—Peter Williamson, PhD

I PRAY YOU, SCHOOL YOURSELF.

—Shakespear: *Macbeth*



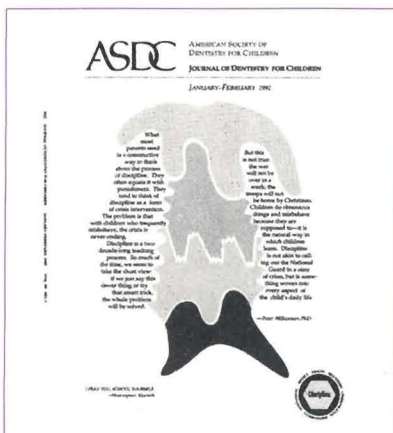
Copyright 1992 by the American Society of Dentistry for Children—ASDC JOURNAL OF DENTISTRY FOR CHILDREN. USPS #279-480. Issued bimonthly—in January-February, March-April, May-June, July-August, September-October, and November-December—at 211 E. Chicago Avenue, Suite 1430, Chicago, IL, (312) 943-1244. Second class postage paid at Chicago, IL and additional mailing office. Subscription prices: within U.S.A., individuals \$65.00 per volume, institution \$95.00, single copies \$20.00; Foreign (including Canada and Mexico) individuals \$75.00 per volume, institution \$105.00, single copies \$25.00. Thirty-five dollars and fifty cents (\$35.50) of the full membership dues are allocated to the Journal. Member—American Association of Dental Editors.

All copy and manuscripts for the journal should be sent directly to the Editorial Office, 211 E. Chicago Ave., Suite 1430, Chicago, Illinois 60611, (312) 963-1244.

Prospective authors should consult "Information for Authors," which appears in the January and July issues. Reprints of this document may be obtained from the Editorial Office.

POSTMASTER

Change of address, subscriptions, advertising and other business correspondence should be sent to ASDC, Journal of Dentistry for Children, 211 E. Chicago Ave., Suite 1430, Chicago, Illinois 60611.



A child's misbehavior should be perceived as healthy and purposeful. Discipline, then, can be approached constructively, as a teaching process rather than a punishing one.

Cover art and design by Sharlene Nowak-Stellmach.

6	Abstracts	16,75	Editorials
15	ASDC logo	11	Index to advertisers
77	Awards information	15	National guidelines
4	Busy reader	12	News
10	Classified advertisements	80	President's message

BEHAVIOR

- 17 **The effects of using infection-control barrier techniques on young children's behavior during dental treatment**
Lawrence J. Siegel, PhD; Karen E. Smith, PhD; George E. Cantu, DDS; William R. Posnick, DDS
With the incidence of both AIDS and hepatitis B increasing within the general population, the need for infection-control measures by health-care personnel is essential. Wearing masks presents an additional non-verbal message to patients, especially children.

- 23 **Prevalence of craniomandibular dysfunction in white children with different emotional states: Part III. A comparative study**
Apostole P. Vanderas, DDS, JD, MPH, MDS
The purpose of this part of the study was to compare the prevalence of CMD between white children classified by the parents as calm and not calm.

EPIDEMIOLOGY

- 28 **Background factors affecting dental caries in permanent teeth of Finnish and Soviet children**
E. Honkala, DDS, PhD, MSc, DDPH; S. Kolmakow, DDS, PhD; V. Nyysönen, DDS, PhD, MPH; E. Kuzmina, DDS, PhD; S. Vasina, DDS, PhD
The role of general external factors has rarely been compared between different populations, because methods of data collection vary.

DEMOGRAPHY

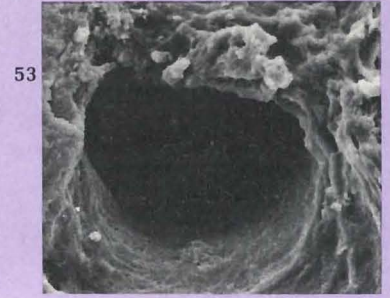
- 34 **1990 dental health objectives for children: What is left to be done?**
H. Barry Waldman, BA, DDS, MPH, PhD
In 1979, a series of broad health goals and specific objectives were established, including twelve for dental health and another set for oral health, to be achieved by 1990 or earlier. This paper reviews progress made, with emphasis on what remains to be accomplished.
- 38 **Will there be a difference in the pediatric dentists of the future?**
H. Barry Waldman, BA, DDS, MPH, PhD
This paper develops an awareness of the evolving demographic characteristics of pediatric dentists.



70



66



53

41 Now that we've gotten their attention, let's get some more services for children!

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

Federal health-care spending for the elderly in the United States far surpasses the rate in all other countries, but there is finally a growing recognition that children must become our number-one national priority.

CLINIC

44 Assessment of 100 children in Jerusalem with supernumerary teeth in the premaxillary region

Yerucham Zilberman, DMD; Mordechai Malron, DMD; Arie Shteyer, DMD

This retrospective study evaluated the prevalence of supernumerary teeth in the premaxilla in a group of children referred for consultation, and determines the presence of associated local disorders before and after surgical intervention.

48 The incidence of postoperative pain and analgesic usage in children

George Acs, DMD, MPH; Ellen Drazner, DMD

There are very few postrestorative pain studies in the dental literature, relative to the number of postextraction studies.

53 A SEM investigation on pulpal-periodontal connections in primary teeth

Annunziata Morabito, MD, DDS; Patrizia Defabianis, MD, DDS

This investigation was undertaken to determine the prevalence of accessory canals in the pulp floor of primary teeth.

58 A direct method of earplug fabrication

Steven L. Cureton, DMD; Frederick Regennitter, DDS

Otitis media is one of the most common infectious diseases of childhood, and the most frequent illness-related reason for office visits.

CASE REPORTS

62 Outpatient dental treatment of pediatric patients with malignant hyperthermia: Report of three cases

Robert Steelman, DMD, MS; Douglas Holmes, DDS, MS

66 Epidermolysis bullosa: Oral management and case reports

Behjat K. Moghadam, DDS, DScD; Ronald E. Gier, DMD, MSD

70 Bilateral eruption sequestra: Report of case

John J. Schuler, DDS; Jeffrey H. Camm, DMD; Glen Houston, DDS

OFFICERS

Donald W. Kohn President
 William H. Lieberman President-Elect
 Jimmy R. Pinkham Vice-President
 Hala Z. Henderson Secretary-Treasurer
 George W. Teuscher Executive Officer

EDITORIAL STAFF

George W. Teuscher Editor-in-Chief
 Donald W. Kohn Associate Editor
 Jimmy R. Pinkham Associate Editor
 Jane W. Teuscher Assistant Editor

EDITORIAL AND PUBLICATIONS COMMISSION

Thomas K. Barber
 Donald F. Bowers
 Stephen J. Goeppferd
 Robert I. Kaplan
 Donald W. Kohn
 Steven M. Levy
 Ralph E. McDonald
 John E. Nathan
 Jimmy R. Pinkham
 Prem S. Sharma
 Paul P. Taylor

TRUSTEES

James T. Barenie (Southeast) '94
 Robert A. Boraz (Southwest) '92
 Rodman O. Emory (Northwest) '94
 Peter J. Fos (Trustee-at-large) '93
 Michael L. Janda (Midwest) '93
 Ronald B. Mack (West) '94
 Dennis N. Ranalli (Mid-Atlantic) '92
 Keith L. Ray (Great Lakes) '93
 John M. Willis (Northeast) '93

IMMEDIATE PAST PRESIDENT

James L. Bugg, Jr.

EDITOR EMERITUS

Alfred E. Seyler

For the busy reader

The effects of using infection-control barrier techniques on young children's behavior during dental treatment – page 17

This report provides a review of infection-control techniques used by health-care practitioners. It is then stated that there is an increased awareness regarding the role of nonverbal influences on the communication process, especially among child patients, for whom fear and anxiety are common traits. This study evaluated whether the use of masks in the dental operatory affected anxiety behavior, based on changes in heart rate, self-reports, and uncooperative responses. The findings here suggest that wearing a mask during dental treatment represents a minimal stressor for the young child with previous dental experience.

Requests for reprints should be directed to Dr. Lawrence J. Siegel, Ferkauf Graduate School of Psychology, Yeshiva University, Mazer Hall, 1300 Morris Park Avenue, Bronx, New York 10461.

Prevalence of craniomandibular dysfunction in white children with different emotional states: Part III. A comparative study – page 23

This study compared the prevalence of CMD between white children classified by the parents as *calm* and *not calm*, with twenty-six boys and twenty girls in each group (total, ninety-two children). They had been selected from a total of 386 white children examined for this study. The children were interviewed for symptoms, examined clinically for signs of CMD and malocclusion, and assigned to the study groups based on parents' responses to a questionnaire. The study showed significant differences in the prevalence of muscle and TMJ tenderness between children with different emotional states.

Requests for reprints should be directed to Dr. Apostole P. Vanderas, 8 Thessalonikis Str., 14561 Kifissia, Athens, Greece.

Background factors affecting dental caries in permanent teeth of Finnish and Soviet children – page 28

The aim of this study was to analyze the association

between some general background factors and caries experience in two groups of Finnish children (from Helsinki and Kuopio) and Soviet children (Moscow and Leningrad). A total of 1187 schoolchildren, ages seven, nine and twelve years, were examined and information about their health habits was gathered by questionnaire. Questions included use of sweets, cakes, soft drinks, sugar-sweetened coffee and tea, toothbrushing frequency and mother's education. Except for age, the factors that explain caries experience clearly differ in Finnish and Soviet children.

Requests for reprints should be directed to Dr. E. Honkala, Dept. of Preventive Dentistry and Cariology, Faculty of Dentistry, University of Kuopio, P.O. Box 6, 70211 Kuopio, Finland.

1990 dental health objectives for children: What is left to be done? – page 34

Major advances in improving the oral health of our nation's children have been accomplished, but much more needs to be done. In addition to the many areas reported here, the Public Health Service lists a long series of emerging general health and dental health issues for the year 2000. The bottom line is to reduce our sense of complacency. We have made dramatic advances on a national average basis. The need is to reach the great numbers of particular populations of children in need of improved oral and general health.

Requests for reprints should be directed to Dr. H. Barry Waldman, Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11794-8715.

Will there be a difference in the pediatric dentists of the future? – page 38

In addition to the marked downsizing of most schools of dentistry, there has been a significant increase in the number of women and minority students, with percentages for both groups having approximately doubled during the last decade. Furthermore, with increasingly higher percentages of minority students applying to pediatric dental programs, the reality is that there will be an increasing number of pediatric practitioners from minority groups.

Requests for reprints should be directed to Dr. H. Barry Waldman, Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11794-8715.

Now that we've gotten their attention, let's get some more services for children! – page 41

In 1991, the message has finally gotten through to the news media and the U.S. Congress that "there are a lot of children in desperate need throughout this country!" Concerning benefits, with federal, state and local money combined, the elderly have at least a three-to-one advantage over children. Children are at greater risk today than they were ten years ago, and there are significant geographic variations in the health and well-being of our children. Now that the media and politicians are willing to use these issues, the time is right to make the best case for our children.

Requests for reprints should be directed to Dr. H. Barry Waldman, Professor and Chairman, Department of Dental Health, School of Dental Medicine, State University of New York at Stony Brook, Stony Brook, NY 11794-8715.

Assessment of 100 children in Jerusalem with supernumerary teeth in the premaxillary region – page 44

This retrospective study evaluated the prevalence of supernumerary teeth in the premaxilla in a group of children referred for consultation, and determines the presence of associated local disorders before and after surgical intervention. The patient files of 100 Israeli schoolchildren (72 boys and 28 girls) were reviewed. Seventy-eight percent of the 130 teeth in this study were unerupted; and 122 were surgically removed. The most common shape was conical or peg-shaped (61 percent).

Requests for reprints should be directed to Dr. Y. Zilberman, Department of Orthodontics, School of Dental Medicine, P.O. Box 1172, 91010, Jerusalem, Israel.

The incidence of postoperative pain and analgesic usage in children – page 48

The purpose of this study is to report the incidence of postrestorative dental pain and analgesic usage in children. A questionnaire completed by parents was employed. The mean age of the patients was 8.1 years; and all patients were in the six- to thirteen-year-old range. Pain following routine restorative procedures was reported by 31.5 percent of the patients. Additionally, 52.9 percent of these patients required analgesic relief.

Requests for reprints should be directed to Dr. George Acs, Director, Division of Pediatric Dentistry, Montefiore Medical Center, 111 E. 210 Street, Bronx, New York 10467.

A SEM investigation on pulpal-periodontal connections in primary teeth – page 53

The ideal goal of pulpotomy procedure in a primary tooth is to maintain space length, preserve masticatory function, and remove infection and chronic inflammation from the oral cavity. From a population of 150 patients between the ages of four and seven years, we collected a sample of 30 primary (nine maxillary and twenty-one mandibular) molars used in this investigation. The aim was to observe the presence of accessory channels on the pulpal floor; they were found in twenty-one of the thirty teeth examined. The scanning electron microscope proved to be an excellent means of evaluating the pulpal floor, where failure of pulp treatment often has its cause.

Requests for reprints should be directed to Dr. Patrizia Defabianis, Corso Montevicchio 62, 10129 Torino, Italy.

A direct method of earplug fabrication – page 58

Otitis media is one of the most common diseases of childhood, accounting for a large percentage of office visits during the first five years of life. Eight specific signs and symptoms are associated with otitis media and its complications and sequelae. Ear plugs in a variety of sizes are often used to prevent water from en-

Continued on page 9

Busy Reader (continued from page 5)

tering the middle ear when tympanotomy tubes are in place. A fabrication technique is described.

Requests for reprints should be directed to Major Steven L. Cureton, Resident, Advanced Educational Program in Orthodontics, Craven Dental Clinic, Fort Knox, Kentucky 40121-5520.

Outpatient dental treatment of pediatric patients with malignant hyperthermia: Report of three cases—page 62

Malignant hyperthermia is a skeletal muscle disorder thought to be genetically acquired. Inhalation anesthesia presents a dangerous risk to the patient predisposed to the condition.

Requests for reprints should be directed to Dr. Robert Steelman, Assistant Professor of Pediatric Dentistry, West Virginia University Health Sciences Center, Morgantown, West Virginia 26506.

Epidermolysis bullosa: oral management and case reports—page 66

The prominent clinical characteristic of this uncommon group of skin disorders, which are acquired or are genetically transmitted, is the development of bullae or vesicles in response to minor mechanical trauma. They can either be skin or mucosal lesions. This paper reports on three cases of epidermolysis bullosa dystrophica. The significance of oral management in treating these subjects is discussed.

Requests for reprints should be directed to Dr. Behjat K. Moghadam, School of Dentistry, University of Missouri-Kansas City, 650 E. 25th Street, Kansas City, MO 64108.

Bilateral eruption sequestra: Report of case—page 70

An eruption sequestrum is a tiny spicule of bone overlying the crown of an erupting permanent molar. As the tooth continues to erupt, the bone fragment usually sequestrates through the mucosa.

Requests for reprints should be directed to Major (Dr.) John L. Schuler, 325th Medical Group/SGD, Tyndall AFB, FL 32403-5300.

Abstracts (continued from page 8)

patients who are susceptible to malignant hyperthermia can receive dental care in a normal fashion.

Hyperthermia; Muscle contraction; Anesthesia, inhalation [and] amide local; Pediatric dentistry

Moghadam, Behjat K. and Gier, Ronald E.: Epidermolysis bullosa: Oral management and case reports. J Dent Child, 59:66-69, January-February 1992.

Oropharyngeal and gastrointestinal lesions of epidermolysis bullosa (EB) tend to potentiate malnutrition and growth retardation in children with the disease. The management and treatment of these subjects is not successful without the establishment of good oral health. Dental treatment together with proper medical management prevent nutritional deficiency, help establish a normal growth pattern and promote a healthier lifestyle for the children with the disease. This paper reports on three cases of epidermolysis bullosa dystrophica. The significance of oral management in treating these subjects is discussed.

Epidermolysis bullosa; Subtypes; Lesions, skin [and] mucosal; Growth; Nutrition; Trauma

Schuler, John L.; Camm, Jeffrey H.; Houston, Glen: Bilateral eruption sequestra: Report of case. J Dent Child, 59:70-72, January-February 1992.

An eruption sequestrum is a tiny spicule of bone overlying the crown of an erupting permanent molar either before or immediately after the emergence of the cusp tips through the oral mucosa. As the tooth continues to erupt, the bone fragment usually sequestrates through the mucosa; and the spicule may be found lying on the occlusal surface of the molar, attached to the soft tissue overlying the distal half of the occlusal surface.

Eruption; Pain; Bony spicules; Occlusal surface; Oral mucosa; Eruption sequestrum

BEHAVIOR

The effects of using infection-control barrier techniques on young children's behavior during dental treatment

Lawrence J. Siegel, PhD
Karen E. Smith, PhD
George E. Cantu, DDS
William R. Posnick, DDS

The increased incidence of acquired immune deficiency syndrome (AIDS) as well as hepatitis B in the general population had focused considerable attention on the need for infection-control measures by health-care personnel. In addition, there is recent evidence to indicate that the prevalence of both HIV- and HBV-positive children is increasing.¹ Because of frequent contact with blood and saliva the Centers for Disease Control (CDC) and the American Dental Association (ADA) have developed guidelines for the protection of health-care providers and patient cross-contamination.²⁻⁴ These guidelines include the use of protective glasses, masks, and gloves by dentists and auxiliary personnel.

Fear and anxiety are common traits among young dental patients.^{5,6} The degree of fear and/or anxiety that the child possesses and the ability of the dentist to guide and modify the resulting behavior will influence the quality of the dental visit.^{7,8} As practitioners we have a wide variety of techniques available for our use in guiding the behavior of children through the dental experience.⁹ These range from the most basic

use of praise and communication skills to the more sophisticated and high-risk pharmacologic techniques.¹⁰

One constant in the successful use of these management techniques up to and including conscious sedation is the ability of the dentist to communicate with the child. There has been an increasing awareness among practitioners regarding the role of nonverbal influences on this communication process.^{11,12}

Given the influence of verbal and nonverbal communication on child-management techniques and the current necessity of infection control barriers, it is important to assess whether these barriers affect anxiety levels and behavior in children undergoing dental treatment. In particular, the wearing of masks by dental personnel may contribute to the fears of preschool-aged children during dental treatment. This age-group is at greatest risk for reacting negatively to the use of such procedures because of their level of cognitive development and more limited conceptual understanding of the purpose for such unfamiliar barrier techniques. Additionally, a recent study evaluating children's ability to recognize facial expressions found that three-year-olds were significantly slower and made more errors in recognizing facial expression than six- and nine-year-old children.¹² The purpose of the present study was to evaluate whether the use of masks in the dental operatory affected anxiety behavior based on changes

Dr. Siegel is with Ferkauf Graduate School of Psychology, Yeshiva University, Mazer Hall, 1300 Morris Park Avenue, Bronx, New York 10461. Dr. Smith is with the University of Texas Medical Branch at Galveston and Drs. Cantu and Posnick are in private practice in Galveston, Texas.

in heart rate and self-report of mood, arousal, feelings of control, and uncooperative responses in young dental patients. It was hypothesized that as a group, children exposed to the dentist wearing a mask would be more anxious and exhibit more disruptive behavior than those where the dentist did not wear a mask.

METHODS

Subjects

Parents with children between the ages of three and six years of age were randomly chosen each day from the list of scheduled patients and approached by the dental assistant about participation in this study. The purpose and methodology of the study were explained and informed consent obtained from parents who wished to participate. A total of sixty-three subjects were recruited; only three parents declined participation.

As a group, the children who participated had a mean age of sixty-one months (S.D. = 14.3; Range = 34 to 83 months). Thirty-one children were male, twenty-nine female. The socioeconomic status of the study group was diverse with seventeen (28 percent) in the lower, twenty-four (40 percent) the middle, and nineteen (32 percent) the upper levels based on the Hollingshead classification system (Hollingshead & Redlich). The parent accompanying the child was primarily the mother (85 percent). The majority of children (75 percent) had experienced a dental visit at some time in their lives. Twenty-six percent of the children had experienced no previous dental visits in the preceding year; 25 percent, one visit; 37 percent, two visits; and 12 percent, three to five visits.

During the study visit, 66 percent of the children experienced a dental examination and all children received dental restorations. A minority of children had additional procedures, including cleaning (12 percent) and tooth extraction (5 percent).

Measures

Information related to demographics, previous dental experiences, parental and child anxiety, and observer ratings of the child's reaction to and cooperation during various phases of the dental appointment were obtained. In addition, changes in heartrate were monitored as another indicator of anxiety.

Demographics and previous dental experiences. A parent questionnaire was used to collect the following information: child's age and gender, parental educational level and occupation, family income, previous dental experiences, and reason for dental visit that day. The parent was asked how many times the child had been to the dentist, the reason for visits, and to rate the overall quality of those visits on a seven point scale; from 1 = extremely negative/stressful to 7 = extremely positive/not stressful at all. In addition, the parent rated the child's overall behavior during previous visits on a seven-point scale; from 1 = uncooperative/highly disruptive behavior to 7 = very cooperative/readily compliant. Ratings similar to these have been used in previous studies of dental anxiety in children.^{13,14}

Parental anxiety. Parental anxiety level was assessed using the state version of the *Spielberger State-Trait Anxiety Scale*.¹⁵ Using a four-point forced choice format, ranging from not at all to very much like me,

A significant difference was found between the mask and no-mask conditions on observer ratings of distress.

respondents answered each of the twenty items about how he or she was feeling at that particular moment. The self-report scale, which yields a total state anxiety score, has been used extensively in research involving a variety of psychiatric, dental, and medical populations.¹⁵

Children's anxiety. The Self-Assessment Mannequin (SAM) was used to assess several dimensions of the child's feelings through self-report.¹⁶ The SAM consists of three series of cartoon-like figures that represent the dimensions of pleasure/happiness, arousal/excitement (anxiety), and dominance/control. The latter dimension reflects the extent to which an individual feels control over a situation versus feeling of being controlled. Subjects are presented the figures for each dimension and instructed to point to the figure that best represents his or her momentary feelings. This measure has been demonstrated to be sensitive to experimental interventions with child dental patients.¹⁷

Ratings of child's reactions and cooperation. Independent ratings were obtained from the dentist and dental assistant on four aspects of the child's behavior during the appointment: anxiety, cooperation, and reaction to the injection and the drill. Each rating was made on a seven-point scale with lower scores indicative of greater anxiety, less cooperation, and greater fear. The rating scales have been used in previous investigations of dental anxiety in children.^{13,14}

Heartrate measure. A photoplethysmograph (Pulse-ometer Heart Speedometer, Model 7719H, Computer Instrument Corp.) that attaches to the subject's earlobe through noninvasive surface electrodes was used to measure heartrate. A heartrate value, averaged over figure consecutive beats, appears as a digital beats-per-minute display. The instrument has been used in previous investigations of children's reactions to medical procedures.¹⁸

PROCEDURE

Participants were divided into two groups. In one group, the dentist wore a disposable surgical mask, as recommended by the CDC and ADA*, and in the other he did not. Because the office is designed in an open bay and all children present could see the dentist when he was working with another child; clinic days were randomly chosen as "mask" or "no-mask" days. All children seen on that day, irrespective of whether they were participating in the study, were seen with a mask

if it was a "mask" day or without a mask, if it was a "no-mask" day. There were no other procedural differences between the two groups. No sedatives or analgesics apart from the use of a local anesthetic were used on children participating in the study.

After obtaining informed consent, the parent was given the demographic and previous dental experience questionnaires and the *State Anxiety Scale* to complete in the waiting area. The child was asked to complete the SAM by the dental assistant while in the waiting area, and a heartrate level was obtained. The dentist then came out to greet the patient. If it was a mask day, the dentist stated that he would be wearing a mask during the procedure that day and showed the child the mask. At that point the child accompanied the dentist to the treatment area. Parents were not present during the dental procedure.

During the actual procedure heartrate levels were obtained before the injection and before activating the handpiece. Overall ratings of the child's behavior during the procedure were made independently by the dentist and dental assistant immediately after the procedure was completed. The child was then accompanied back to the waiting room where the SAM was administered again.

RESULTS

Assessment of group comparability

Random allocation to the two conditions resulted in thirty-three children in the "mask" group and twenty-seven in the "no-mask" group. The two groups were compared on a variety of variables to assess group comparability. No significant differences in age or parental anxiety levels were found based on between group analyses of variance or in distribution of gender based on chi-square analysis. No significant differences in socioeconomic status, parental ratings of the stress children experienced during previous dental visits, or parental ratings of current stress were found based on *Wilcoxon Signed Rank Tests*.

The only significant difference between the two groups was found on parental ratings of the child's cooperation during previous experiences based on a *Wilcoxon Sign Rank Test* ($Z = 2.03$, $p < .05$). Closer inspection of the data revealed that eight children in the mask condition were rated as highly or moderately uncooperative relative to two children in the no-mask condition. Children were further divided, therefore, into two groups: those rated as moderately to highly uncoop-

*Aseptex ®3-M No. 1942; D-seps[®] Barrier Protection Products.

erative during a previous dental visit ($n = 22$) and those rated as cooperative ($n = 38$). Data were then analyzed separately by group and condition, in addition to the main comparisons.

No significant differences between groups were found on number of previous experiences with dental visits based on a *Wilcoxon Sign Rank Test*. Yet fifteen of the children had no previous experience with a dentist. To control for this variable, children were also grouped according to whether they had any previous experience with the dentist ($n = 45$) or not ($n = 15$). Results that took previous cooperation and experience into account are reported only when they differed from the main comparisons.

Reliability of observational ratings

Spearman rho correlation coefficients were obtained to assess the degree of correspondence between the dentist's and dental assistant's observational ratings of the children's behavior during the dental procedure. Ratings were significantly correlated on all dimensions rated; anxiety, $\rho = .94$, $p < .0001$; cooperation, $\rho = .97$, $p < .0001$. Moreover, it was found that ratings of different aspects of the dental procedure made by the same rater were highly intercorrelated (ρ ranging from .88 to .94, $p < .0001$). Given these high intercorrelations, the ratings of the dental assistant were averaged to obtain one measure of distress which was entered into subsequent analyses.

Comparability between groups on dependent variables at baseline.

Groups were then compared on baseline measures of variables used to assess the effect of the mask condition: heartrate prior to introduction of the experimental manipulation and children's ratings of mood arousal, and perceptions of control. No significant differences between groups were found on the baseline measures.

Analyses of dependent variables

Wilcoxon Sign Rank Tests were used to assess for group differences on observer ratings of distress and children's ratings of the SAM. Difference scores for the SAM were obtained by subtracting children's baseline ratings from ratings obtained at the end of the dental visit. The difference scores were entered into subsequent analyses. Two difference scores were also used to analyze the heartrate data in two separate analyses of variance. Children's heartrates at time of injection

Children in the
no-mask condition
had a slightly
better feeling of being
in control.

and introduction of the handpiece were each subtracted from baseline heartrate levels. Though no significant differences between group differences were found on baseline measures using the SAM or on heartrate, difference scores were used as a means of controlling for within subject variability.

Observer ratings

A significant difference was found between the mask and no-mask conditions on observer ratings of distress ($Z = 3.85$, $p < .0001$). Children in the mask condition had a mean rating of 4.72 (S.D. = 1.8) indicating that overall these children reacted with moderate distress but recovered quickly. Children in the no-mask condition had a mean rating of 6.25 (S.D. = 1.1) indicating that overall these children reacted well, tending to minimize any pain or discomfort. Previous experience was found to have a moderating effect as the significant difference was only noted in those children who had at least one previous experience ($Z = 3.90$, $p < .0001$; Mask Mean = 4.48, S.D. = 1.65; No-Mask Mean = 6.17, S.D. = 1.18). Children with no previous experience showed no significant differences in observer ratings of distress between the two conditions. Previous cooperation had no moderating effect on the main group analysis.

Children's report

No significant differences were found between groups on changes in children's ratings of mood or arousal before and after the dental visit. A trend for differences

between groups was noted on changes in children's perceptions of control ($Z = 1.91, p < .06$). As a group, children in the mask condition on the average reported little change before and after the dental visit (Mean = 0, S.D. = 1.77), while children in the no-mask condition on the average reported slight change in the direction of feeling more in control (Mean = .70, S.D. = 1.23). This effect was moderated by both previous experience and previous cooperation. Significant differences in perceptions of control were found only for children who had at least one previous dental visit ($Z = 2.47, p < .05$) or those whose parents reported them to be cooperative during previous visits ($Z = -1.98, p < .05$).

Heartrate levels

No significance between group differences were noted on changes in heartrate from baseline to injection of a local anesthetic or introduction of the handpiece. Trends in the hypothesized direction were found for patients who had no previous dental experience [$F(1,13) = 3.67, p < .08$] but only on heartrate changes from baseline to injection of local anesthetic. Children with no previous dental experience who were in the mask condition had greater heartrate increases than those in the no-mask condition (Mean = -9.9, S.D. = 6.3 vs. Mean = -3.7, S.D. = 6.0).

DISCUSSION

The purpose of this study was to document the extent to which the wearing of a protective mask during dental treatment contributed to the distress-related behaviors of young children. The overall findings tended to be in the predicted direction with children who were treated by a dentist who did not wear a mask showing slightly better adjustment than children who were exposed to a masked dentist. Better adjustment during the dental session for the no-mask group was reflected through the measures of observed distress, self-report of perceived control, and heartrate as assessed from the baseline to injection phases.

An interesting finding was the impact of a child's previous dental experience on his or her response to the mask or no-mask condition. The data indicated that the level of previous experience tended to influence the child's response to the dentist either with or without a mask. Children with at least one previous dental session (no-mask) were found to exhibit a slightly greater level of observed distress, when in the mask condition,

and slightly greater feelings of control, when in the no-mask. These findings were not found for children with no previous exposure to the dental experience. Children with no previous experience, on the other hand, tended to demonstrate increases in heartrate from the baseline to injection phases, when in the mask condition as compared to the no-mask condition. Similar heartrate changes were not exhibited by children with previous dental experience.

Although the statistically significant differences between the groups suggest a trend in the direction of greater distress-related behavior for the mask as compared to the no-mask condition, these findings should be interpreted with caution. That is, the absolute differences between the two groups is small when considering the clinical implications of these differences. This is particularly evident when considering the observational measure of behavioral distress, which assessed behavior throughout the dental session. While the no-mask group achieved a mean score that suggested that they reacted well and tended to minimize pain and discomfort, children in the mask group obtained a significantly lower mean score, but had a mean that indicated that they showed only a moderate level of distress, recovered quickly, and eventually behaved in a nondistressed manner.

Thus, the findings from this study suggest that wearing a mask during dental treatment represents a minimal stressor for the young child with previous dental experience and has not appreciable impact on the child's behavior during the dental session. Given the influence of previous experience as a moderator variable, it can be suggested that the discrepancy between the child's past experience in which the dentist did not use a mask in contrast to the current situation in which the dentist wore a mask may have contributed to the minimal distress experienced by children in the mask condition.

RECOMMENDATIONS

- Protective barriers consistent with the CDC and ADA must be used to prevent infection of health care workers and cross-contamination of patients.
- Introduction of the child to the dental environment and experience (examination) can be made without the use of a protective mask.
- Introduction of the protective mask can be done by the clinician at the restorative appointment in such a way as to minimize its effect on the child's behavior.

REFERENCES

1. Leggott, P.J. and Walker, P.O.: Infection control in pediatric dentistry—considerations and procedures. Update in Pediatric Dentistry, Vol III, No. 2, April 1990.
2. Centers for Disease Control: Recommended infection-control practices for dentistry. MMWR, 35:237-242, April 1986.
3. Centers for Disease Control: Update: Universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis virus, and other bloodborne pathogens in health-care settings. MMWR, 37:377-388, June 1988.
4. Association Reports, Council on Dental Therapeutics: Infection control recommendations for the dental office and the dental laboratory. JADA, 116:241-248, February 1988.
5. Cuthbert, M.E. and Melamed, B.G.: A screening device: Children at risk for dental fears and management problems. J Dent Child, 61:432-435, November-December, 1982.
6. Siegel, L.J.: Dental treatment. In D. Routh (Ed.), *Handbook of pediatric psychology*, New York: Guilford Press, 1987.
7. Filewich, R.J.; Jackson, E.; Shore, H.: Effects of dental fear on efficiency of routine dental procedures. J Dent Res, 60:(Special Issue A, 533) (Abstract No. 895), March 1981.
8. Hentschel, V.; Allander, L.; Winhold, A.: Specific conditions of distress in the dental situation. Swedish Dent J, 1:71-84, January 1977.
9. Chambers, D.W.: Behavior management techniques for pediatric dentist: An embarrassment of riches. J Dent Child, 44:30-34, January-February 1977.
10. Pinkham, J.R. ed.: *Pediatric dentistry, infancy through adolescence*. Philadelphia: W.B. Saunders Company, pp 269-280, 1988.
11. Pinkham, J.R. and Patterson, J.R.: Voice control: an old technique examined. J Dent Child, 52:199-202, May-June 1985.
12. Wilson, S.; Flood, T.; Kramer, N. *et al*: A study of facially expressed emotions as a function of age, exposure time, and sex in children. *Pediatr Dent*, 12:28-32, February 1990.
13. Siegel, L.J. and Peterson, L.: Stress reduction in young dental patients through coping skills and sensory information. J Consult Clin Psychol, 785-787, December 1980.
14. Siegel, L.J. and Peterson, L.L.: Maintenance effects of coping skills and sensory information in young children's responses to repeated dental procedures. *Behav Ther*, 12:530-535, September 1981.
15. Spielberger, D.C.: *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologist Press, Inc., 1983.
16. Lang, P.J.: Behavioral treatment and biobehavioral assessment: Computer applications. In J Sidowski (Ed.) *Technology in mental health care delivery systems*. Norwood, N.J.: Ablex Publishing, 1980.
17. Melamed, B.G.; Bennett, C.G.; Jerrell, G. *et al*: Dentists' behavior management as it affects compliance and fear in pediatric patients. J Am Dent Assoc, 106:323-330, March 1983.
18. Smith, K.E.; Ackerman, J.D.; Blotcky, A.D.: Reducing distress during invasive medical procedures: Relating behavioral interventions to preferred coping style in pediatric cancer patients. J *Pediatr Psychol*, 14:405-419, September 1989.

BREAST-FEEDING IN 1991

Human milk is remarkably rich in immune components. Community-based epidemiologic studies do not support the view that these components necessarily have a direct role in the protective effect of breast milk on infant mortality, but such components (especially organism-specific IgA) can modify diarrheal symptoms. A more direct role for breast milk in preventing infection and death is most convincingly shown in studies of hospitalized, high-risk newborns (those who are born prematurely or have intrauterine growth retardation). Thus, the immune components of breast milk may increase the chance of survival for at least low-birth-weight newborns in both underdeveloped and economically developed countries.

In countries such as the United States, sanitation is usually not a problem, and nutritionally adequate alternatives to breast milk are generally available. Thus, in the United States breast-feeding is usually not a measurable factor in infants' survival. Nonetheless, most physicians strongly encourage mothers of healthy, full-term infants to breast-feed their babies for at least three to six months. After six months, nutritional supplementation is needed but breast-feeding can continue. In the United States, breast-feeding can be most strongly defended in terms of its economic advantages (especially for low-income families), its potential effects on the clinical severity of gastrointestinal infections, the presumed beneficial effects on the maternal-infant interaction, the mother's perceptions of that interaction, and its contribution to the mother's confidence in her maternal capabilities. The importance of such intangible benefits of breast-feeding should not be underestimated.

Jason, Janine: Breast-feeding in 1991.
N Engl J Med, 325:1036-1037, October 3, 1991.

Prevalence of craniomandibular dysfunction in white children with different emotional states: Part III. A comparative study

Apostole P. Vanderas, DDS, JD, MPH, MDS

The etiology of the dysfunction of the masticatory system has been considered to be multifactorial.¹ Malocclusion, oral parafunctions, and emotional states are the factors most investigated in adults.²⁻⁶ Three studies conducted on children and adolescents reported higher prevalence of craniomandibular dysfunction (CMD) in subjects with the traits of nervousness, anxiety, excitability, stress, and excessive fear in threatening situations.⁷⁻⁹ No statistical tests were carried out, however, to show whether there were significant differences between the subjects with and without these emotional factors. The etiologic importance of the emotional states in children, therefore, has not been investigated adequately.

The purpose of this part of the study was to compare the prevalence of CMD between white children classified by the parents as *calm* and *not calm*.

MATERIALS AND METHODS

A total of 386 white children, males and females, age six to ten years, selected from the school of Dental Medicine and Children's Hospital of Pittsburgh was examined for this study. The children were interviewed for symptoms and examined clinically for signs of CMD and malocclusion. A questionnaire was dis-

tributed to the parents before the examination to collect information related to organic diseases that can cause CMD, history of trauma, upper respiratory infection, toothache, orthodontic treatment, and psychological qualities of the children. The subjects were classified by the parents in the following categories: *calm*, *tense*, *anxious*, *nervous*, or *under stress*. If a child was classified as *tense*, *anxious*, *nervous*, or *under stress*, the parents were asked to justify this classification by giving the actual life events that contributed to these conditions. On the basis of the answers to the questionnaire, the entire sample was divided into the following groups:

- Subjects rated by the parents as *calm*; this group was referred to as *calm group* (N = 250).
- Subjects rated by the parents as *tense*, *anxious*, *nervous*, or *under stress*; this group was referred to as *not calm group* (N = 105).
- Subjects with dentofacial injuries (N = 25).

Six subjects had upper respiratory infection and/or toothache and were excluded from the study.

The symptoms recorded in this study were headaches occurring once a week or more, pain in the temple region or when the mouth was opened wide or chewing, difficulties in opening wide, and clicking. The questions were addressed to the subjects in the following manner:

- Do you get headaches?
- How often do you get headaches?

Once in a while _____ Once a week _____ More than once a week _____

- Does it bother you to open your mouth wide?

Dr. Vanderas is currently in the private practice of pediatric dentistry in Athens, Greece.

This part of the study is based on a thesis submitted to the graduate faculty committee of the University of Pittsburgh as a partial requirement for the Master of Dental Sciences.

- Does it hurt you in the temple region?
 (The temple region was shown)
- Does it hurt you to open your mouth wide or when chewing?
- Does your jaw make a popping or clicking noise?

The clinical examination of the masticatory system included mandibular movements, deflection of the mandible on opening, temporomandibular joint (TMJ) sounds, TMJ tenderness, and muscle tenderness. The interview and the clinical examination related to the function of the masticatory system, as well as the selection and the classification of the subjects into groups as above were explained in detail in Part I of the study.¹⁰

At the occlusal examination, the following types of morphologic and functional malocclusion were recorded: *anterior crossbite, posterior crossbite, open bites, overjet, deep bite, anteroposterior distance between retruded and intercuspal positions, lateral deviation between retruded and intercuspal positions, and interferences in the terminal hinge movement.*

On the basis of age, sex, and different types of malocclusion recorded in this study, an experimental group of forty-six *not calm* children (twenty-six males, twenty females) and a control group of forty-six *calm* children (twenty-six males, twenty females) were identified for comparison in the prevalence of signs and symptoms of CMD. Table 1 shows the distribution of the subjects by age and sex in the two groups. The respective differences in the severity of CMD between members of the two groups were investigated by using Helkimo's clinical and anamnestic dysfunction indices.¹¹

STATISTICAL METHODS

The data were computerized and the SPSS/PC+ statistical package was used for their analysis. Differences were tested by the chi-square test. The 95 percent probability level was used.

RESULTS

Differences in the prevalence of signs

The frequency of each sign in the control and experimental groups is presented in Table 2. The differences between the two groups for each sign separately are reported below.

MANDIBULAR MOVEMENTS

No statistically significant differences were found between the two groups in the frequency of limited maximal opening, right and left mandibular movements, and protrusion. Also, no sex differences were noticed.

DEFLECTION ON OPENING

No statistically significant difference was found between the two groups in the prevalence of deflection on opening ($\chi^2 = 0.00, p = 1.00$). In addition, the chi-square test showed no significant differences between males ($\chi^2 = 0.00, p = 1.00$) and females ($\chi^2 = 0.00, p = 1.00$) of the two groups.

Table 1 Distribution of the subjects by age and sex in the control and experimental groups.

Groups	Age										Totals
	6		7		8		9		10		
	M	F	M	F	M	F	M	F	M	F	
Control	6	3	2	6	6	4	7	3	5	4	46
Experimental	6	3	2	6	6	4	7	3	5	4	46
Totals	12	6	4	12	12	8	14	6	10	8	92

Table 2 Prevalence of each sign in the control and experimental groups.

Groups	Mandibular movements			Mandibular protrusion	TMJ* Function		Tenderness	
	Limited maximal opening	Lateral movements R	Lateral movements L		Deflection on opening	TMJ* sounds	TMJ*	Muscle
Control (%)	—	—	—	—	19.6	8.7	—	28.3
Experimental (%)	2.17	—	2.17	2.17	19.6	17.4	13.0	63.0

*TMJ stands for temporomandibular joint

TMJ SOUNDS

There was not statistically significant difference ($\chi^2 = 0.86$, $p = 0.35$) between the control and experimental groups in the prevalence of TMJ sounds. Also, no statistically significant differences were found between males ($\chi^2 = 1.69$, $p = 0.19$) and females ($\chi^2 = 0.00$, $p = 1.00$) of the two groups.

TMJ TENDERNESS

The difference in the prevalence of TMJ tenderness was statistically significant ($\chi^2 = 4.45$, $p = 0.034$) between the two groups. The frequency was higher in the experimental group (Table 2). No statistically significant differences were found, however, between the males ($\chi^2 = 1.41$, $p = 0.23$) and females ($\chi^2 = 1.44$, $p = 0.22$) of the two groups.

MUSCLE TENDERNESS

The difference in the prevalence of muscle tenderness was highly statistically significant ($\chi^2 = 9.85$, $p = 0.001$) between the two groups. The frequency was higher in the experimental group (Table 2). Further statistical analysis for each muscle separately revealed significant differences between the two groups in the prevalence of tenderness of the lateral ($\chi^2 = 7.71$, $p = 0.005$) and medial ($\chi^2 = 5.98$, $p = 0.01$) pterygoid muscles. The differences with respect to tenderness of the posterior temporalis ($\chi^2 = 1.37$, $p = 0.24$), anterior temporalis ($\chi^2 = 0.51$, $p = 0.47$) and masseter ($\chi^2 = 1.37$, $p = 0.24$) muscles did not reach the level of significance. The prevalence of the tenderness of each palpated muscle was higher in the experimental group (Table 3). Regarding sex differences, the chi-square test showed significant difference between the males of the two groups ($\chi^2 = 6.26$, $p = 0.01$), while the difference between females ($\chi^2 = 2.72$, $p = 0.09$) did not reach the level of significance. With respect to the tenderness of each palpated muscle, statistically significant difference between the females of the two groups was found in the tenderness of the lateral pterygoid muscle ($\chi^2 = 4.10$, $p = 0.04$). The other differences did not reach the level of significance.

Differences in the prevalence of symptoms

Table 4 reveals the prevalence of each symptom in the two groups. Statistically significant differences between the two groups were not found in any of the symptoms, as well as with respect to sex.

Differences in the severity of signs and symptoms

The frequency of the clinical and anamnestic dysfunction indices is shown in Table 5. The only difference that approached the level of significance was that of the clinical dysfunction index with moderate symptoms (DiII) between the two groups ($\chi^2 = 2.92$, $p = 0.08$). The other differences in the frequency of the clinical and anamnestic dysfunction indices between the two groups were not statistically significant. In addition, the chi-square test did not reveal any sex difference with respect to the dysfunction indices.

DISCUSSION

A statistically significant sex difference ($p = 0.009$) was found in the composition of the initial samples between the *calm* and *not calm* groups. More males were classified in the *not calm* group, while more females in the *calm* group. In addition, age and malocclusion are known to have an influence on the dysfunction of the masticatory system.^{7,8,12-15} To neutralize these factors, therefore, a matching by age, sex, and malocclusion was performed. Based on this matching procedure as well as the differential diagnosis of the etiologic factors reported in Part I of the study, all the known factors causing dysfunction, except the emotional states, were

Table 3 □ Prevalence of the tenderness of each palpated muscle in the control and experimental groups.

Prevalence	Muscle				
	Anterior temporalis %	Posterior temporalis %	Masseter %	Lateral pterygoid %	Medial pterygoid %
Control	—	—	—	23.9	19.6
Experimental	6.5	4.3	6.5	54.3	45.7

Table 4 □ Prevalence of each symptom in the control and experimental groups.

Groups	Head-aches %	Difficulties in opening wide %	Pain in temple region %	Pain in opening wide and chewing %	Reported clicking %
Experimental	10.9	13.0	6.5	15.2	10.9

Table 5 □ Clinical and anamnestic dysfunction indices in the control and experimental groups.

Groups	Clinical index				Anamnestic index		
	DiO	DiI	DiII	DiIII	AiO	AiI	AiII
Control	63.04	21.7	15.2	—	73.91	4.3	21.7
Experimental	34.7	30.4	32.6	2.2	69.56	15.2	15.2

controlled for between the experimental and control groups.¹⁶

Two mechanisms have been developed in the literature to explain the effect of emotional factors on the masticatory system: a) emotional factors increase the frequency of parafunctional activity; and b) pain and dysfunction arise from increased muscle tension caused by emotional factors.^{1,3,16-19}

This study showed statistically significant differences in the prevalence of TMJ and muscle tenderness between the two groups. The difference in the frequency of TMJ tenderness between males and females of the two groups, however, was not significant. An interesting observation was that TMJ tenderness was not developed in any of the children of the control group, while it was developed in six children (three males and three females) of the experimental group (Table 2). The difference in the prevalence of muscle tenderness between males of the two groups was significant, but between females did not reach the level of significance.

Regarding the tenderness of each palpated muscle, significant differences between the two groups were found in the frequency of tenderness of lateral and medial pterygoid muscles. The differences in the tenderness of the other muscles were not significant but it should be mentioned that tenderness of these muscles was not found in any of the children of the control group, while it was found in eight children (four males and four females) of the experimental group (Table 3). Since the other known etiologic factors of craniomandibular dysfunction were controlled in the study, the differences found in this investigation should be attributed to the emotional states.

The fact that no statistically significant differences

related to TMJ sounds were found between the two groups might be explained by the mechanisms through which the emotional factors act on the masticatory system. As mentioned before, emotional states increase parafunctional activity and/or muscle tension that can elicit tenderness of pain of the muscles of mastication.^{1,20} Although an interrelation between muscle tenderness and TMJ sounds might exist, the duration of the presence of the muscle symptoms might not be long enough to create significant differences regarding TMJ sounds between the two groups. Also, the tenderness of the muscle was not severe enough to create significant differences in the prevalence of the deflection of the mandible on opening and limitations of the mandibular movements.

With respect to the symptoms, no statistically significant differences were found between the control and the experimental groups. This result should be attributed to the fact that most of the signs detected in this study were in the subclinical phase of the disease and, therefore, symptoms had not yet developed.

Although the frequency of the severity of craniomandibular dysfunction measured by the *Helkimo's index* as mild, moderate, and severe was higher in the experimental group, the difference was not statistically significant.¹¹ This finding may be attributed to the increased adaptability of the masticatory system, due to the young ages of the children. Also, it is likely that the duration and intensity of the emotional factors caused by various life events were not high enough to have a significant influence on the severity of craniomandibular dysfunction.⁹

This study showed significant differences in the prevalence of muscle and TMJ tenderness between

The difference in the prevalence of muscle tenderness was highly statistically significant between the two groups.

children with different emotional states as determined in Part I and Part II of the investigation.^{9,10} This result reveals that children with emotional states run a greater risk of developing these signs. Since muscle tenderness is the most prevalent sign of craniomandibular dysfunction in children and adolescents, and TMJ tenderness is one of the definitive signs, it is suggested that emotional factors should be taken into consideration in the treatment planning of these signs.²¹

REFERENCES

1. Rugh, J.D. and Solberg, W.K.: Psychological implications in temporomandibular pain and dysfunction. *Oral Sci Rev*, 1:3-20, 1976.
2. Perry, H.T.; Lammie, G.A.; Main, J. *et al*: Occlusion in a stress situation. *J Am Dent Assoc*, 60:626-633, May 1960.
3. Rugh, J.D. and Solberg, W.K.: Electromyographic studies of bruxist behavior before and after treatment. *Abstr J Dent Res*, 54:L563, 1975.
4. Mohlin, B. and Kopp, S.: A clinical study on the relationship between malocclusions, occlusal interferences, and mandibular pain and dysfunction. *Swed Dent J*, 2:105-112, 1978.
5. Mohlin, B.; Ingervall, B.; and Thilander, B.: Relation between malocclusion and mandibular dysfunction in Swedish men. *Dur J Orthod*, 2:229-238, 1980.
6. Rugh, J.D.: Psychological factors in the etiology of masticatory pain and dysfunction. In: *The President's conference on the examination, diagnosis, and management of temporomandibular disorders*. Laskin, D.M. *et al*, Ed. Chicago: Am Dent Assoc, 1982, pp 85-94.
7. Wigdorowicz- Makowerowa, N.; Grodzki, C.; Parrek, H. *et al*: Epidemiologic studies on prevalence and etiology of functional disturbances of the masticatory system. *J Prost Dent*, 41:76-82, January 1979.
8. Egermark-Eriksson, I.: Mandibular dysfunction in children and in individuals with dual bite. *Swed Dent J*, Supp. 10, 1982.
9. Vanderas, A.P.: Prevalence of craniomandibular dysfunction in white children with different emotional states. Part II: Not calm group. *J Dent Child*, 56:348-352, September-October 1989.
10. Vanderas, A.P.: Prevalence of craniomandibular dysfunction in white children with different emotional states. Part I: Calm group. *J Dent Child*, 55:441-448, November-December 1988.
11. Helkimo, M.: Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. *Swed Dent J*, 67:101-121, 1974.
12. Brandt, D.: Temporomandibular disorders and their association with morphologic malocclusion in children. In: *Developmental aspects of temporomandibular joint disorders*. Carlson, D.S. *et al*, Ed. Monograph 16, *Craniofacial Growth Series*, Ann Arbor: University of Michigan, 1985, pp 279-288.
13. Nilner, M. and Kopp, S.: Distribution by age and sex of functional disturbances and diseases of the stomatognathic system in 7-18 years old. *Swed Dent J*, 7:191-198, 1983.
14. Magnuson, E.; Egermark-Eriksson, I.; and Carlsson, E.G.: Four-year longitudinal study of mandibular dysfunction in children. *Community Dent Oral Epidemiol*, 13:117-120, 1985.
15. Vanderas, A.P.: An epidemiologic approach to the etiologic factors of craniomandibular dysfunction in children and adolescents: The host-agent model. *J Cran Pract*, 6:172-178, April 1988.
16. Yemm, R.: Neurophysiologic studies of temporomandibular joint dysfunction. *Oral Sci Rev*, 1:31-53, 1976.
17. Laskin, D.M.: Etiology of the pain dysfunction syndrome. *J Am Dent Assoc*, 79:147-153, July 1969.
18. Solberg, W.K. and Rugh, J.D.: The use of biofeedback devices in the treatment of bruxism. *J South Calif Dent Assoc*, 40:852-853, September 1972.
19. Rugh, J.D. and Solberg, W.K.: The identification of stressful stimuli in natural environments using a portable biofeedback unit. *Res Soc Biofeedback Proc*, Colorado Springs, Colorado, 1974.
20. Vestergaard-Christensen, L.: Facial pain and internal pressure of masseter muscle in experimental bruxism in man. *Arch Oral Biol*, 9:1021-1031, 1971.
21. Vanderas, A.P.: Prevalence of craniomandibular dysfunction in children and adolescents: a review. *Pediatr Dent*, 9:312-316, December 1987.

THE DENTAL DIAGNOSTIC SCIENCES AND THE FUTURE OF DENTAL PRACTICE

The diagnostic technology available to dental clinicians is increasing in quantity, complexity, and potential information yield. Researchers will continue to develop methods and devices to address problems affecting the maxillofacial complex. Dental education and the profession need to foster an attitude change in the public and in future dental school applicants. The concept that dentistry is a medical science with the additional demand for technical expertise should be promoted. The traditional descriptor of dentistry as an "art and science" is no longer adequate.

The technology exists to solve many problems. Dentists can access and adopt many innovative diagnostic methods and devices. Problem-solving limitations are imposed only by self-complacency. Though many will be happy to practice dentistry as history and tradition dictate, tools are available and await highly motivated and educated dental clinicians to develop themselves into oral diagnosticians, as well as oral rehabilitators.

Razmus, Thomas F.: Guest editorial
J Dent Res, September 1991

EPIDEMIOLOGY

Background factors affecting dental caries in permanent teeth of Finnish and Soviet children

E. Honkala, DDS, PhD, MSc, DDPH
S. Kolmakow, DDS, PhD
V. Nyysönen, DDS, PhD, MPH
E. Kuzmina, DDS, PhD
S. Vasina, DDS, PhD

The main factors associated with the etiology of caries are well documented. From the standpoint of prevention, restriction of sugar ingestion has been generally recommended, especially for children. The preventive effect of fluorides has also been clearly documented. On a community basis, the role of oral hygiene, especially regular toothbrushing, has been negligible; although in well controlled programs, it also has been effective in preventing caries.¹ One recent study, however, demonstrated the effect of toothbrushing on the declining prevalence of caries.³

The role of general external factors has rarely been compared between different populations, because methods of data collection vary. The *International Collaborative Study* revealed distinctly different caries experiences in different countries, and an attempt was made to explain this on the basis of existing differences in systems of oral health care. There are, however, very few international studies on caries experience in which the measured variables have been collected by

strictly comparable methods.

The aim of this study was to analyze the association between some general background factors and caries experience in two groups of Finnish and Soviet children. In an attempt to analyze the changing pattern of caries experience according to age, the sample was selected from three different age-groups.

SUBJECTS AND METHODS

School children ages seven, nine, and twelve years (n = 1187) were examined clinically in Helsinki and Kuopio (Finland) and in Moscow and Leningrad (USSR). The sample is described in Table 1. The fluoride con-

Table 1 □ Age, sex and geographic distribution of subjects.

Place of residence	Girls			Boys			Totals
	Age (years)						
	7	9	12	7	9	12	
USSR							
Moscow	49	35	44	51	65	56	300
Leningrad	45	53	62	55	46	39	300
Finland							
Helsinki	45	48	49	46	46	44	278
Kuopio	49	49	46	47	61	57	309
Totals	188	185	201	199	218	196	1187

Dr. Honkala is Assistant Professor, Department of Preventive Dentistry and Cariology; Dr. Kolmakow is Assistant Professor, Department of Oral Pathology, Oral Roentgenology and Forensic Dentistry; and Dr. V. Nyysönen is Acting Professor, Department of Community Dentistry, Faculty of Dentistry, University of Kuopio, Finland. Drs. Kuzmina and Vasina are Assistant Professors, Department of Preventive Stomatology, Medical Stomatological Institute, Moscow, USSR.

Table 2 □ Percentage (%) of Soviet (USSR) and Finnish (SF) children according to use of different sugar products, toothbrushing and mother's education in all age-groups (years).

	USSR			Finland			Signif. (USSR vs SF)		
	7	9	12	7	9	12	7	9	12
Sweets									
less than once a week	4	13	17	2	4	3			
once a week	32	20	26	50	47	33			
3-4 times a week	40	33	31	40	43	49			
1-2 times a day	18	18	21	6	6	13			
more than twice a day	6	16	5	2	-	2	***	***	***
Cakes									
once a week	29	44	44	49	48	45			
3-4 times a week	53	37	35	37	43	40			
1-2 times a day	15	14	20	11	8	13			
more than twice a day	3	5	1	3	1	2	**	**	NS
Soft drinks									
once a week	40	51	58	30	36	33			
3-4 times a week	45	32	36	30	33	38			
1-2 times a day	12	13	6	33	26	22			
more than twice a day	4	4	-	7	6	7	***	**	***
Sugar-Sweetened coffee									
once a week	87	81	87	93	92	87			
3-4 times a week	12	13	10	3	4	4			
1-2 times a day	2	6	3	4	3	7			
more than twice a day	-	-	-	-	1	2	**	**	**
Sugar-Sweetened tea									
once a week	3	4	5	76	74	60			
3-4 times a week	21	4	2	10	12	19			
1-2 times a day	57	62	60	13	11	19			
more than twice a day	19	30	33	1	3	2	***	***	***
Toothbrushing									
never	0	0	1	0	0	0			
less than once a week	4	4	1	2	2	5			
weekly but not daily	36	36	38	22	22	22			
daily	60	60	60	76	76	73	NS	**	***
Mother's education									
primary school	16	9	12	31	35	38			
secondary school	63	60	52	53	52	49	**	***	***
high school or university	21	31	35	16	13	13			

Stat. testing by analysis of variance: * p<0.05;** p<0.01;*** p<0.001

tent in drinking water at the time of examination was 0.2 to 0.4 ppm in Moscow, Leningrad, and Helsinki and 1.0 ppm in Kuopio. Artificial fluoridation of piped waters began in Kuopio in 1956 and in Leningrad in 1969. Water fluoridation was stopped in Leningrad in 1979, but continues in Kuopio.

In both countries the children's teeth were examined between March and May 1985 by two examiners (SK, EK) in both countries. Five to fifteen minutes were devoted to each examination. The intraexaminer and interexaminer reproducibilities were over 95 percent; these percentages were the result of many calibration exercises during the four-year planning stage of the study. The detailed methodology and statistics have been published elsewhere.^{5,6} Examinations were conducted under standard light, using fiber optic light as a source of transilluminated and reflected light. In addition, fissure sealants, which are commonly used in Finland, were recorded separately for each specific tooth surface.

Information about health habits and mother's education were gathered in a questionnaire sent to the parents of all the children who participated in the study in both countries. This questionnaire (identical in Finnish and in Russian) included questions about use of sweets, cakes, soft drinks, sugar-sweetened coffee and tea, toothbrushing frequency and mother's education.

The questionnaire was tested in pilot studies in both countries.

The number of decayed and filled surfaces (DFS) was used in the analyses as a measure of caries experience. Consumption of different sugar snacks as well as frequency of toothbrushing were recorded dichotomously into "daily" and "not-daily" classes. Mother's education was noted in three categories (primary school only, secondary school, high school and university) and these same categories were then used in the analyses. In the bivariate analysis the results were tested by Student's t-test, Chi-square test and analysis of variance. An F-test was used for evaluating the associations of the different independent variables in the log-linear models.

RESULTS

Dental health habits and mother's education

When the general patterns of dental health habits were compared, very distinct differences were found between groups of children in the two countries, except for use of cakes among twelve-year-olds and toothbrushing frequency among seven-year-olds (Table 2). The Soviet children used sweets and sugar-sweetened tea more frequently than the Finnish children did, but

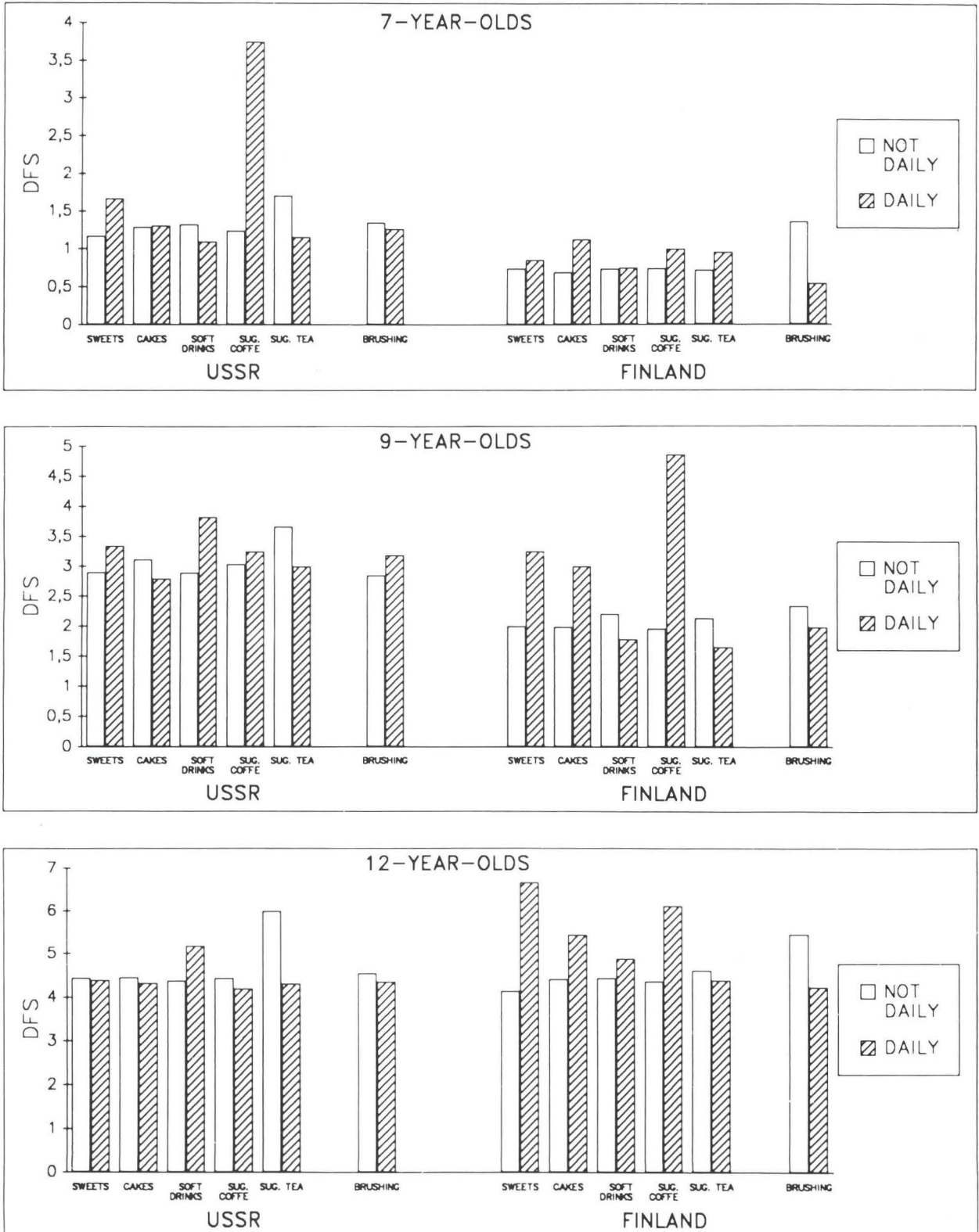


Figure 1. Mean DFS indices according to frequency of using different sugar products and toothbrushing in each age-group among Soviet and Finnish children.

the Finnish children used more soft drinks and slightly more sugar-sweetened coffee than their Soviet counterparts. Toothbrushing frequency was significantly higher among Finnish nine- and twelve-year-olds than among the Soviet children. The Soviet mothers in this sample had, on an average, more education than did the Finnish mothers.

Caries experience and the studied background

Caries experience as measured by DFS was higher among the Soviet than among the Finnish children at the ages of seven and nine years; but among twelve-year-olds, the difference was not significant. There were no statistically significant differences in caries experience within the Finnish and within the Soviet children of the same age according to place of residence.

Caries experience according to use of different sugar products and toothbrushing frequency is presented for the different age-groups in both countries (Figure 1). In all age-groups studied, there were more consistent associations between caries experience and the background factors among Finnish than among Soviet children. Use of sugar products correlated consistently with caries experience in all age-groups in Finland, but not in the USSR. Use of sugar-sweetened tea, however,

was negatively correlated with caries experience in both countries (except among Finnish seven-year-olds). Except among Soviet nine-year-olds, daily toothbrushing was associated with lower caries experience in all groups studied. These associations were also more prominent in Finland than in the USSR.

In Finland but not in the USSR, caries experience in all the age-groups increased as mother's education increased (Figure 2).

When the number of sealants in Finland were controlled statistically in the analyses, all the statistically significant associations remained the same.

Simultaneous associations between caries experience and background factors

When all the background factors studied were analyzed simultaneously by multifactorial analyses, the only significant independent variables were toothbrushing frequency and age in Finland and use of sweets and age in the USSR (Table 3).

DISCUSSION

In this kind of study design, certain limitations are evident. The samples included here are not representative of the selected age-groups in the cities concerned,

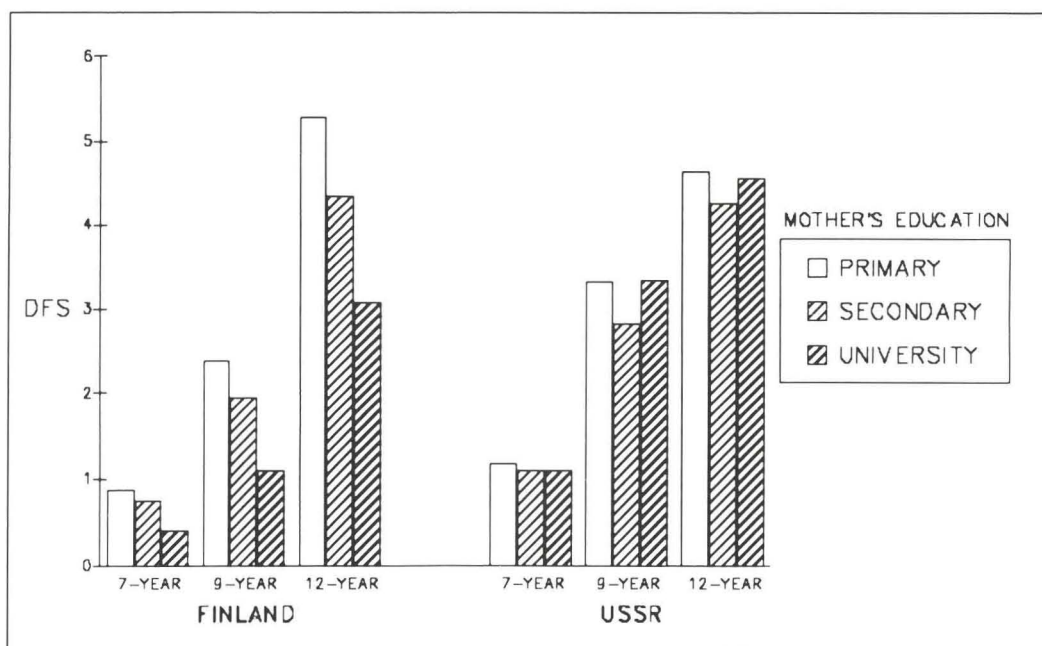


Figure 2. Mean DFS indices according to mother's education in each age-group among Soviet and Finnish children.

Table 3 □ The final log-linear regression models for explaining caries experience.

	Risk Ratio	95 % Confidence interval
USSR		
1. Toothbrushing	1.69	1.35 - 2.11
2. Age	1.52	1.44 - 1.59
Finland		
1. Use of sweets	1.77	1.39 - 2.25
2. Age	1.64	1.54 - 1.74

because only a few schools could be included in the study. In spite of this, the results probably reflect the real differences between these two ethnic groups. The representativeness was also unnecessary for the aims of this study, where only clusters of these two ethnic groups were needed.

DFS-values were used in this analysis, because they give more reliable and consistent information about the disease than DS-values do. DFS-values also measure caries from over a longer period. In the cross-sectional study design, DS-values also have smaller variance, thus giving the background variables less explanatory power. M-component was not included, because only two teeth in the whole sample were missing due to caries.

Some problems arise from the variables measuring behavior, because they were only measured at the time of the study and do not give information, therefore, about changes that may have occurred in the past. There are also some universal problems in collecting information about food consumption; simple frequency questions are not very reliable in this kind of study design, but they can be used to describe behavior.⁷

This study design, however, allows comparison of caries experience and its association with these important and well-documented factors for explaining caries experience. The data (information obtained from clinical examinations and questionnaire) were collected by exactly the same methods for both groups. Comparisons between these two groups (Finnish and Soviet children), therefore, are justified. Repeatability of the clinical diagnoses was very high and there is no reason to expect the validity of the answers to differ between the two ethnic groups.

On the bivariate level the individual background factors seemed to have the expected associations with caries experience, while the level of significance was lower than it has been in previous studies. The studied ethnic groups differed from each other mainly by the consumption of tea and toothbrushing frequency. Their

effect on caries experience, therefore, had special interest in this study. The effect of sugar-sweetened tea seemed to be the same in both ethnic groups. Probably this effect could be explained by the presence of fluorides, which have been shown to be activated by sugar during the subsequent pH changes in plaque.⁸ Toothbrushing frequency seemed to have similar effects on caries experience, but the differences between two ethnic groups arose probably because of a varying effectiveness of toothbrushing and the presence of fluorides in nearly all toothpaste sold in Finland. The background factors studied seemed to explain caries experience quite well among Finnish children, but not among Soviet children. This was especially evident for the socioeconomic variable (mother's education), but was also in accordance with the previous studies in Finland and in the USSR.^{9,10}

This study showed lower caries experience in young Finnish children than in young Soviet children; but this difference totally disappeared among twelve-year-olds. The most probable explanation for this finding is the fact that there is a comprehensive program of caries prevention in Finland, but not in the USSR. The prevention programs no longer seem to succeed in keeping the caries experience lower among twelve-year-olds. Nor were the sealants, which were only used in Finland, able to maintain the low DFS values among Finnish children. This finding could be explained by the possible difference in tooth resistance to decay between these two ethnic groups. This explanation has been confirmed by the finding of the greater number of enamel focal demineralization lesions among Finnish children than among the Soviet children.⁶

No significant differences in caries experience between children in fluoridated and nonfluoridated cities in both countries was observed in this study. Probably this finding reflects the situation, where differences in caries prevalences between fluoridated and nonfluoridated communities have been diminishing.

The ultimate goal of multivariate analysis was to discover the most important factors associated with caries experience in the two ethnic groups. The final models were quite different for Finnish and Soviet children. Consumption of sugared tea did not appear in the final model, because only a few children used it in Finland and almost everyone in the USSR. In contrast to bivariate analyses the final model included toothbrushing in the USSR and use of sweets in Finland. This unexpected finding cannot be explained with this study design and will require further studies of the caries process or caries resistance in these two ethnic groups.

In conclusion, the two ethnic groups studied clearly differ with regard to the association between caries experience and its generally documented determinants. The caries process or caries resistance, therefore, might differ in the two ethnic groups, and these differences need to be studied further.

REFERENCES

1. Ainamo, J.: Relative roles of toothbrushing, sucrose consumption and fluorides in the maintenance of oral health in children. *Int Dent J*, 30:54-66, March 1980.
2. Axelsson, P. and Lindhe, J.: Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. *J Clin Periodont*, 5:133-151, May 1978.
3. Ainamo, J. and Parviainen, K.: Influence of increased toothbrushing frequency on dental health in low, optimal, and high fluoride areas in Finland. *Community Dent Oral Epidemiol*, 17:296-299, December 1989.
4. WHO: *Oral health care systems. An International Collaborative Study*. London: Quintessence Publ Co., 1985.
5. Kolmakow, S; Honkala, E.; Borovsky, E.V. *et al*: Relationship between lesions of enamel focal demineralization and caries in groups of Finnish and Russian children. *J Pedodont*, 11:358-374, Summer 1987.
6. Kolmakow, S.: Clinical forms of caries in permanent teeth among Finnish and Russian children. *Publ Univ Kuopio*, Original Rep 4/1989.
7. Gersovitz, M.; Madden, J.; Wright, H.: Validity of the 24-h dietary recall and seven-day record for group comparisons. *J Am Diet Assoc*, 73:48-55, July 1978.
8. Luoma, H.: Fluoride in sugar. *Int Dent J*, 35:43-49, March 1985.
9. Hausen, H.; Heinonen, O.P.; Paunio, I.: Caries in permanent dentition and social class of children participating in public dental care in fluoridated and nonfluoridated areas. *Community Dent Oral Epidemiol*, 9:289-291, December 1981.
10. Kasenova, L.R.: Relationship of dental caries and periodontal disease incidence and intensity in school children, and the level of health culture of different population groups. *Stomatologija (Mosc)*, 59:71-73, September-October 1980.

VALIDITY OF DIAGNOSTIC AND TREATMENT DECISIONS OF FISSURE CARIES

The caries prevalence among Swiss children has been declining dramatically over the last two decades [Marthaler *et al*, 1988; Steiner *et al*, 1989]. Despite this lower overall prevalence of dental caries, an increased proportion of the total caries is found in pits and fissures in fluoridated areas, because pits and fissures are less protected by fluoride than are smoother surfaces. The National Dental Caries Prevalence Survey, conducted during 1979-1980 in the United States, reported that occlusal (fissure) caries in the age-group 5-17 years accounted for 84 percent of the caries experience [US, Public Health Service, 1981]. Furthermore, during the former decade, proximal caries of children had reduced by more than 50 percent, whereas occlusal lesions had decreased by only 26 percent. Fourteen-year-old teenagers in Switzerland showed a similar pattern. In 1963, the mean number of $D_{3-4}F$ surfaces on pits and fissures was 9.90, but only 4.44 $D_{3-4}F$ on proximal and buccal surfaces of incisors. In 1987 the latter index had decreased to 0.09, while the former was still high at 3.03 [Marthaler *et al*, 1988]. Wendt and Koch [1988] stated that 60 percent of all restorations are occlusal, although the total area of occlusal surfaces accounts for only 12.5 percent of all tooth surfaces.

Therefore, occlusal caries represents the major portion of the total caries experience of children and thus has to be diagnosed most frequently. The principal diagnostic tools today are still mirror, light, and explorer, although it has been shown that radiographs or the measurement of electrical resistance may also aid diagnosis [Flaitz *et al*, 1986; White *et al*, 1978; Sawle and Andlaw, 1988].

In the past few years a number of studies have been conducted to elucidate the question of whether probing fissures has disadvantages such as the transfer of cariogenic microorganisms or damage to the integrity of surface enamel. Indeed, it has been shown in vitro and in vivo that probing can produce irreversible traumatic defects in occlusal fissures, favouring conditions for lesion development. It has, therefore, been recommended to use only visual inspection with a good light source, but no explorer [Ekstrand *et al*, 1987; Van Dorp *et al*, 1988].

Lussi, A.: Validity of diagnostic and treatment decisions of fissure caries. *Caries Res*, 25:296-303, July-August 1991.

DEMOGRAPHY

1990 dental health objectives for children: What is left to be done?

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

In 1979, the Secretary of Health, Education and Welfare reported an effort "to encourage a second public health revolution in the history of the United States."¹ (Note: the first had been the struggle against infectious diseases at the turn of the century.) A series of broad health goals and specific objectives were established to be achieved by 1990 or earlier. Of the more than two hundred general health objectives, twelve dental objectives were identified (under the section "*Fluoridation and Dental Health*") and were reviewed in the 1990 progress report issued by the U.S. Public Health Service.² In addition, a set of objectives was established for the "Oral Health" for the year 2000. (Note: The change in titles "...reflects more than pure semantics and reveals a great deal about the transition occurring in the dental profession."²)

The following presentation will review the progress in meeting the goals that were established for the dental needs of children, but with particular emphasis on "*what is left to be done.*"

HEALTH STATUS OBJECTIVES

Objective 1

By 1990, the proportion of nine-year-old children who have experienced dental caries in their permanent teeth should be decreased to 60 percent.

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

Status

The 1986-87 National Institute of Dental Research (NIDR) survey of school children found that, among nine-year-olds, only 35 percent had experienced dental caries in their permanent teeth.*

However

A number of surveys within selected geographic areas and of particular populations found differences from the NIDR data for the general population.

A 1983-84 study of Native American youths reported much higher rates of dental caries. Among young children, 52 percent had experienced dental caries; in adolescents, 93 percent.

A 1986-87 North Carolina school study found higher levels of dental caries for children whose parents had no education beyond high school and for those living in rural areas.

A 1987-88 study of Ohio school children found that 23 percent had one or more teeth with untreated cavities; for Medicaid beneficiaries, 32 percent.

A 1987 Kentucky oral health survey found that Appalachian children had a mean Decayed-Missing-Filled-Surface (DMFS) rate of 6.56, compared to a statewide mean of 5.35, a national (NIDR) mean of 3.07.

A survey of children whose parents were migrant farmworkers found higher dental caries levels and lower treatment levels than those reported for national averages; e.g. 25 percent of migrant children (5-11 years

*Unless otherwise specified, all data were drawn from the report, "Progress Toward Improved Oral Health: Review of Objectives."²

Table 1 □ Mean DMFS rates for children age 9 and 15, by selected characteristics, (NIDR) 1986-87.⁽²⁾

	Age 9	Age 15
Entire U.S.	1.14	5.71
Gender		
Girls	1.21	6.11
Boys	1.07	5.34
Residence		
SMSA	1.09	5.54
non-SMSA	1.25	6.19
Race		
White	1.09	5.53
Black & others	1.32	6.27

Table 2 □ Percent of school children with gingival bleeding, when probed, by age and sex, 1986-87.⁽²⁾

Age	Male	Female	Totals
14	65%	58%	62%
15	63	55	59
16	61	54	58
17	57	56	57
Totals	62%	56%	59%

of age) had caries free permanent teeth, compared to 58 percent for the national average.³

□ DMFS rates were higher for girls than boys; residents of non-Standard Metropolitan Statistical Areas (SMSA) than SMSA residents; nonwhites than whites (Table 1).

What is left to be done?

While it is essential to continue to maintain improvements in caries and treatment rates for the general population, there should be specific efforts for the needs of:

- Children (age 6-8 years) whose parents have less than a high school education, (70 percent have had caries, 43 percent had untreated decay).
- American Indian/Alaska Native children (6-8 years): 92 percent have had caries in primary dentition; 52 percent in permanent teeth; 64 percent had untreated decay. By age 15, 93 percent have had caries, 84 percent had untreated decay.

□ Black children (age 6-8): 93 percent have had caries; 38 percent of young and adolescent black children had untreated decay.

□ Hispanic children: 36 percent of young children and between 31 and 47 percent of adolescents had untreated decay.

Objective 2

By 1990, the prevalence of gingivitis in children age six to seventeen should be decreased to 18 percent.

□ Status

Insufficient data to determine whether the objective was achieved.

□ However

The 1986-87 NIDR National Survey reported that 59 percent children between fourteen and seventeen years of age had gingival bleeding upon probing (Table 2).

What is left to be done?

A 1979-80 national survey reported that 92 percent of school-age children had mild or moderate gingival inflammation; indicating a need for "routine oral prophylaxis." Three percent of the children were categorized as having severe gingival inflammation.

RISK REDUCTION OBJECTIVES

Objective 1

By 1990, no public schools should offer highly cariogenic foods or snacks in vending machines or in school meals.

The 1986-87 NIDR National Survey reported that 59 percent of children between fourteen and seventeen years of age experienced gingival bleeding upon probing.

The need is to focus dietary efforts upon individuals and groups at high risk to dental caries.

Status

Insufficient data to determine whether the objective was achieved; probably not achieved.

However

The reality is that sugared snacks are widely available and many schools use sales of these items as a major source of funds for band uniforms, playground equipment, and computers.

What is left to be done?

Recent research has indicated that "...susceptibility (to dental caries) is unrelated to the reported intake of cariogenic food."² The need is to focus dietary efforts upon individuals and groups at high risk to dental caries.

Objective 2

By 1990, virtually all students in secondary schools and colleges who participate in organized contact sports should routinely wear proper mouth guards.

Status

Insufficient data to determine whether the objective was achieved at the individual level.

However

Seventy-five percent of reported episodes of traumatic injury to teeth occurred in persons under fifteen years of age; the most common activities were associated with sports and play. A study of high school basketball players reported that of the 96 percent who were not wearing mouth protectors, 32 percent sustained oral injury.

What is left to be done?

Organizations sponsoring recreation and sports programs must require the use of appropriate protective gear.

PUBLIC AWARENESS OBJECTIVES

Objective 1

By 1990, at least 95 percent of school children and their parents should be able to identify the principle risk

factors related to dental disease and be aware of the importance of fluoridation and other measures in controlling these diseases.

Status

The objective had not been achieved. The results from the 1985 National Health Interview Survey (NHIS) indicated that 22 percent of respondents (18 years and older) did not report that fluoridated water, (and 11 percent did not report that fluoride toothpaste or rinse) were "definitely" or "probably" important in preventing tooth decay. In addition, 78 percent of respondents had not heard of dental sealants. Respondents with lower income levels and education tended to be less informed.⁴

What is left to be done?

In general, advertisements for fluoride toothpastes and rinses, and the need to limit between-meal sweets, have been effective. Further efforts must be made to reach those particular populations that have a lesser knowledge of preventive measures.

SERVICES OBJECTIVES

Objective 1

By 1990, at least 95 percent of the population on community water systems should be receiving the benefits of optimally fluoridated water.

Status

The objective has not been achieved. By 1988, 39 percent of population served by public water supply had no access to fluoridated water. The States of Georgia, Illinois, Indiana, Maryland, North Dakota, South Dakota, and the District of Columbia have achieved the objective for at least 95 percent of their populations.

What is left to be done?

- In the States of California, New Jersey, Hawaii, Nevada and Utah, 17 percent or below of the population served by public water supplies have access to fluoridated water.

- In 1989, 36 percent of fluoridated water systems did not maintain their fluoride levels within the optimal range (generally, they were at a lower level). These water systems tended to be for smaller communities (covering about 19 percent of population receiving fluoridated water).
- There have been increases in the media coverage of studies linking fluoridated water to cancerous conditions in some animal studies. "...opposition to community water fluoridation is likely to increase, perhaps markedly."²

Objective 2

By 1990, at least 50 percent of school children living in fluoride deficient areas that do not have community water systems should be served by an optimally fluoridated school water supply.

Status

No data are available; unlikely that the objective was achieved.

What is left to be done?

School fluoridation may not make a major contribution to the overall fluoridation effort. However, "...it can provide positive health benefits to children who otherwise might be denied access to systemic fluorides."²

Objective 3

By 1990, at least 65 percent of school children should be proficient in personal oral hygiene practices and should be receiving other needed preventive dental services in addition to fluoridation.

Status

Limited data are available.

What is left to be done?

- Minority children and children in low income families, compared to their respective counterparts, have greater dental needs, but have fewer dental visits and a lower percent reported a dental visit in the previous year.⁵
- Children in nonmetropolitan areas had higher DMFS and DMFT rates than children in metropolitan areas.
- Children who reside in the Southern and Northeast regions of the country had a lower F/DMFS rate than children in other parts of the country.⁶

- The NIDR survey of school children's oral status found that the range of children with no dental sealants (one or more teeth) was from 87 percent of children in the Northwest to 95 percent of the children in the Midwest. Even in the state with highest prevalence of dental sealant (Utah), 69 percent of children did not have intact dental sealants on one or more teeth.
- Approximately half the states do not have a central recording mechanism for cleft lip and/or palate.
- Approximately half the states do not have an organized referral system to craniofacial anomaly teams.

THE FUTURE

Let there be no doubt; major advances in improving the oral health of our nation's children have been accomplished. But, much more needs to be done. In addition to the many areas presented above, the Public Health Service report lists a long series of emerging general health and dental health issues for the year 2000 for children (and adults), including baby bottle tooth decay, the need to reduce cigarette smoking by children, and prevention programs to eliminate physical and sexual abuse.

The bottom line is to reduce our sense of complacency. On a national average basis we have made dramatic advances. The need is to reach the great numbers of particular populations of children in need of improved oral and general health.

REFERENCES

1. Corbin, S.B.; Kleinman, D.V.; Maas, W.R. et al: *Promoting Health/Preventing Disease*. Report of the mid-course review of the fluoridation and dental health objectives for the nation. Richmond, VA: American Association of Public Health Dentistry, November 1985.
2. U.S. Department of Health and Human Services, Centers for Disease Control: *Progress Toward Improved Oral Health: review of objectives*. Washington, D.C.: Government Printing Office, September 1990.
3. Woolfolk, M.; Hamard, M.; Bagramian, R.: Oral health of children of migrant farm workers in Northwest Michigan. *J Pub Health Dent*, 44:101-105, Summer 1984.
4. Corbin, S.B.; Maas, W.R.; Kleinman, D.V. et al: 1985 NHIS findings on public knowledge and attitudes about oral diseases and preventive measures. *Pub Health Rep*, 102:53-60, January-February 1987.
5. Waldman, H.B.: Are minority children getting their fair share of dental services. *J Dent Child*, 57:380-384, September-October 1990.
6. Waldman, H.B.: Confirming the continuing potential for pediatric dental services in nonurban areas. *J Dent Child*, 57:421-423, November-December 1990.

Will there be a difference in the pediatric dentists of the future?

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

Most presentations on the future of pediatric dentistry have emphasized the changing number and characteristics of children or variations in the numbers of pediatric dentists.¹⁻⁴ Only limited attention has been directed specifically to some personal characteristics (i.e. gender, race, ethnicity and nationality) of current and future pediatric dental practitioners.^{5,6}

In an effort to develop an awareness of the evolving demographic characteristics of pediatric dentists, the following presentation will review available data from the first report on the *Postdoctoral Application Support Service* (PASS), and other information from the American Dental Association and the Academy of Pediatric Dentistry.⁷

POSTDOCTORAL APPLICATIONS

The PASS system provides an opportunity for a graduating dental student to apply to a series of graduate programs using a standardized application form (and official documentation from the applicant's school of dentistry). Based on a priority listing system, the applicants and programs are matched; thereby decreasing paperwork and eliminating the problems of multiple acceptances and associated delays in finalizing program appointments. In the initial year of the PASS program

(1991*), 282 post-doctoral programs in general dentistry (Advanced Education in General Dentistry [AEGD] and General Practice Residencies [GPR]) oral and maxillofacial surgery (surgery), and Pediatric Dentistry were involved. The participation rate among the AEGD and GPR programs was 64 percent; 72 percent of surgery programs; and 75 percent of pediatric dentistry programs.

DENTAL SCHOOL CHANGES

Dental school demographic changes have been more than just decreases in the overall number of first-year students (from 6,301 in 1978 to 4,001 in 1990 [36.5 percent decrease]). In addition to the marked downsizing of most schools of dentistry, there has been a marked increase in the numbers of women and minority students. In 1990, in the entering class, there were 1,522 females (38 percent of the class—compared to 20 percent in 1980) and 1,196 minority enrollees (30 percent of the class—compared to 14 percent in 1980).^{8,9}

The changing pattern of dental student demographics is reflected in the young men and women entering the profession. By 1990, 30 percent of the graduates of schools of dentistry were women and a quarter were members of the various minority groups (Table 1).

APPLICANTS TO ADVANCED DENTISTRY PROGRAMS

Combined data for 1990 applicants to the advanced training programs (AEGD, GPR, surgery and pediatric

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

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

Table 1 □ Percent distribution of dental school graduates, pediatric dental program and graduate program enrollees and applicants, by gender, race and ethnicity: 1988–1990.^{7,11,13}

	Dental school graduates	Pediatric dentistry programs		Graduate programs*	
		Applicants	1st year enroll.	Applicants	Enrollment
Gender					
Female	30.8%	50.6%	"60%"	30.5%	21.6%
Male	69.2	49.4	"40%"	69.5	78.4
			Total		
			Enrollment		
Race/ethnicity			1988		
White	74.8	58.6	66.2	70.3	82.3
Asian	12.4	17.4	15.3	13.9	9.2
Black	5.1	6.1	3.9	6.3	3.4
Hispanic	7.6	17.9	14.1	8.2	4.9
Total					
minority	25.2%**	41.4%	33.8%	29.7%**	17.7%**

*Applicant data include, Advanced Education in General Dentistry (AEGD), General Practice Residencies (GPR), Oral and Maxillofacial Surgery, Pediatric Dentistry.

Enrollment data include all advanced programs

**Includes approximately one percent or less Native Americans

Table 2 □ Number of students enrolled in first year of pediatric dentistry programs: selected years 1972–1990.^{14,15}

Year*	First year enrollment
1972	163
1974	177
1976	165
1978	173
1980	190
1982	158
1984	164
1986	152
1988	162
1990	161

dentistry) closely mirrored gender and race/ethnicity distributions of dental school graduates. There were particular demographic variations, however, between the applicants to pediatric dentistry programs and dental school graduates.

- A half of the applicants to pediatric dentistry programs, compared to 31 percent of dental school graduates, were women.
- Forty-one percent of the applicants to pediatric dentistry programs, compared to 25 percent of dental school graduates, were minority group members; with a higher representation of Asians and Hispanics than their percent representation amongst dental school graduates (Table 1).

In addition, 28.9 percent of applicants to pediatric dentistry programs were non-U.S. citizens (compared to 16.4 percent for GPR programs, 17.3 percent for surgery programs, and 30.3 percent for AEGD programs).⁷

DEMOGRAPHIC CHANGES IN PEDIATRIC DENTISTRY PROGRAMS

Since the mid-1980s, the number of students enrolled in first year pediatric dental programs have leveled off

at approximately 160 students; somewhat lower than the range in the 1970s and early 1980s (Table 2).

In a previous presentation, which reviewed some of the demographic changes of student enrolled in pediatric dentistry training programs, it was noted that by the end of the 1980s:

- Despite marked increases in the number of women enrolled in advanced programs, the ratio of women-to-men in advanced programs was below the ratio for dental school graduates.
- The ratio of women-to-men in advanced pediatric programs, however, was more than double the ratio of women-to-men in all advanced programs.
- Minorities represented a third of the enrollment in advanced pediatric programs (Table 1).⁵

And these dramatic changes continue. In 1990, approximately 60 percent of first year enrollees in pediatric dentistry programs were women (double the percent of women graduating from dental school in 1990). Similarly, women represent 60 percent of the accepted first year pediatric dentistry class for 1991.¹³

In addition, in 1990, almost 20 percent of first year enrollees in pediatric dental programs were foreign educated dentists; many of them will be unable to secure licensure in the United States.¹³

Half of the applicants to advanced pediatric dental programs are women, while 31 percent of dental school graduates are women.

There has been a
marked
increase in the
numbers of
women and minority
students.

HOW WILL PEDIATRIC DENTISTS DIFFER IN THE FUTURE?

It is obvious that as female representation in dental schools and pediatric dental training programs continue to increase dramatically, their proportional representation in the American Academy of Pediatric Dentistry (which currently stands at approximately 15 percent) will continue to increase during the next years.¹³ But any attempt to review the impact that increasing numbers of female pediatric dentists will have on available personnel, should consider the American Dental Association's report that female practitioners spend fewer hours in practice and fewer hours treating patients than their male counterparts.¹⁶

In addition, there are particular differences in the private-practice, ownership patterns of male and female dentists. The ADA reports that in 1987, approximately 7 percent of male dentists, compared to approximately 30 percent of female dentists were in nonownership positions in private practice. And this difference in work pattern persisted regardless of the number of years since graduation.¹⁶ Thus, will increasing numbers of female pediatric dentists prefer employment, rather than ownership arrangements? And if this development occurs, what will be the impact, if any, on the delivery of dental services to children? Unfortunately, there are few if any specific answers at this time.

And further, with increasingly higher percents of minority students applying to pediatric dental programs, it would seem natural to anticipate their increasing representation within the specialty of pediatric dentistry. The difficulty arises in attempting to differentiate between minority group students who will remain in the

United States and those who will return to their own countries after completion of the course of training. (Note: many foreign educated enrollees are from Asian and Latin American countries.)¹³ In addition, the presence of "large" percentages of foreign educated students in pediatric dental programs raises questions about the function of these particular programs.

Nevertheless, the reality is that there will be an increasing number of minority pediatric practitioners.

"...as the dental profession in general, and pediatric dentistry in particular, attempt to reach out to serve more varied segments of our communities, the evolving demography of the profession may facilitate this process."⁵

As increasing data become available from the PASS graduate system, attention will need to be directed to developing patterns of change that will help pediatric dentistry plan for its future.

REFERENCES

1. Waldman, H.B.: Evolving demographic patterns and potential for pediatric dental practice. *J Dent Child*, 56:372-374, September-October 1989.
2. Waldman, H.B.: Special pediatric population groups and their use of dental services. *J Dent Child*, 56:211-215, May-June 1989.
3. Waldman, H.B.: Changing number and distribution of pediatric dentists. *J Dent Child*, 56:375-377, September-October 1989.
4. Waldman, H.B.: Basking in the sunshine at the end of the tunnel. *Ped Dent*, 12:402-407, November-December 1990.
5. Waldman, H.B.: Pediatric dentists: evolving demography. *J Dent Child*, 57:111-113, March-April 1990.
6. Waldman, H.B.: Pediatric dentistry in a period of decreasing numbers of dentists. *J Dent Child*, 56:121-124, March-April 1989.
7. Solomon, E.S.; Druitt, J.K.; Whiton, J.C.: Characteristics of applicants to postdoctoral education programs. *J Dent Educ*, 55:172-174, February 1991.
8. Division of Educational Measurement: *1990-91 first year enrollment levels and profile. DEM Data Update*. Chicago: American Dental Association, February 4, 1991.
9. Waldman, H.B.: Dental school demographics more than just decreases in the overall number of students. *J Am Coll Dent*, 57:22-28, Winter 1990.
10. Division of Educational Measurement: *Minority enrollment in advanced dental education programs. DEM Data Update*. Chicago: American Dental Association, July 14, 1989.
11. Division of Educational Measurement: *1988-89; 1989-90 Annual Report on Dental Education*. Chicago: American Dental Association.
12. Council on Dental Education: *Supplement 2 to the Annual Report on Dental Education, 1989-90*. Chicago: American Dental Association.
13. Executive Director, American Academy of Pediatric Dentistry. Personal communication, February 1991.
14. *Annual Report on Advanced Dental Education, 1980-81 through 1990-91*. Chicago: American Dental Association.
15. *Advanced Dental Education: Recommendations for the 80s*. Final Report of the Task Force on Advanced Dental Education of the American Association of Dental Schools. Washington, D.C.: American Association of Dental Schools, 1980.
16. Council on Dental Practice: *A comparative study of male and female dental practice patterns*. Chicago: American Dental Association, 1989.

Now that we've gotten their attention, let's get some more services for children!

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

I'm really not too sure how we did it. Nevertheless in past few months the news media and U.S. Congress have gotten the message that, "there are a lot of children in desperate need throughout this country!"

- "Hungry children put at 5.5 million. Study finds that one in eight under age 12 skip meals due to lack of money."¹
- "19 cities listed for aid to cut infant mortality."²
- "How to protect babies from crack."³
- "Spurning Bush, Congress provides new money to fight infant deaths."⁴
- "U.S. infant mortality highest among developed nations."⁵

When I asked the question in the mid-1980s, "are the unmet needs of children overshadowed by our concern for the aged?"⁶ I felt like the proverbial "voice in the wilderness." But now a chorus of concern is responding to the needs of our children.

- "In public health care spending, no other country matches our (old) age bias."⁷
- "In 1987, the U.S. ranked 29th in the world in the percent of infants born too small."⁵
- "Our goal is to place children at the top of the national agenda."

Children must become our number one national priority. Children are our economy, our national defense, our future."⁸

- "Mr. Rostenkowski (Chairman of the House Ways and Means Committee) said that, 'the sad story of the 1980s was that the old have gotten more while the young have gotten less.'⁹
- "...Congress significantly expanded Medicaid by mandating that States phase-in coverage of children under age 19 in families with incomes up to 100 percent of the federal poverty level."¹⁰

THE DISPARITY BETWEEN EXPENDITURES FOR THE YOUNG AND THE OLD

The 1991 report by the National Taxpayers Union Foundation, highlighted the reality that three-fifths of all federal benefits are directed to the elderly.⁷ Since World War II, their share of benefits has dwarfed other age-groups, reaching more than \$10 thousand per elderly person in 1987; compared to \$855 per child (Figure 1). If all state and local benefits were included (e.g. social services and education), the elderly would have at least a three-to-one per capita advantage over children.⁷

Federal health-care spending for the elderly in the United States far surpassed the rate for spending in all other countries. The ratio of public per capita health-care spending for the elderly and children in the United States is almost twice that of the United Kingdom and more than double the ratio in Canada and Japan (Figure 2).

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

Figure 1. Federal spending per capita on elderly and children by type of spending in fiscal year 1987⁷

			Total = \$10,018					
		Percent of total	XXXXXXXXXX	XXXXXXXXXX		Percent of total		
Social security cash	\$5,746	57.3%	XXXXXXXXXX					
Federal pension cash	908	9.1	XXXXXXXXXX					
Veterans & means tested cash	337	3.4	XXXXXXXXXX	Social security & pension cash	\$180	21.0%		
Food & housing	190	1.9	XXXXXXXXXX	Veterans & means tested cash	149	17.4		
Medicare	2,331	23.3	XXXXXXXXXX	Food & nutrition	187	21.9		
Medicaid & other health care	444	4.4	XXXXXXXXXX	Housing	54	6.3		
Social services, etc.	62	0.6	XXXXXXXXXX	Health care	53	6.2		
			XXXXXXXXXX	Education, social services, etc.	232	27.1		Total = \$855
Total	\$10,018	100.0%	XXXXXXXXXX	Total	\$855	100.0%		
			XXXXXXXXXX					XXXXXXXXXX
			XXXXXXXXXX					XXXXXXXXXX
			-----					-----
			Per elderly person					Per child

GEOGRAPHIC VARIATIONS IN THE HEALTH OF OUR CHILDREN

The 1991 report by the Center for the Study of Social Policy, on the well-being our children emphasized that “the 1980s were a ‘decade of deterioration’ for children.”¹⁰ The “Kids Count” project of the Center looked at eight measures of well-being, including child poverty, births to unmarried teens and teenage violent deaths. While there have been improvements in death rates for infants and young children, the report concluded that children are at greater risk today than at the beginning of the 1980s. The Kids Count report ranked the states on the measures of child well-being. Overall, the best states were: Vermont, Utah, Massachusetts, Minnesota, and New Hampshire. The worst political jurisdictions were: Washington, D.C., Georgia, Louisiana, South Carolina, and Mississippi (Table 1).

Similarly, there are dramatic differences in the death rates of very young children in the cities throughout

Our goal is to place children at the top of the national agenda.

Figure 2. Public per capita health care spending on the elderly as a percent of public per capita spending for the non-elderly, 1980.⁷

Nonelderly = 100%						
790%						

XXXX						
XXXX						
XXXX						
XXXX						
XXXX	419%					
XXXX	----					
XXXX	XXXX	361%	361%	345%		
XXXX	XXXX	----	----	----		
XXXX	XXXX	XXXX	XXXX	XXXX	270%	
XXXX	XXXX	XXXX	XXXX	XXXX	----	
XXXX	XXXX	XXXX	XXXX	XXXX		176%
XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	----
XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
United States	United Kingdom	Canada	Japan	Italy	Germany	France

the nation. For example, during the second half of the 1980s, the number of deaths in the first year of life per one thousand live births in the District of Columbia were approximately double the number in Houston and Los Angeles (Table 2).

ANOTHER FRONT PAGE NEWS ITEM

“Resurgent measles much worse than a nuisance.”¹² Over 18,000 childhood cases of measles were reported in 1990, with scores of deaths and more than 8,000 adults cases. The disease that seemed to have all but disappeared since the development of a measles vaccine has made a dramatic comeback since 1989. In a church group in Philadelphia that rejected all medical treatment, 500 people were infected and six children died.

There are dramatic differences in the death rates of very young children in the cities throughout the nation.

TO RELISH ADVERSITY?

No, I do not take pleasure in the misfortunes of others. But if these unfortunate events do occur, I am willing to use them to improve the conditions of the many children in desperate need; particularly if the news media and the politicians are prepared to address the issues.

In an attempt to galvanize support, I've reported list after list of problems faced by our children.^{13,14} Well, the word of the imbalance of our attention to the

youngsters in our nations increasingly is reaching the consciousness of the public media and our legislative representatives. The time is ripe to increase our efforts to focus the attention of our communities on the health needs (including dental needs) of our children. I realize that as I write these words in the spring of 1991, we are in the midst of an economic downturn throughout our nation. Local, state and national governments are struggling to maintain some semblance of fiscal balance in their budgets.

But these are the times when we can make the best case for the care of our children. The media and the politicians are willing, respectively, to use these issues to sell newspapers and themselves as champions of those in need. Surely, we can do the same to bring increased health services to our children. Who knows, maybe I do relish adversity?

Table 1 □ Ranking of states by "child well-being" (from best to worst): 1991.¹¹

1. Vermont	18. Idaho	35. Texas
2. Utah	19. Montana	36. Delaware
3. Massachusetts	20. Washington	37. Michigan
4. Minnesota	21. Wyoming	38. Alaska
5. New Hampshire	22. Virginia	39. Illinois
6. Connecticut	23. Ohio	40. Arkansas
7. Rhode Island	24. S. Dakota	41. N. Carolina
8. Iowa	25. Oregon	42. Alabama
9. N. Dakota	26. W. Virginia	43. Tennessee
10. Wisconsin	27. Oklahoma	44. Arizona
11. Hawaii	28. Missouri	45. Florida
12. Maine	29. Nevada	46. New Mexico
13. Pennsylvania	30. California	47. Mississippi
14. Nebraska	31. Indiana	48. S. Carolina
15. Kansas	32. New York	49. Louisiana
16. New Jersey	33. Maryland	50. Georgia
17. Colorado	34. Kentucky	51. Washington, D.C.

Table 2 □ Deaths in the first year of life per 1,000 live births in each city. Averages for data from 1984 to 1988.²

City	Deaths per 1,000 live births
Washington, D.C.	21.10
Detroit	20.38
Newark	18.61
Baltimore	17.43
Memphis	17.00
Philadelphia	16.66
Atlanta	16.50
Chicago	16.26
Cleveland	16.11
New Orleans	15.31
St. Louis	15.13
Kansas City, MO.	13.85
Indianapolis	13.53
Boston	13.41
New York	12.83
Milwaukee	12.79
Jacksonville, FL.	12.67
Houston	11.43
Los Angeles	10.54

REFERENCES

- Pear, P.: Hungry children put at 5.5 million. *New York Times*, March 27, 1991.
- Pear, R.: 19 cities listed for aid to cut infant mortality. *New York Times*, March 8, 1991.
- How to protect babies from crack: Editorial. *New York Times*, March 11, 1991.
- Pear, R.: Spurning Bush, Congress provides new money to fight infant deaths. *New York Times*, March 26, 1991.
- Ensuring healthy babies in upstate New York: pressing problems, promising strategies: fact sheet. U.S. House of Representatives, Select Committee on Children, Youth and Families. Washington, D.C.: July 16, 1990.
- Waldman, H.B.: Are the unmet needs of children overshadowed by our concern for the aged? *J Dent Child*, 53:267-270, July-August 1986.
- Entitlements and the Aging of America. Washington, D.C.: National Taxpayers Union Foundation, 1991; in *Medical Benefits*, 8:5, April 15, 1991.
- Rockefeller, J.D., IV, Senator and Chairman, National Committee on Children. Washington, D.C., News release, April 26, 1990.
- Tolchin, M.: Lawmakers tell the elderly: 'next year' on health care. *New York Times*, November 23, 1989.
- Miller, G., Chairman, Select Committee on Children, Youth and Families. U.S. House of Representatives. Letter to interested personnel. Washington, D.C.: November 8, 1990.
- Kelly, D.: Kids' well-being suffered in 1980s. *USA Today*, February 1, 1991; in *Medical Benefit*, 8:4, March 15, 1991.
- Rosenthal, E.: Resurgent measles much worse than a nuisance. *New York Times*, April 24, 1991.
- Waldman, H.B.: A litany for change. *J Dent Child*, 57:194-197, May-June 1990.
- Waldman, H.B.: 'I know you've heard it before, but...' (A litany for change—Part II). *J Dent Child*, 58:50-54, January-February 1991.

CLINIC

Assessment of 100 children in Jerusalem with supernumerary teeth in the premaxillary region

Yerucham Zilberman, DMD
Mordechai Malron, DMD
Arie Shteyer, DMD

Most supernumerary teeth are reportedly located in the anterior maxillary region.¹⁻⁵ Their presence may lead to local disorders, such as delay in eruption of permanent teeth, development of dentigerous cysts, resorption of adjacent roots and eruption of a supernumerary tooth into the nasal cavity.⁵⁻⁹ Supernumerary teeth are detected either by routine radiographic examination, or as a result of clinical signs, such as delayed eruption or displacement of the permanent dentition.⁹ Early diagnosis is important, so as to enable treatment planning and assure good prognosis.⁷ To facilitate timely treatment, it is imperative that the clinician be aware of the eventual presence of supernumerary teeth, understand the clinical signs associated with this disorder, and is cognizant of its prevalence in the local population.

This retrospective study evaluated the prevalence of supernumerary teeth in the premaxilla in a group of children in Jerusalem referred for consultation, and determines the presence of associated local disorders before and after surgical intervention.

MATERIALS AND METHODS

The data for this study were obtained from the records of the Department of Oral and Maxillofacial Surgery, Hadassah Medical Center in Jerusalem. Of the 159 files of children who had been diagnosed over a five-year period as having supernumerary teeth in the premaxillary region, 100 had sufficient data to pursue the objects of the current investigation.

The first phase of the study encompassed the gathering of statistical information. For each subject, a questionnaire, which included items pertaining to age, sex, clinical, radiographic and surgical findings was completed. None of the children entered in the study suffered from systemic disorders, such as cleidocranial dysostosis or clefts, which have been reported to have a higher incidence of supernumerary teeth.⁵ Nearly all patients had undergone surgery for removal of the involved supernumerary teeth, performed either shortly after diagnosis, or postponed for later intervention. In a number of patients in whom the supernumerary tooth constituted an obstacle to the eruption of the permanent teeth, initial orthodontic treatment had been implemented to provide the necessary space. In some of these patients, the orthodontic treatment was continued after the surgical intervention to facilitate eruption and alignment of the permanent dentition.

In the second phase of the survey, the entire sample was recalled for reexamination. Unfortunately, not all

Dr. Zilberman is with the Department of Orthodontics; and Dr. Shteyer is with the Department of Oral and Maxillofacial Surgery, Hebrew University-Hadassah School of Dental Medicine, Jerusalem, Israel. Dr. Malron did this investigation in partial fulfillment for a DMD degree. At present he is in private practice.

Table 1 □ Distribution of the supernumerary teeth according to age and sex of the 100 patients.

Age (years)	Male	Female	Totals
< 4	6	3	9
4-6	17	1	18
7-9	30	13	43
> 10	19	11	30
Totals	72	28	100

Table 2 □ Distribution of the supernumerary teeth according to their number per patient.

Number of teeth per subject	Number of patients	Supernumerary teeth	
		Number	Percentage
1	74	74	56.9
2	23	46	35.4
3	2	6	4.6
4	1	4	3.1
Totals	100	130	100.0

Table 3 □ Distribution of the supernumerary teeth according to their status: erupted *vs* unerupted.

Status	Supernumerary teeth	
	Number	Percentage
Erupted	29	22.0
Unerrupted	101	78.0
Totals	130	100.0

Table 4 □ Distribution of the supernumerary teeth according to their location in relation to the adjacent teeth.

Location	Supernumerary teeth	
	Number	Percentage
Between central incisors	37	28.5
Above central incisors	65	50.0
Between central and lateral incisors	16	12.3
Above lateral incisors	2	1.5
Between lateral incisor and canine	6	4.6
No information available	4	3.1
Totals	130	100.0

patients responded and only thirty-five children were available for the clinical follow-up examination.

RESULTS

The findings of this study are summarized in Tables 1 to 6 and commented upon, where appropriate, in the discussion section.

DISCUSSION

Delayed or noneruption of permanent dentition due to supernumerary teeth in the anterior maxillary region may lead to local disorders, which, in turn, may ensue in esthetic or functional disturbances, or both. Our figure of 52 percent of patients with delayed eruption of the permanent teeth (Table 6) approximates that of 60 percent in Howard's sample.² Apart from delayed or

noneruption, *per se*, supernumerary teeth may cause malposed eruption, such as inclination or rotation of the permanent dentition (Table 6). The overall number (80 percent) of local malocclusions because of supernumerary teeth found in our patient group concurs with findings reported by others.^{1,2,10}

In this retrospective study, classification of occlusion at the time of detection of the supernumerary teeth was available only for 44 of the 100 children. Of these, 59 percent were in Angle's class I malocclusion and the remainder in class II. Apart from the study by Howard on delayed eruption caused by supernumerary teeth, in which he states that "no unusual representation of skeletal patterns was found", no attempt to relate supernumerary teeth to occlusal classification could be found in the literature.² The incidence of class I malocclusion in our forty-four children may be indicative of the distribution of Angle's classes among children

Seventy-eight percent of supernumerary teeth were unerupted, the majority of which were located palatally.

Table 5 □ Distribution of the supernumerary teeth according to shape.

Supernumerary teeth		
Shape	Number	Percentage
Conical or 'peg-shaped'	79	60.8
Normal	13	10.0
Small	7	5.4
Premolar-like	18	13.8
No information available	13	10.0
Totals	130	100.0

Table 6 □ Distribution of the patients according to the clinical and radiographic findings associated with the supernumerary teeth.

Finding	Number of patients
Permanent teeth	
Delayed eruption	52
Inclination/rotation	28
Dilaceration of roots	13
Delayed root development	10
External root resorption	2
Crown hypoplasia	1
Normal eruption and development	51
Supernumerary teeth	
Cystic proliferation	5
Inverted	32
Total*	162

*In some patients more than one finding was noted.

with supernumerary teeth in the premaxillary region, although a larger sample of patients is necessary to verify such trend.

Our finding of 5 percent dentigerous cysts associated with supernumerary teeth falls within the range of 1.5 to 9 percent reported for this disorder.^{4,5,8,11} The high variability quoted for cystic proliferation may be due to the fact that the diagnosis of cysts on the basis of radiographic changes is liable to nonuniform interpretation.

Other disorders noted in the present study were root dilaceration (thirteen patients), delayed root development of permanent dentition (ten patients), external root resorption of the lateral incisor (two patients) and

crown hypoplasia of a central incisor (one patient; Table 6). The rate of occurrence of the disorders points to a not-infrequent association between various morbidities and the presence of supernumeraries in the premaxillary region.

In our sample, boys preponderated 2.5:1 (Table 1), which approximates the higher limit of the 1.3:1 to 3:1 range of reported sex ratios.^{11,13}

Supernumerary teeth may occur singly or in multiple form in the same person. In our group of 100 patients with a total of 130 supernumeraries, seventy-four children had one, twenty-three had two, two had three, and in one child four such teeth were present. In a survey in Danish children, Koch *et al* obtained slightly different figures: in 74 percent of their subjects, there was one supernumerary; in 25 percent, two; and in 1 percent, more than two were found.¹¹ In a group of 204 Hong Kong children, Tay *et al* found in about 66 percent one supernumerary tooth, the rest presenting with two, which was also the highest number of supernumeraries present in any of their patients.⁷

Seventy-eight percent of the supernumerary teeth in our patients were unerupted (Table 3), most of which were located palatally. Of the total number of unerupted supernumeraries, 78 percent were positioned above or between the roots of the central incisors (Table 4). Others recorded the higher figure of 84.7 percent of unerupted supernumeraries, with 97.8 percent of them being situated around the roots of central incisors.⁷

Supernumerary teeth may appear in a variety of shapes, though the most common type is the conical, or peg-shaped, as was the case in our sample (61 percent; Table 5). Koch *et al* registered 56 percent conical, 12 percent tubercular, 11 percent incisor-shaped and 12 percent other configurations among their group of patients.¹¹ A Dutch study records conical (peg-shaped)

The most common type of supernumerary tooth is conical in shape (61 percent in this study sample).

in 25/63 children, followed by the premolar form in sixteen, while in eleven cases the morphological type was unknown.¹⁴

In the present patient population, 122 (of the 130) supernumerary teeth were surgically removed. About 50 percent of the children were age seven to nine years, 15 percent were less than seven years, while the rest were older than nine years at the time of the surgical intervention. Of the extracted teeth, eighty-nine (73 percent) had developed in the direction of natural eruption, thirty-two (26 percent) had grown nasally, and one tooth was positioned horizontally. These figures differ from those reported in the study by Tay *et al*, who observed 16.8 percent normally oriented supernumeraries, 77.6 percent in inverted position, and 5.6 percent in transverse relation to the permanent teeth.⁷

In the second part of the study, we intended to correlate location of the supernumerary teeth, timing of surgery (early vs late) with normal/malposed eruption of the permanent teeth. The relatively low response to repeated invitations for follow-up examination (35/100 subjects), and the impossibility to differentiate whether the incentive to comply with the recall was dental awareness or the presence of local disorders rendered such correlation, however, impractical.

A prospective study is now in progress that focuses on the age of the patient undergoing surgery for removal of supernumerary teeth. Accurate and systematic recording of the surgical sequelae and the position of the permanent dentition may help establish the op-

timal age for surgical intervention to assure the most favorable prognosis for the permanent dentition.

REFERENCES

1. Day, R.C.B.: Supernumerary teeth in the premaxillary region. *Brit Dent J*, 116:304-308, April 1964.
2. Howard, R.D.: The unerupted incisor. A study of the postoperative eruptive history of incisors delayed in their eruption by supernumerary teeth. *Dent Practit*, 17:332-341, May 1967.
3. Foster, T.D. and Taylor, G.S.: Characteristics of supernumerary teeth in the upper central incisor region. *Dent Practit*, 20:8-12, September 1969.
4. Di Biase, D.D.: Midline supernumeraries and eruption of the maxillary central incisor. *Dent Practit*, 20:35-40, September 1969.
5. Primosch, R.E.: Anterior supernumerary teeth— assessment and surgical intervention in children. *Pediatr Dent*, 3:204-215, June 1981.
6. Brin, I.; Zilberman, Y.; and Azaz, B.: The unerupted maxillary central incisor: review of its etiology and treatment. *J Dent Child*, 49:352-356, September-October 1982.
7. Tay, F.; Pang, A.; Yuen, S.: Unerupted maxillary anterior supernumerary teeth: report of 204 cases. *J Dent Child*, 51:289-294, July-August 1984.
8. Lustmann, J. and Bodner, L.: Dentigerous cysts associated with supernumerary teeth. *Int J Oral Maxillofac Surg*, 17:100-102, April 1988.
9. Kaler, L.C.: Prevalence of mesiodens in a pediatric Hispanic population. *J Dent Child*, 55:137-138, March-April 1988.
10. Gardiner, J.H.: Supernumerary teeth. *Dent Practit*, 12:63-73, October 1961.
11. Koch, H.; Schwartz, O.; Klausen, B.: Indications for surgical removal of supernumerary teeth in the premaxilla. *Int J Maxillofac Surg*, 15:273-281, June 1986.
12. Stafne, E.C.: Supernumerary teeth. *Dent Cosmos*, 74:653-659, July 1932.
13. Luten, J.R., Jr.: The prevalence of supernumerary teeth in primary and mixed dentitions. *J Dent Child*, 34:346-353, September 1967.
14. Witsenburg, B. and Boering, G.: Eruption of impacted permanent upper incisors after removal of supernumerary teeth. *Int J Oral Surg*, 10:423-431, December 1981.

BARRIERS TO PREVENTIVE HEALTH CARE

Lack of participation may explain in part why it is difficult to demonstrate that preventive measures lead to improved health (Shadish, 1981). Financial barriers stop many Americans from obtaining preventive health care (Gemperline, Brockert, & Osborn, 1989; Newacheck & Halfon, 1988). More and more families have no insurance or inadequate coverage. In addition, private insurance typically fails to cover the costs of prevention.

Low-income children are especially subject to ill health and especially vulnerable to its consequences. To the limited extent that broadly defined preventive health care for low-income children has been provided and studied, the results are promising for both short-term (EPSDT) and long-term (Head Start) outcomes (Irwin & Conray-Hughes, 1982; Lazar & Darlington, 1982). The disappointment of these programs is their failure to reach more than a small proportion of eligible children.

Williams, B.C. and Miller, C.A.:

Preventive health care for young children. Arlington, VA: National Center for Clinical Infant Programs, 1991, p 10.

The incidence of postoperative pain and analgesic usage in children

George Acs, DMD, MPH
Ellen Drazner, DMD

The study of postextraction pain in adults, particularly as a model for assessing analgesic efficacy, is well established.¹⁻³ In recent years, several studies have sought to examine the incidence of postextraction pain in children.^{4,5} Due to the dynamic nature of the developing dentition, the model for assessing postextraction pain in children has varied, as has the reported incidence of postextraction pain.

Although numerous articles in the medical and dental literature support the notion that adults can experience postoperative pain, the phenomenon of acute postoperative pain in children has remained largely unexamined. In the 1970s interest in the area of chronic pain in children helped to establish, however, that children were capable of describing their pain and could quantify the pain experience.^{6,7} The "psychogenic" perspective, promulgated by many investigators supported the notion that the response to pain was complex and included not only the physical stimulus, but a host of other tangible and intangible variables.⁸⁻¹⁰ Although the emphasis of pain studies in children was still on issues of chronic pain, the groundwork for understanding acute pain was established.

Newborns have been shown to react to deep pressure sensation and to react to cutaneous stimulation by the age of seven days.⁸ Escalona showed that by twenty-four weeks of age, infants no longer exhibited the primary characteristics of simple reactivity to noxious stimuli. By this age, their responses could be described only in terms of complex and patterned behavior.⁹

Mather and Mackie established that children did experience pain following abdominal surgery and did require analgesics for the relief of pain.¹¹ Their findings were contrary to popularly held beliefs that children neither experienced pain, nor required analgesics.

Acs *et al* reported on the incidence of postextraction pain and analgesic usage in children.¹² Moore *et al* and McGaw *et al*, in separate investigations reported the relative efficacy of various analgesics in the relief of postextraction pain in children.^{5,13}

Silvestri *et al* and Grover *et al* reported on the incidence of pain following restorative dental procedures in adults.¹⁴⁻¹⁶ In addition to quantification, these authors attempted to characterize the discomfort and offer possible etiologies for the discomfort experienced.

There are exceedingly few postrestorative pain studies in the dental literature, relative to the number of postextraction studies. Additionally, as with most pain studies, adult subjects have typically been investigated.

The purpose of this study is to report the incidence of postrestorative dental pain and analgesic usage in children.

Dr. Acs is Director, Division of Pediatric Dentistry, Assistant Professor of Pediatric Dentistry/Pediatrics, Montefiore Medical Center/Albert Einstein College of Medicine, Bronx, New York 10467.

Dr. Drazner is Director, Graduate Program in Pediatric Dentistry, Assistant Professor of Pediatric Dentistry, New York University College of Dentistry, New York, New York.

This study was conducted at: The Brookdale Hospital Medical Center, Brooklyn, New York 11212.

Pain following routine restorative procedures was reported by 31.5 percent of the study group.

MATERIALS AND METHODS

A questionnaire was developed and distributed to the parents of pediatric dental out-patients undergoing routine invasive dental procedures. The questionnaire was distributed within an inner city hospital clinic. All children who were to undergo routine invasive restorative dental procedures were eligible for inclusion in the study. Exclusion criteria included those patients requiring conscious sedation or general anesthesia in order to complete treatment. In addition, any child assessed by the investigating dentists to be incapable of communication, whether due to age or developmental disability was excluded from the study, although treatment was provided as planned. The survey form was distributed to all parents of children who had agreed to participate in the study. Procedures were performed according to previously approved treatment plans following departmental protocols governing the use of local anesthetics and rubber dam utilization for all operative dental procedures.

Following the treating dentist's coding for the independent variables of age, sex, and procedure, the survey form was given to the parent. Parents were asked to complete the form, assessing the dependent variables of pain and analgesic usage. Parents were instructed either to return the survey cards at the subsequent visit or by mail. Treating dentists were instructed to avoid the suggestion of postoperative pain to the parent or child, but to answer any questions that were posed by the parent or child. No prescriptions for pain medication were given.

Since no "sham" administrations of local anesthesia were given, nor were any invasive procedures attempted without the administration of a local anesthetic, there was no true control for this study. An additional group of twenty patients who underwent the noninvasive procedures of dental prophylaxis and topical fluoride application were included, however, in this study.

The returned survey cards were collected and assembled for statistical analysis, in order to determine the possible associations between dependent and independent variables. Chi-square contingency testing, with Yates Correction for Continuity, was performed on all data gathered from the questionnaire.

RESULTS

The questionnaire was returned by 61.4 percent of patients in the study groups (N = 88). All patients in the noninvasive procedure group returned their questionnaires. The mean age in the study group was 8.1 years. All of the patients were in the six to thirteen year-old age-range. There were no significant differences in age or sex distribution between the two test groups.

Report of pain

Procedure Pain following routine restorative procedures was reported in 31.5 percent of the study group (N = 54). None of the patients in the dental prophylaxis group reported pain ($p < 0.01$, Table 1).

Table 1 □ The report of pain and medication usage.

Procedure	N	Reporting pain (%)	Subjects taking medication (%)
Restorative	54	17 (31.5)*	9 (16.7)
Control	20	0 (0.0)	0 (0.0)
Totals	74	17 (22.9)*	9 (12.2)

* Pain report, restorative vs. control $p < 0.01$, chi square = 8.17, 1 d.f.

Table 2 □ Age: The report of pain and medication usage.

Age-Group	N	Reporting pain (%)	Subjects taking medication (%)
6-9	30	8 (26.7)	6 (20.0)
10-13	24	9 (37.5)	3 (12.5)
Totals	54	17 (31.5)	9 (16.7)

Table 3 □ Age: The report of pain and medication usage by male patients.

Age-Group	N	Reporting pain (%)	Subjects taking medication (%)
6-9	16	1 (6.3)	0 (0.0)
10-13	14	2 (14.3)	1 (7.2)
Totals	30	3 (10.0)	1 (3.3)

**Pain is partially a
 learned response.**

Age There were no age related differences in the report of pain, regardless of the sex of the patient (Table 2).

Sex Female patients were significantly more likely to report pain following invasive restorative dental procedures ($p < 0.001$, Tables 3,4,5). Stratification by age grouping indicated that females were consistently more likely to report postoperative pain (Tables 6 and 7).

Medication usage

Use of medication was reported by 16.7 percent of all patients undergoing invasive restorative dental procedures. Analgesic relief was required by 52.9 percent of patients reporting pain. Although the overall data suggest that female patients are significantly more likely to require analgesics (Table 5), age stratification of the

data indicates that the difference resides in the six to nine-year-old group comparisons ($p < 0.025$, Table 6).

DISCUSSION

Numerous studies in the medical and psychosocial literature investigated the influences of age, sex, race and culture on the report of pain in adults. Typically, these studies have yielded contradictory results.¹⁷ The multifactorial nature of the pain response makes it extraordinarily difficult to control many of the potential variables that may influence an adult's reaction to a stimulus. Since pain has been shown to be partially a learned response, the reaction of individuals to a given stimulus should vary with their own life experiences.¹⁸ Presumably, children have had fewer life experiences and their reactions may be more objectively based. The learned response of pain can be especially crucial with regard to the patient's lifelong relationship with the dental community. The fear of pain or the actual realization of pain may determine whether or not patients seek services on a routine basis or on an emergency basis.

By far, the vast majority of papers in the dental literature dealing with issues of pain have examined post-extraction pain in adults; most frequently, third molar models have been used.¹⁹ These extraction models have little applicability in the study of pain in children, due to the differences in the extent of induced trauma. Interestingly, very little attention has been paid to pain following restorative dental procedures. Historically,

Table 4 □ Age: The report of pain and medication usage by female patients.

Age-Group	N	Reporting pain (%)	Subjects taking medication
6-9	14	7 (50.0)	6 (42.9)
10-13	10	7 (70.0)	2 (20.0)
Totals	24	14 (58.3)	8 (33.3)

Table 5 □ The report of pain and medication usage: Male vs. female patients.

Sex	N	Reporting pain (%)	Subjects taking medication (%)
Male	30	3 (10.0)	1 (0.3)
Female	24	14 (58.3)*	8 (33.3)**

* Pain report, female vs. male, restorative dentistry $p < 0.001$, chi square = 12.29, 1 d.f.

** Medication use, female vs. male, restorative dentistry $p < 0.025$, chi square = 6.62, 1 d.f.

Table 6 □ Sex and the report of pain and analgesic usage: Six to nine-year-old group.

Sex	N	Reporting pain (%)	Subjects taking medication (%)
Male	16	1 (6.2)	0 (00.0)
Female	14	7 (50.0)*	6 (42.9)**

* Pain report, male vs. female, restorative dentistry $p < 0.025$ chi square = 5.24, 1 d.f.

** Medication use, male vs. female, restorative dentistry $p < 0.025$ chi square = 6.10, 1 d.f.

Table 7 □ Sex and the report of pain and medication usage: Ten to 13-year-old group.

Sex	N	Reporting pain (%)	Subjects taking medication (%)
Male	14	2 (14.3)	1 (7.1)
Female	10	7 (70.0)*	2 (20.0)

* Pain report, male vs. female, restorative dentistry $p < 0.025$ chi square = 5.53, 1 d.f.

although the dental profession has sought to educate the public on the merits of the restoration of teeth, rather than their extraction, only very limited efforts to understand the incidence or nature of pain have been made.

The present study sought to report the incidence of postoperative pain in children and to describe the patterns of self-medication following dental visits. Due to the nature of the study, it was difficult to define a true control-group.

The validity of a pain survey tool completed by parents for their children has been established.⁶ Ross and Ross demonstrated that children older than five years can represent their feelings adequately.²⁰ Additionally, Williams *et al* showed that parents are the most capable individuals in interpreting their children's reactions and expressions.²¹

The present study indicated that 31.5 percent of all children undergoing restorative dental procedures reported pain. Additionally, 52.9 percent of patients undergoing restorative dentistry and reporting pain required analgesics.

The literature contains conflicting results with regard to the roles of age and sex in the establishment of pain tolerance. Acs *et al*, in an extraction study, reported that, although, female patients tended to report pain and require analgesics more frequently, the differences were not significant.¹² It was noted that for extractions of standardized difficulty, however, older children were significantly more likely to report pain; although age had no influence on the patterns of analgesic usage. In the present study, female patients are significantly more likely to report pain following restorative dental procedures, regardless of age. Additionally, six to nine-year-old females were significantly more likely to require analgesics for such procedures. The consistent pattern of increased reporting of pain and use of medication by female patients, following restorative procedures, is of interest and appears to warrant further investigation. Attempts to standardize restorative and local anesthetic procedures may help to elucidate the observed differences.

Previous studies that have examined postextraction pain in children have shown a wide range in the incidence of pain. Acs, *et al* reasoned that some of these differences were due to patient age, the number of extractions performed, and the degree of difficulty of the extractions.^{22,23} Although the reported incidence of pain in the current study appears to be very similar to the previously cited extraction study in children, there are, nevertheless, several important differences in the

patient populations that may bear on the large differences in the report of pain. In the previously reported study, 96.5 percent of all patients returned surveys, compared to 61.4 percent patients in the present study. Due to the high compliance in the former study, there was likely no selection bias. The present study, however, may have suffered from such bias. It is possible that the patients who experienced pain were more likely to be motivated to respond to the survey. Additionally, differences in socioeconomic status, race, and culture between the two groups may also have contributed to the observed differences. The available literature on these issues is replete with controversy.^{24,25}

Pain was reported by 31.5 percent of pediatric patients undergoing restorative dental procedures. Previous reports in adult populations indicate a 50 to 90 percent incidence of discomfort. Differences in the presently reported incidence of pain and previous studies may be due to differences in operative procedures, or to the differences in life experiences of children and adults. Additionally, the previously cited studies may have unwittingly influenced the report of pain by listing many of the possible types of pain in the questionnaire.

Although the report of postextraction pain in children has been assessed relative to the number of teeth extracted and to a semi-quantitative measure of tissue trauma reflecting the degree of difficulty of the extraction, such distinguishing characteristics have not yet been defined for restorative dental procedures. Further study is warranted to discover whether age-controlled patients report pain differently, based on restorative procedures performed on primary versus secondary teeth, depth of lesions, and the number of teeth restored in a quadrant. Additionally, surveying the same patient for both restorative procedures and an extraction, while randomly varying the sequence of procedures, should provide more reliable information on the role of patient and procedure. As previously discussed, although this approach may be desirable, it may be extraordinarily difficult, however, to implement this study design, without an alteration of the philosophical approach to patient management, and commitment to a quadrant treatment approach to care. Such an alteration, in response to the needs of study design, may cause concern for human review boards and, in fact, may not be ethical.

The use of postoperative analgesics in the pediatric dental population has been previously described for single tooth extractions.¹² Although studies involving extractions of third molars or multiple extractions of

teeth have reported high analgesic usage ratios, most such studies are designed to evaluate the efficacy of various analgesics and most often supply patients with analgesics.³ Whether or not this protocol ultimately influences the report of pain or analgesic usage is not known. In the current study, 16.7 percent of all patients required analgesics. This finding is consistent with the previously reported 22.2 percent incidence of analgesic usage in the pediatric population following extraction.¹² For those actually reporting pain, 52.9 percent of the restorative patients required an analgesic. This compares to an overall 59.0 percent utilization rate previously reported for children undergoing extractions. There is no significant difference between patterns of use of analgesics based on age or treatment groups. This is consistent with the previous suggestion that the use of an analgesic for dental procedures is reflective of an "early learned response", in that its incidence appears not to vary with age or procedure. The early establishment of such a utilization pattern is probably related to parental histories of utilization, as well as parental expectations of pain based on their own experiences. The differences noted in analgesic usage among female patients may be due to environmental or social factors that help to form the "early learned response".

CONCLUSIONS

- Postoperative pain is commonly reported by children.
 - Female patients were significantly more likely to report pain.
 - 16.7 percent of all patients required an analgesic.
- The predictability of the report of pain and the need for postoperative analgesics should raise the awareness of dentists treating children. Fear, perceived pain, actual intraoperative pain and postoperative pain are all issues that must be considered in the comprehensive management of patients. Such an approach and understanding of patient needs and reactions are vital to the development of a lasting and trusting relationship between the child patient and the dental professional.

REFERENCES

1. Dionne, R.A. and Cooper, S.A.: Evaluation of pre-operative ibuprofen for post-operative pain after removal of third molars. *Oral Surgery*, 6:851-856, June 1978.
2. Swedlow, M.; Murray, A.; Daw, R.H.: A study of post-operative pain. *Acta Anaesth Scand*, 7:1-6, January 1963.
3. Lokken, P.; Olsen, I.; Brlaset, I. *et al*: Bilateral surgical removal of impacted lower third molar teeth as a model for drug evaluation: a test with ibuprofen. *Eur J Clin Pharmacol*, 4:209-216, April 1975.
4. Acs, G. and Moore, P.A.: Pain and analgesic consumption in children. *J Dent Res*, 63:265, March 1984.
5. McGaw, T.; Raborn, W.; Grace, M.: Analgesics in pediatric dental surgery: relative efficacy of aluminum ibuprofen suspension and acetaminophen elixir. *J Dent Child*, 54:106-109, March-April 1987.
6. Savedra, M.; Gibbons, P.; Tester, M. *et al*: How do children describe pain? A tentative assessment. *Pain*, 1:95-104, January-March 1982.
7. Abu-Saad, H.: Assessing children's response to pain. *Pain*, 19:63-77, January-April 1984.
8. Poznanski, E.A.: Children's reactions to pain: a psychiatrist's perspective. *Clinical Pediatrics*, 12:1114-1119, December 1976.
9. Escalona, S.: *The Roots of Individuality*. Chicago: Aldine Publishing Co., 1968.
10. Savedra, M.: Coping with pain: strategies of severely burned children. *Matern Child Nursing*, 2:197-203, February 1977.
11. Mather, L. and Mackie, J.: The incidence of post-operative pain in children. *Pain*, 15:271-282, April-June 1983.
12. Acs, G.; Moore, P.A.; Needleman, H.L. *et al*: The incidence of post-extraction pain and analgesic usage in children. *Anesthesia Progress*, 33:147-151, May-June 1986.
13. Moore, P.A.; Acs, G.; Hargreaves, J.: Post-extraction pain relief in children: a clinical trial of liquid analgesics. *Clin Pharm Ther*, 11:573-577, November 1985.
14. Silvestri, A.R.; Cohen, S.N.; Wetz, J.H.: Character and frequency of discomfort immediately following restorative procedures. *JADA*, 7:85-89, January 1977.
15. Grover, P.S.; Hollinger, J.; Lorton, L.: A review of the incidence of pain after an operative treatment visit: Part I. *J Prost Dent*, 2:224-225, February 1984.
16. Grover, P.S.; Lorton, L.; Hollinger, J.: A clinical study of the incidence of pain after an operative treatment visit: Part II. *J Prost Dent*, 3:369-371, March 1984.
17. Weisenberg, M.: *Pain: Clinical and Experimental Perspectives*. St. Louis: The C.V. Mosby Co., 1975.
18. Grainger, J.K.: Perception: its meaning, significance and control in dental procedures. *Aust Dent J*, 1:24-30, January 1972.
19. Levine, J.D.; Gordon, N.C.; Smith, R. *et al*: Post-operative pain: effect of extent of injury and attention. *Brain Res*, 5:500-504, February 1982.
20. Ross, D.M. and Ross, S.A.: Childhood pain: the school aged child's viewpoint. *Pain*, 20:179-191, January-March 1984.
21. Williams, J.M.G.; Murray, J.J.; Lund, C.A. *et al*: Anxiety in the child dental clinic. *J Child Psychol and Psychiat*, 4:305-310, February 1985.
22. Acs, G.; Moore, P.A.; Shusterman, S. *et al*: The extent of trauma and post-extraction pain in children. *Pediatric Dentistry*, 4:210-214, September 1988.
23. Acs, G.; Moore, P.A.; Needleman, H.L. *et al*: The extent of surgical trauma and post-extraction pain in children. *J Dent Res*, 3:271, March 1985.
24. Woodrow, K.M.; Friedman, G.D.; Siegalub, A.B. *et al*: *Pain: Clinical and Experimental Perspectives*. Chicago: C.V. Mosby Co. 1975.
25. Zbrowski, M.: Cultural comparison in responses to pain. *J Social Issues*, 1:16-30, January 1952.

A SEM investigation on pulpal-periodontal connections in primary teeth

Annunziata Morabito, MD, DDS
Patrizia Defabianis, MD, DDS

The ideal goal of pulpotomy procedure in a primary tooth is to maintain space length, preserve masticatory function, and remove infection and chronic inflammation from the oral cavity. Examination of the literature shows the overwhelming importance of performing the pulpotomy on teeth in which chronic inflammation has been confined to the coronal pulp, while the radicular pulp is free of inflammation. Teeth selected according to these criteria will have a more optimistic prognosis. Despite selecting the cases accurately and using the correct procedures, the pulp treatment occasionally fails. The failure is often due to the presence of aberrant pulpal-periodontal connections whose adequate treatment is very difficult. Numerous articles on pulpal-periodontal tissue relationships in permanent and primary teeth have proved the existence of many accessory canals in the furcation region, both in maxillary and mandibular teeth. Their existence was shown as early as 1925 by Hess *et al* by injection of India ink in the pulp chamber.¹ Many techniques were later used to diagnose the existence of accessory canals including injection of epoxy resin in the pulp chamber, drawing dye solution from the pulp chamber, radiographic and histologic studies, ground sections and decalcified sections.²⁻⁶ Similar results have been achieved by other investigators.⁷ Burch and Heulen, among the others,

found that 76 percent of the permanent molars they had studied using a scanning electron microscope, had numerous accessory canals in the furcation area.⁸ According to R.K. Woo, the presence of these openings appears to be prevalent in the young and males.⁹

The dimensions of these canals vary greatly from 7 to 34 μm ; greater dimensions are quite unusual. Scott and Symons have given an accurate explanation of the etiology of their formation.¹⁰ They are the result of a localized failure in the formation of Hertwigs Sheath during embryonic stages of tooth formation. This defect is probably due to the persistence of abnormally placed blood vessels reaching the pulp.

This leads to a failure in odontoblastic differentiation and dentine formation and ends in the presence of aberrant openings connecting the pulp and the periodontal tissues. These canals are evident at any point along the root or neck of a tooth, but they are never found close to the apical connection. Through them, fluids, bacteria and toxins may diffuse in the periodontal tissues and vice versa.¹¹

Their importance, from a clinical viewpoint, is controversial. Sicher states that these connections make treatment almost impossible; Ingle, on the other hand, feels that in most cases they do not represent a clinical problem because the tissue within the accessory channels remains vital, even when the contents of the pulp chamber and of the main canal become necrotic.^{12,13} The present investigation was undertaken with the objective to determine the prevalence of accessory canals in the pulp floor of primary teeth. These aberrant con-

Dr. Morabito is professor and chairman of pedodontics; Dr. Defabianis is lecturer in pedodontics, Department of Pedodontics, University of Torino, Torino, Italy.

nections can explain the failure of pulpotomy procedures.

MATERIALS AND METHODS

From a population of 150 patients between four and seven years old, we collected the sample of thirty primary molars (nine maxillary and twenty-one mandibular primary teeth) used in the present investigation. All the patients were examined in the Department of Pedodontics of the Dental School in Torino. All the teeth were extracted using local anesthesia and then identified with name, sex, and date of birth of the child.

The primary molars selected had all been treated with pulpotomy. The development of periodontal abscesses after the pulp treatment occurred after the institution was advised of a pulpectomy procedure. The complications were beyond treatment and extraction the only option available to us.

In all cases, radiographic examination showed the presence of a radiolucency confined to the region directly below the furcation of the roots. Apical areas were not involved.

The teeth selected for our investigation had more than half of their root lengths present, so that the apices could be clearly distinguished from the furcations.

Immediately after the extraction of each tooth, a high speed rotary instrument using profuse water spray was used to remove the roof of the chamber to expose the pulp. A sharp spoon excavator and a barbed broach were used for extensive pulp tissue removal. For debridement of the remaining soft tissue, each specimen underwent ultrasonic cleaning and was then immersed in a 1.5 percent solution of sodium hypochlorite for five minutes. Then they all were rinsed under running tap water for two minutes, labelled and prepared for SEM examination.

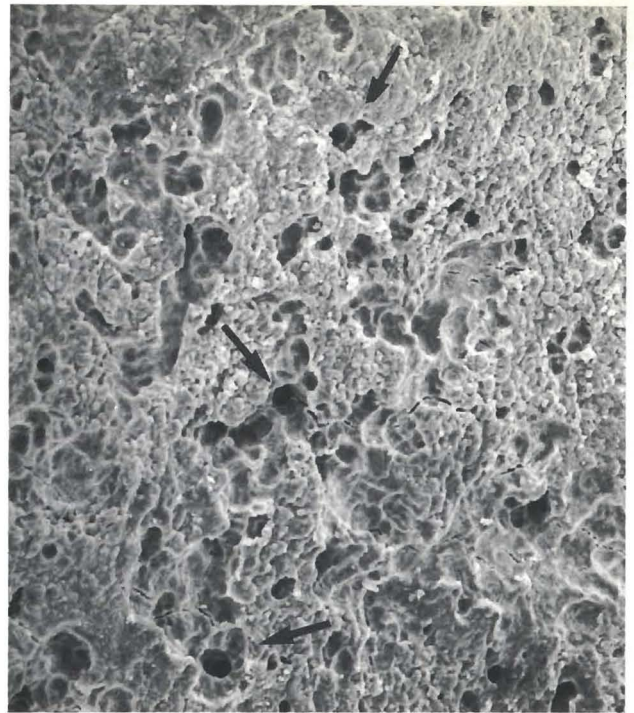


Figure 1. The pulpal floor aspect of the tooth at 100X magnification. Small accessory canals indicated by arrows are evident.

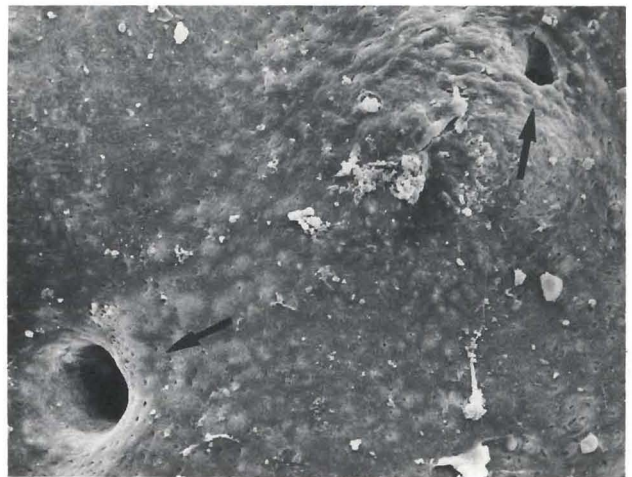


Figure 2. Two accessory canals indicated by arrows are seen at 200X magnification.

The canals are the result of a localized failure in the formation of Hertwigs Sheath during embryonic stages of tooth formation.

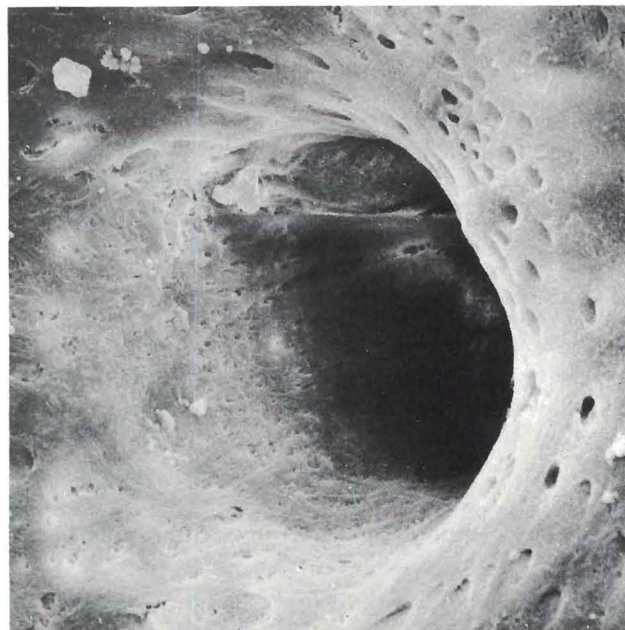


Figure 3. At 650X magnification, one of the two accessory canals indicated by arrows in Figure 2 is more evident. The periphery, orifice, and walls are seen; some dentinal tubules are shown.



Figure 5. The walls of the accessory canal under observation at 875X magnification have travelled through dentine. Dentinal tubules are evident.

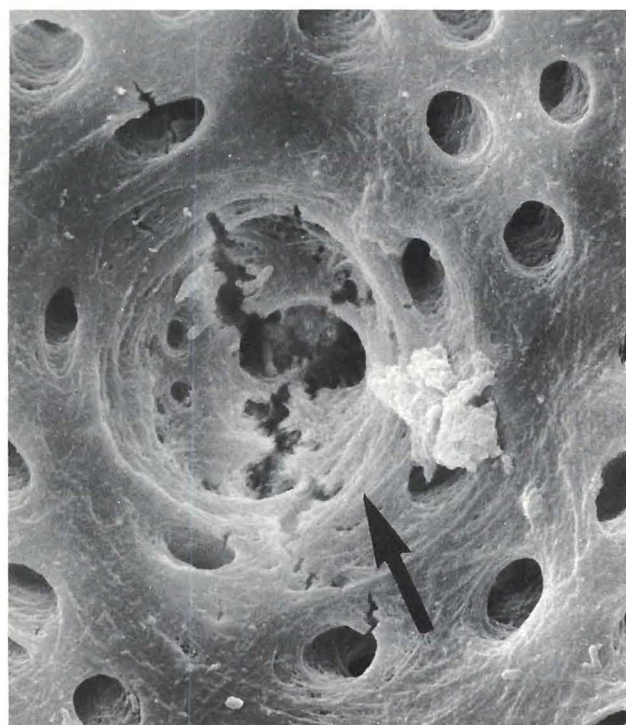


Figure 4. The accessory canal indicated by the arrow is evident at 2300X magnification. It is surrounded by dentinal tubules.



Figure 6. Two accessory canals are seen at 550X magnification. Many calcospherites are evident.

Scanning micrographs were obtained in magnification of 200X, 300X, 550X, 650X, 875X and 2300X.

Magnification exposure was made at approximately 20 kv.

FINDINGS

Aberrant canals were found in the pulp floor in three maxillary molars and eighteen mandibular ones. In nineteen teeth, they were numerous and very close to each other, mainly in the central part of the chamber.

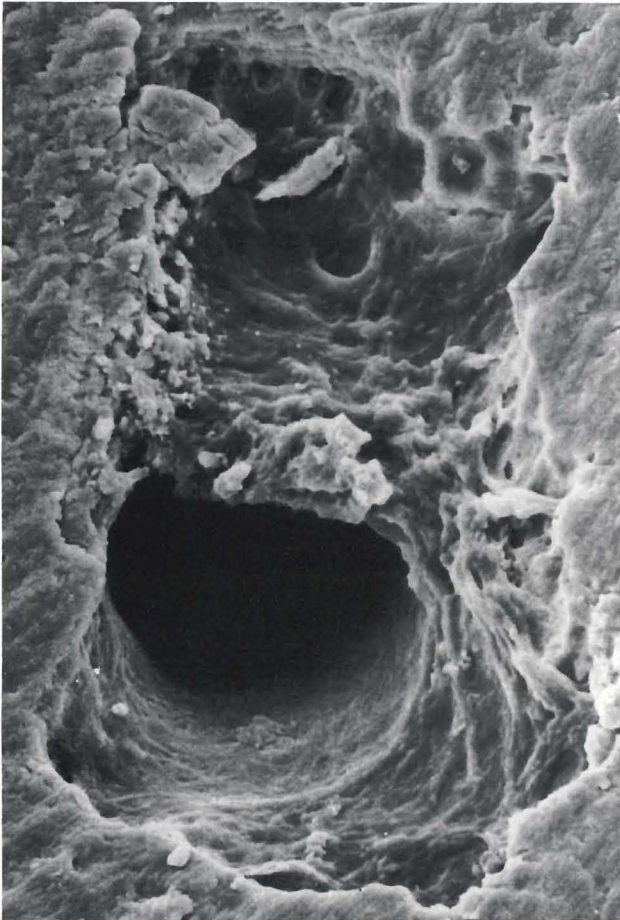


Figure 7. An accessory canal at the border of the pulp floor is seen at 300X magnification.

In two of the teeth examined, the canals showed random positioning.

Aberrant openings all differed in dimensions and shape. Most of them were round, others were oval.

The floor of the pulp chamber had a rough appearance. The majority of the canals observed entered the pulp floor through the peak of the furcation, just in its center.

All the accessory openings were smooth walled and travelled through dentine. Orifices of dentinal tubules were scattered around the walls of the canals observed.

Sex appeared to have no bearing on their presence. The canals appeared equally in maxillary and mandibular teeth, with no difference between first and second primary molars.

DISCUSSION

In spite of the small number of primary teeth examined, our investigation proved the existence of pulpal-periodontal connections in a high percentage (about 60 percent) of cases as claimed by other investigators. Woo and coworkers state that accessory canals when present in one primary molar, are not necessarily found in its antimere.⁹

All canals travelled only through dentine; this fact was proved by the presence of orifices of dentinal tubules spread all over the surface of the canal walls.

The pulp morbidity responsible for the tooth extraction and the preparation of the sample for SEM examination did not allow the observation of the tissue present in the accessory canals. Moss and Woo *et al* showed, with their histologic studies, the presence of connective tissue pulp cells (except odontoblasts) and blood vessels in some of them, while others were empty or full of necrotic debris.^{5,9} The lack of blood vessels could explain why the tissue in these canals is unable to recover from injury. Some authors also feel that these aberrant pulpal-periodontal connections are of great clinical significance during pulp therapy. Stallard is of the opinion that—through them—the inflammatory process can spread rapidly from pulp to periodontal ligament and tissues.¹⁴ Transport of infected material may occur in and out of the tooth involved. Adequate treatment of these teeth is almost impossible; the presence of bacteria inside the accessory canals causes the persistence of chronic granulation tissue beneath the tooth. Bauer reported that this chronic inflammatory tissue does not show the characteristic walling off of the infectious process that is usually seen at the apex of permanent teeth.¹⁵

Woo also states that there seems to be an inverse relationship between patient age and prevalence of accessory canals in primary molars. In his opinion this trend could be explained by the natural filling up of some of them with age.

Nevertheless, clinical evaluation of the teeth to be treated is of great importance. Clinical testing (mobility, thermal sensitivity, percussion, palpation, quantity of bleeding from the exposure site) are to be evaluated every time, to decide whether pulpotomy should be done. Radiographic interpretation can give some clue as to the extent of the carious lesion, presence of abnormal resorptive processes or interradicular rarefaction.

From a clinical and radiographic evaluation, it is possible to decide the best therapeutic procedure to apply according to the degree of inflammation present.

REFERENCES

1. Hess, W.: *The anatomy of root canals of teeth*. London: J. Bale, Sons and Danielsson, Ltd., 1925.
2. Simpson, W.J.: An examination of root canal anatomy of primary teeth. *J Canad Dent Assoc*, 39:6737-6740, September 1973.
3. Winter, G.B.: Abscess formation in connection with deciduous molar teeth. *Arch Oral Biol*, 7:373-379, May-June 1962.
4. Vermot-Gaud, M.: Mise en evidence et recherches statistiques sur la frequence des canaux pulpo-parodontaux sur les molaires de lait et leur incidence sur l'infection du septum interradiculaire. *Rev Franç Stomat*, 14:1487-1504, November 1967.
5. Moss, J.: Histologic study of pulpal floor of deciduous molars. *J Am Dent Assoc*, 70:372-379, February 1965.
6. Carlson, O. and Andersen, J.: On the anatomy of the pulp chamber and root canals in human deciduous teeth. IV Tandlaegeblad, 70:529-561, 1966.
7. Koenigs, J.F.; Brilliant, J.D.; Foreman, D.W.: Preliminary scanning electron microscope investigation of accessory foramina in the furcation area of human molar teeth. *Oral Surg*, 38:773-782, November 1974.
8. Burch, J.C. and Hulen, S.: A study of the presence of accessory foramina and the topography of molar furcations. *Oral Surg*, 38:451-455, 1974.
9. Woo, R.K.; Miller, J.: Accessory canals in deciduous molars. *J Int Assoc Dent Child*, 12:51-57, 1981.
10. Scott, J.H. and Simons, N.B.: *Introduction of dental anatomy*. Edinburgh and London: E.S. Livingstone, 1971, p 231.
11. Matusow, R.J.: Microbiology of the pulp and periapical tissues. Culture control. *Dent Clin N Am*, 11:549, 1967.
12. Sicher, H.: *Oral anatomy*. St. Louis: The C.V. Mosby, Co., 1952, pp 237-240.
13. Ingle, J.I.: *Endodontics*. Philadelphia: Lea and Febiger, 1965, p 72.
14. Stallard, R.E.: Periodontic-endodontic relationships workshop on the biologic basis of modern endodontic practice. *Oral Surg*, 34:314-326, August 1972.
15. Bauer, W.H.: Effect of periapical process of deciduous teeth on the buds of permanent teeth. *Am J Orthodon and Oral Surg*, 32:232, April 1946.

CHILD PEDESTRIAN INJURY

The ability to identify census tracts at risk is an important first step in initiating pedestrian injury control efforts. Local information about child pedestrian collisions can be a powerful incentive for mobilizing broad-based community support for prevention efforts. Community coalitions that include representatives from the city health department, traffic safety and engineering, police department, public schools, medical community, automobile and driver associations, housing authority, and community organizations can be motivated to address the problem through site-specific community education, planning, and outreach.

In addition, educational programs aimed at improving children's street related behaviors might be more effective if directed at children living and playing in census tracts with a high frequency of pedestrian collisions. Parents might also benefit from an educational program that concerns a problem in their neighborhood. Attitudes regarding child supervision, street crossing, and walking to and from school may be appropriate targets for parental educational efforts. Likewise drivers can be made aware that they are entering an area at high risk for child pedestrian collisions by use of strategically placed warning signs or through local public service announcements.

Geographically focused prevention efforts might also involve environmental or roadway improvement. Census tracts with a high frequency of collisions could be targeted for enhanced or improved traffic control signs, alteration of traffic light patterns, changes in vehicle street parking, and improvement of school and pedestrian crosswalk zones.

Better enforcement of existing laws and regulations in high-risk areas could also contribute to a reduction in child pedestrian injuries. Examples include the pedestrian right of way in crosswalks, laws regarding driving while intoxicated, vehicle speed laws, and parking regulations.

Thus, the ability to identify geographic areas at high risk for child pedestrian collisions is crucial to the development and implementation of a wide range of focused pedestrian injury prevention efforts in an urban setting.

Braddock, Mary *et al*: Population, Income, and Ecological Correlates of Child Pedestrian Injury.

Pediatrics, 88:1242-1247, December 1991.

A direct method of earplug fabrication

Steven L. Cureton, DMD
Frederick Regennitter, DDS

Otitis media is one of the most common infectious diseases of childhood. A survey of the office practices of physicians who provide medical care to children showed that otitis media was the most frequent diagnosis for illness and the most frequent reason, after well-baby and child care, for office visits.¹ Teele and colleagues found that diseases of the middle ear accounted for a large proportion of visits during the first five years of life, rising from 22.7 percent in the first year to about 40 percent in years four and five; about one visit in three made for illness of any kind resulted in the diagnosis of middle ear disease; approximately three quarters of all visits to follow up any illness were made to follow up diseases of the middle ear.

SIGNS AND SYMPTOMS OF OTITIS MEDIA

Eight specific signs and symptoms are associated with otitis media and its complications and sequelae:

- Otagia, or ear pain.
- Otorrhea, a discharge from the middle ear.
- Vertigo.
- Nystagmus, a unidirectional, horizontal, jerk-type movement of the eyes.
- Tinnitus.

- Swelling about the ear.
- Facial paralysis.
- Conjunctivitis.

Simultaneous cultures of the conjunctivae and middle ear exudates reveal nontypable Hemophilus influenza in almost all cases.³

TYMPANOTOMY TUBES

Myringotomy (incision through the tympanic membrane) with insertion of tympanotomy tubes is currently the most common surgical procedure performed in children requiring general anesthesia. It is estimated that in 1976 two million tubes were manufactured and, presumably, inserted through the tympanic membranes of probably more than one million patients.⁴

All children who have a cleft palate will have a high incidence of otitis media early in life and should be managed by insertion of tympanoplasty tubes as early in life as feasible.⁵

Most tympanotomy tubes remain in the tympanic membrane for six to twelve months, although some have been known to have remained in place for years.

Protection of the ear when tympanotomy tubes are in place

Water from bathing or swimming should not be allowed to enter the middle ear through the tympanotomy tube, since contamination usually results in otitis media and discharge. Several methods are currently

Major Cureton is a resident, Advanced Educational Program in Orthodontics, Craven Dental Clinic, Fort Knox, KY 40121-5520 and Lt. Regennitter is Director, Advanced Educational Program in Orthodontics, Craven Dental Clinic, Fort Knox, KY 40121-5520.

used to prevent water from entering the middle ear when tympanotomy tubes are in place. Ear plugs in a variety of sizes are often used. The most effective protection device is individualized and directly made. Some ENT specialists offer this service, but many will "fit" the patient with a prefabricated ear plug. These devices are usually small, clear, and very thin. The intent of this article is to introduce a direct method of ear plug fabrication using a polyvinylsiloxane impression material.*

Fabrication

Begin with a cotton pellet about the size of the opening of the external auditory meatus. Tie a piece of suture material (or floss) to the cotton pellet (Figure 1). Insert the cotton pellet into the external auditory meatus about 5 mm with a pair of cotton forceps (Figure 2). Place the tip of the injection gun close to the external auditory meatus (Figure 3). Never allow the tip to form a seal with the ear. This could cause undo pressure on the tympanic membrane. Allow the material to flow into the external auditory meatus. As the ear fills, slowly back the syringe out so that visual contact can be maintained between the material and the tip of the syringe. Continue to fill the external ear into undercuts for re-

*Kerr: Romulus, MI 48174

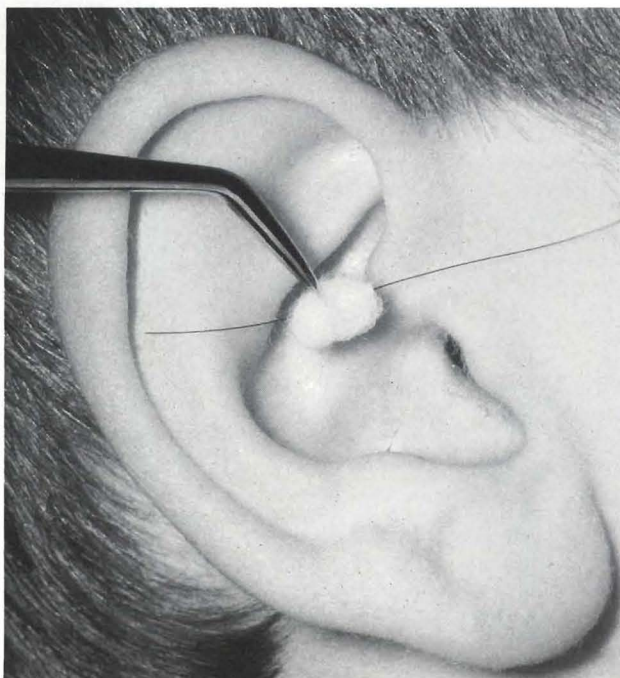


Figure 1. A piece of suture material is tied to a cotton pellet.

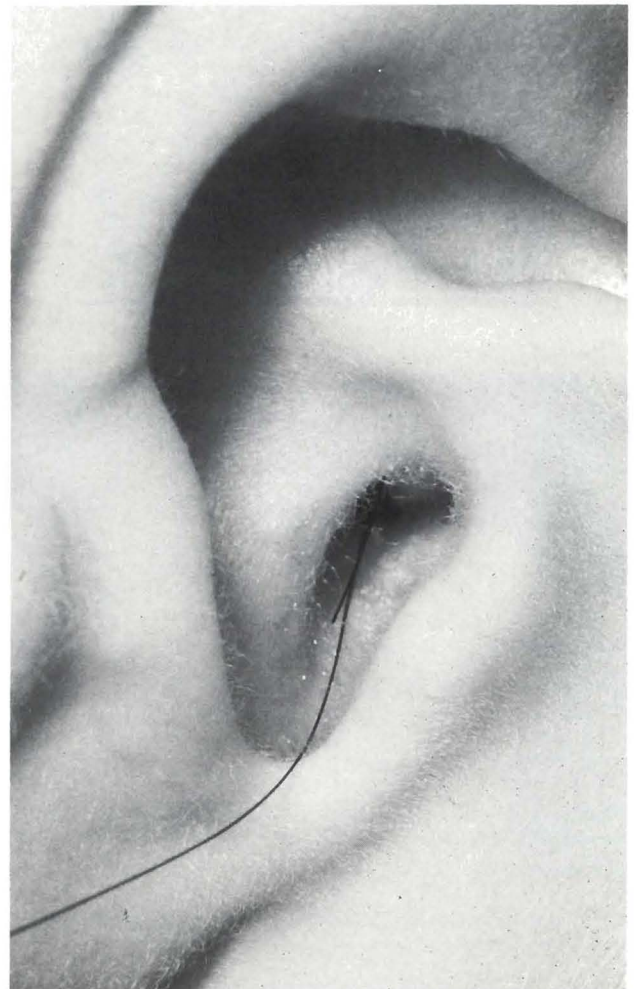


Figure 2. The cotton pellet is inserted into the external auditory meatus to an approximate depth of 5 mm.



Figure 3. The tip of the injection gun is placed close to, but not touching, the external auditory meatus.

Children with cleft palate will have a high incidence of otitis media early in life.

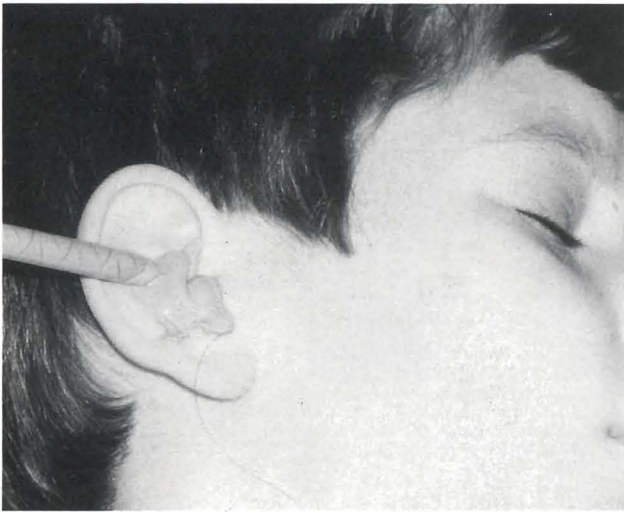


Figure 4. Undercuts in the external ear are filled for purposes of retention.

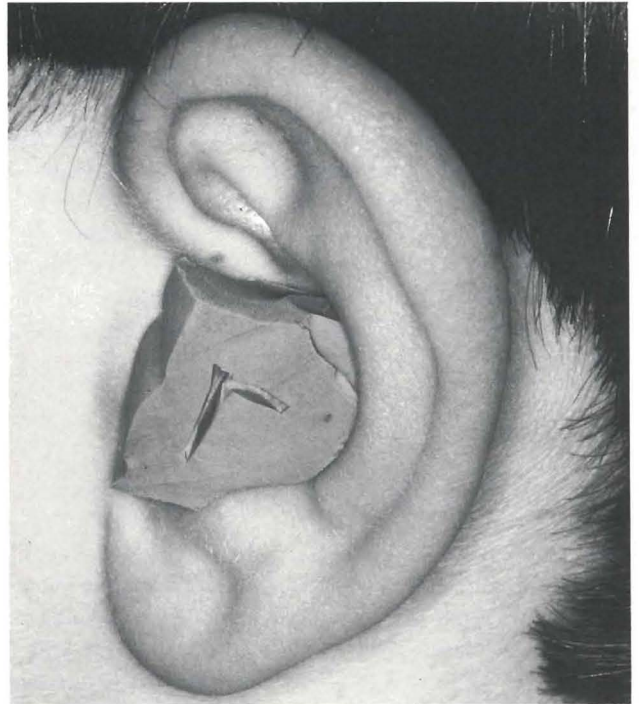


Figure 6. The ear plug is trimmed and labelled.

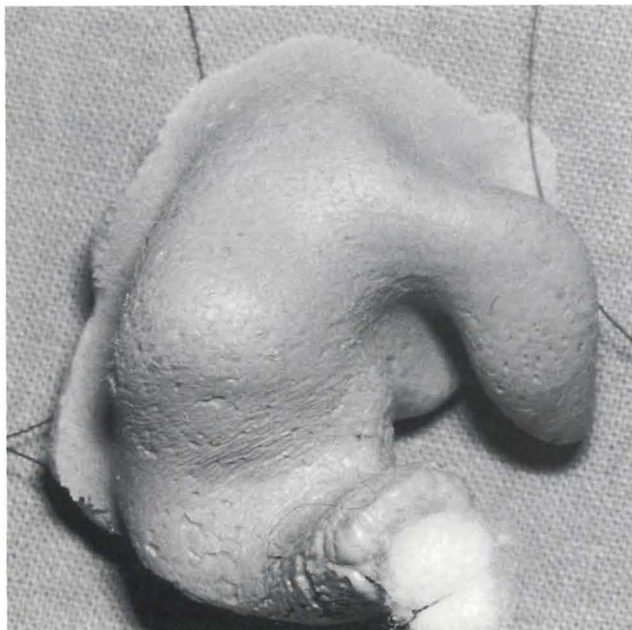


Figure 5. The ear plug is removed, and the cotton pellet and suture are discarded.

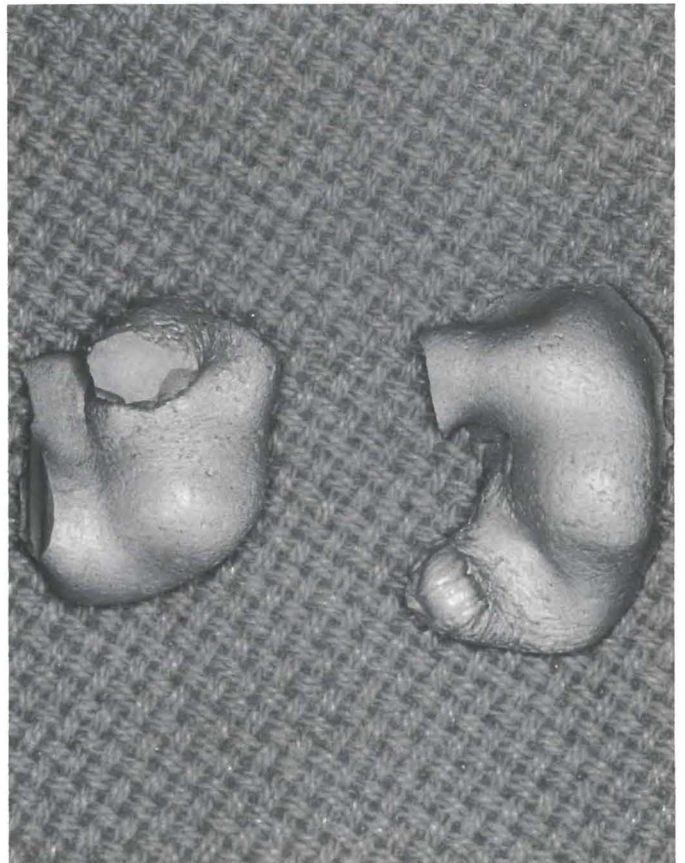


Figure 7. Finished ear plugs.



Figure 8. Patient with ear plugs in place.

tentive purposes (Figure 4). Once the material sets, remove it from the ear by using a combination pulling/rotation motion. Once the ear plug is removed, the cotton pellet and suture are discarded (Figure 5). The ear plug is then trimmed with a Bard Parker and labeled "L" for left (Figure 6). The result is a durable ear plug that is an exact fit to the patient's anatomy (Figures 7,8).

DISCUSSION

It is imperative that water not enter the middle ear after tubes are inserted. The best method of assuring this is by fabricating an ear plug that is individualized specifically to the patient's ear anatomy. There is nothing available for the consumer that is better.

Materials of polyvinylsiloxane and silicone come in a variety of colors but brighter colors are preferred for several reasons. They are not as easily misplaced, they can be found more easily when dropped in a swimming pool, and they can be readily visualized by an anxious parent from a significant distance.

ENT specialists and audiologists also use a direct method of ear plug fabrication. A silicone material is mixed on a pad and inserted into a syringe and then the impression made. However, many areas do not have an ENT and do not offer this service. The patient either has to travel a long distance for an individualized ear plug or purchase a prefabricated one. The general practitioners in the area should be notified that individualized ear plugs can be directly fabricated by the dentist for his patients who have tympanotomy tubes. The fee can be negotiated between you and the general practitioner.

The opinions contained in this article are those of the authors and are not to be construed as official or reflecting the views of the U.S. Army, Department of Defense, or Government.

REFERENCES

1. Koch, H. and Dennison, N.J.: Office visits to pediatricians. Hyattsville, MD: National Ambulatory Medical Care Service, National Center for Health Statistics, 1974.
2. Teele, D.W.; Klein, J.O. *et al*: Burden and the practice of pediatrics: Middle ear disease during the first five years of life. *JAMA* 249:1026-1029, February 1983.
3. Bodor, F.F.; Marchant, C.D.; Shurin, P.A. *et al*: Bacterial etiology of conjunctivitis-otitis media syndrome. *Pediatrics*, 76:26-28, July 1985.
4. Paradise, J.L.: On tympanotomy tubes, rationale, results, reservations, and recommendations. *Pediatrics*, 60:86-90, July 1977.
5. Bluestone, C.D.: Eustachian tube obstruction in the infant with cleft palate. *Ann Otol Rhinol Laryngol*, 80 (Suppl. 2):1-30, 1971.

PSYCHOSOMATIC MUSCULOSKELETAL PAIN

Children may display a wide variety of psychosomatic symptoms and degree of disability. The most frequent psychosomatic symptoms are headache, abdominal pain, and musculoskeletal complaints, with the latter occurring in up to 20 percent of all children.

Sherry, D.D. *et al*: Psychosomatic musculoskeletal pain in childhood: Clinical and psychological analyses of 100 children. *Pediatrics*, 88:1093-1099, December 1991.

CASE REPORTS

Outpatient dental treatment of pediatric patients with malignant hyperthermia: Report of three cases

Robert Steelman, DMD, MS
Douglas Holmes, DDS, MS

Malignant hyperthermia is a skeletal muscle disorder, which has been thought to be genetically acquired as an autosomal dominant trait.^{1,2} The incidence of malignant hyperthermia has been reported to be about 1:15,000 in the pediatric age-group and 1:50,000 in adults.^{1,3} The disorder occurs at least 40 percent of the time in patients younger than fourteen years of age and males are affected more often than females.³

Generally, patients who are predisposed to malignant hyperthermia are at risk when subjected to the inhalational anesthetics (halothane, ethane and forane) and succinylcholine, a depolarizing neuromuscular blocking agent, during general anesthesia.^{1,2,4,5} These agents apparently impair the uptake and release of calcium ions by the sarcoplasmic reticulum.^{1,2,6,7} Consequently, the muscle remains in a continually contracted state. As a direct result of prolonged muscle contraction, serum levels of creatine phosphokinase (CPK) rise, adenosine triphosphate and creatine phosphate stores are depleted, and a great amount of energy is released leading to an elevation of body temperature.^{2,4,6}

Patients who are susceptible to malignant hyperthermia can be identified through a positive family history of the disorder. CPK enzyme levels may also be higher than normal and exposure of muscle, obtained during biopsy, to halothane and caffeine results in a prolonged state of contraction.^{1,3,6}

Warning signs of impending malignant hyperthermia during general anesthesia include the following:

- Trismus involving the masseter muscle.
- Tachycardia with premature ventricular contractions.
- Tachypnea.
- Cyanosis.
- Increased body temperature, which may reach levels as high as 110°F.^{2,3,6}

Metabolic abnormalities include respiratory and metabolic acidosis, hyperkalemia, hypernatremia, increased blood levels of lactic acid, and decreased PaO₂.^{3,6} If the syndrome is allowed to progress, hypotension, pulmonary edema, and acute renal failure ensue and are terminal events.^{2,6}

Treatment of malignant hyperthermia centers around early detection, cessation of inhalational anesthetics, administering 100 percent oxygen, external cooling, gastroperitoneal lavage, and correcting hyperkalemia, hypernatremia, and metabolic acidosis.⁶ Dantrolene sodium, a skeletal muscle relaxant, should be administered intravenously at a dosage of 1 to 2 mg/kg, every five to ten minutes to a total dose of 10 mg/kg. Dantrolene exerts its effect on the sarcoplasmic reticulum and prevents the release of calcium.⁷ The muscle, therefore, remains in a state of relaxation. Administration should continue for twelve to twenty-four hours, due to the possible recurrence of malignant hyperthermia as the dantrolene is metabolized.³

Malignant hyperthermia has also been thought to be triggered by amide local anesthetics and epineph-

Dr. Steelman is an Assistant Professor and Dr. Holmes is an Associate Professor of Pediatric Dentistry, West Virginia University Health Sciences Center, Morgantown, West Virginia 26506.

Warning signs of impending malignant hyperthermia during general anesthesia should be strictly heeded.

rine.^{3,5,8} On close examination of the literature, however, no documented case of malignant hyperthermia can be found, when local anesthetics (amide or ester types) were used with or without a vasoconstrictor for dental surgery.

The purpose of this report is to present three cases of pediatric patients who were successfully treated on an outpatient basis for their dental needs without the need for dantrolene premedication.

CASE REPORTS

Case One

W.W., an eight-year-old male presented to the Department of Pediatric Dentistry with a chief complaint of a toothache over the past two days. The parents of the patient had not been successful in procuring dental treatment, due to the patient's positive history for malignant hyperthermia. The patient's medical history revealed no drug allergies, current medications, or cardiac defects. The patient had a positive family history of malignant hyperthermia. CPK levels were found to be elevated. The patient was advised to avoid inhalational anesthetics and succinylcholine, if any general anesthesia was contemplated.

The results of a physical examination showed a well nourished, well developed male in no acute distress. Examination of the oral mucous membranes, gingiva, TMJ, muscles of mastication, and cranial nerves was within normal limits. An extensive carious lesion was noted on the distal of the maxillary left first primary molar. The tooth displayed a moderate degree of mobility and pain was elicited following palpation and percussion. Following a radiographic examination, it was elected to extract the tooth. In view of the patient's

susceptibility to malignant hyperthermia, an anesthesia consultation was obtained. It was elected not to premedicate the patient with dantrolene. Continuous monitoring of vital signs was recommended, using an automated blood pressure unit, pulse oximeter, EKG, and axillary dermal thermometer. A member of the Department of Anesthesia was on stand-by, if needed.

The patient was administered nitrous oxide-oxygen (40 percent/60 percent) and one cartridge of 2 percent lidocaine containing epinephrine at a concentration of 1:100,000 by way of infiltration. After an adequate depth of anesthesia was obtained, the tooth was extracted with a 301 straight elevator and a 150 forceps. No intraoperative tachycardia was noted nor was any premature ventricular contraction noted. The patient's oxygen saturation remained at 98 percent. Blood pressures remained stable and no increase in temperature was noted. One hundred percent oxygen was given for five minutes following extraction. Monitoring continued for thirty minutes following the procedure with no untoward side effects. A one-day postoperative telephone call revealed no adverse reactions.

Case Two

BJM, a five-year-old white female presented to the Department of Pediatric Dentistry for comprehensive dental care. She was referred from a family practice dentist, due to a positive medical history for malignant hyperthermia.

The patient's mother reported discovering a family history of malignant hyperthermia, when the patient's maternal grandmother died during surgery. Muscle biopsies of the family were positive for malignant hyperthermia for BJM and her mother. The remaining medical history for the patient was not significant, ex-

cept for ptosis of the eyes at birth. All vital signs were within the normal range for the patient's age.

There were no significant findings during the extraoral examination. The intraoral soft tissue and occlusion examination were also within normal limits. Clinical and radiographic examination revealed carious lesions on teeth A,B,J,K,L, and T.

A consultation with anesthesiology was obtained, and it was recommended that the patient be treated as a "normal" person, but not to use nitrous oxide. Additionally, it was recommended that epinephrine not be used, if possible.

Comprehensive treatment was provided on an outpatient basis in four appointments. All procedures were monitored with a pulse oximeter and an external temperature probe. Three percent mepivacaine without vasoconstrictor was used for local anesthetic. Appropriate infiltration was used successfully when the patient indicated sensitivity was present after the initial anesthetic.

All functions monitored remained within normal limits during each appointment and for one hour post-treatment. The patient's mother reported no complication following treatment. The patient was observed at recall appointments.

Case Three

A.B., a six-year-old female, reported to the Department of Pediatric Dentistry with a chief complaint of a toothache and swollen jaw over the past seven days. The patient had a positive family history for malignant hyperthermia and serum CPK levels were found to be elevated. Following a muscle biopsy, a halothane-caffeine contracture test proved to be positive. The parents were cautioned concerning general anesthesia. Attempts to seek dental treatment from private practitioners were fruitless, due to the dentists' reluctance to treat a patient who was susceptible to malignant hyperthermia.

The patient was not taking any medications and no known drug allergies were reported. A grade II/VI systolic ejection murmur was present and deemed to be organic in nature following a medical consultation. An examination showed normal mucous membranes and gingival structures. Examination of the TMJ, muscles of mastication, occlusion, and cranial nerves were within normal limits. An extensive carious lesion was noted on the distal of the left mandibular first primary molar. A localized, nonfluctuant, vestibular swelling was present and did not undermine the inferior border of the mandible. Following a radiographic examination of the

area, it was elected to extract the tooth. The patient was given 1.0 gram of penicillin VK, an hour before the procedure. Preoperative vital signs were: BP = 96/60 mmHg, pulse = 96 beats/min., respirations = 20 breaths/min, and weight = 50 pounds. One cartridge of 2 percent Polocaine containing levonordefrin at a concentration of 1:20,000 was administered by way of a left inferior alveolar block. After an adequate depth of anesthesia was obtained, the tooth was extracted with a pediatric 151 forceps. No intra or postoperative complications occurred. The parents were instructed to give the patient 500 mg of penicillin VK, six hours after the first dose. A one-day postoperative follow-up revealed no untoward reactions. Subsequent dental appointments for restorative procedures have been accomplished, using a local amide anesthetic containing a vasoconstrictor, without incident.

DISCUSSION

The cases presented support the belief that patients who are susceptible to malignant hyperthermia can receive dental treatment without special precautions.⁴ Avoidance of amide local anesthetics has been advocated for these patients, presumably because these drugs could cause calcium to be released from the sarcoplasmic reticulum.^{4,8} D'Ambrosio and Adrognia have reported that no evidence could be found to support avoidance of amide local anesthetics.⁴ Gronert has reported that the controlled use of small volumes of amide local anesthetics should not trigger an episode of malignant hyperthermia.⁸ Berkowitz and Rosenberg reported that the use of the local anesthetic mepivacaine, for muscle biopsy, did not trigger an episode of malignant hyperthermia in 103 suspected malignant hyperthermia patients.⁹ Katz reported that lidocaine was used to control dysrhythmias that occurred in a patient with malignant hyperthermia.¹⁰ Wingard and Bobko reported that intravenous administration of lidocaine to malignant hyperthermia pigs, at a dosage of 15 mg/kg, did not trigger an episode of malignant hyperthermia; but instead all animals developed systemic toxicity.¹¹ Furthermore, prior administration of lidocaine did not prevent development of subsequent malignant hyperthermia after succinylcholine and halothane had been given. Adriani and Sundin reported successful dental treatment for a male patient with malignant hyperthermia.⁶ The patient was monitored continuously with an EKG, automated blood pressure unit, pulse counter, and skin thermometer. Nitrous oxide was used at a concentration of 20 percent and 1.5 cc of 1.0 percent lidocaine containing 1:200,000 epinephrine was deliv-

ered by way of a right inferior alveolar nerve block. Two teeth were restored with no adverse reaction. Subsequent appointments were also uneventful.

There has been no documented evidence that vasoconstrictors trigger an episode of malignant hyperthermia.⁶ D'Ambrosio and Adragna suggested that if one cartridge of an anesthetic containing epinephrine at a concentration of 1:100,000 (18 µg) were completely absorbed within one hour, the total amount of epinephrine present (exogenous plus endogenous) in an adult would increase by only 2.1 percent.⁶ The probability that this small increase of epinephrine could trigger an episode of malignant hyperthermia would be low.

Stress has also been suggested as a possible triggering agent for malignant hyperthermia.^{6,8} No documented case of malignant hyperthermia can be found that resulted from the stress(es) encountered during dental treatment. The extraction of an abscessed tooth can create a great deal of stress, due, in part, to possible diminished levels of profound anesthesia. It seems, therefore, that if stress was a significant triggering agent for malignant hyperthermia, more cases would have been reported, especially involving dental treatment.

Dantrolene premedication prior to dental treatment is not warranted. Not only does dantrolene premedication take a long time to complete (one to two days before surgery), but there have been reports that malignant hyperthermia can occur despite dantrolene premedication.^{3,12}

There have been many patients who have been denied dental care, because of their susceptibility to malignant hyperthermia. Such need not be the case. It appears that these patients can be safely treated for their dental needs on an outpatient basis, using a local anesthetic with a vasoconstrictor without fear of triggering an episode of malignant hyperthermia. No special precautions need to be taken.

CONCLUSIONS

Based on the results of our case studies, we concur with treatment guidelines presented by D'Ambrosio and Adragna for patients who are susceptible to malignant hyperthermia.⁶ We feel that dantrolene premedication is not needed; amide local anesthetics containing a vasoconstrictor may be safely used; continuous physiological monitoring is not necessary; and these patients should receive dental care in the normal fashion.

REFERENCES

1. Davidson, D.B. and Myall, R.W.: Malignant hyperthermia: Dental treatment of patients at risk. *Spec Care Dent*, 4:81-83, March-April 1984.
2. Warrington, R.D.; Kochansky, C.Y.; Bach, D.E.: Treatment of a patient susceptible to malignant hyperthermia. *Clin Prev Dent*, 8:27-29, January-February 1986.
3. Barba, M.W.; Post, A.C.; Duncan, W.K.: Dental treatment of a malignant hyperthermia-susceptible child. *Pediatr Dent*, 7:61-63, March 1985.
4. D'Ambrosio, J. and Adragna, M.G.: Guidelines for the use of local anesthetics in the dental treatment of patients who are susceptible to malignant hyperthermia. *Spec Care Dent*, 8:61-63, March-April 1988.
5. Cherry, I.; Lopez, J.I.; Schuman, N.J.: Dental treatment for a patient with Duchenne muscular dystrophy and malignant hyperthermia. *Gen Dent*, 34:299-300, July-August 1986.
6. Adriani, J. and Sundin, R.: Malignant hyperthermia in dental patients. *JADA*, 108:180-184, February 1984.
7. Barnhart, E.R., Ed.: *Physician's Desk Reference*. New Jersey: Medical Economics, 1989, pp 1478-1479.
8. Gronert, G.A.: Malignant hyperthermia. *Anesthesiology*, 53:395-423, November 1980.
9. Berkowitz, A. and Rosenberg, H.: Femoral block with mepivacaine for muscle biopsy in malignant hyperthermia patients. *Anesthesiology*, 62:651-652, May 1985.
10. Katz, J.D. and Krich, L.B.: Acute febrile reaction complicating spinal anesthesia in a survivor of malignant hyperthermia. *Can Anaesth Soc J*, 23:285-289, May 1976.
11. Wingard, D.W. and Bobko, S.: Failure of lidocaine to trigger porcine malignant hyperthermia. *Anesth Analg*, 58:99-103, March-April 1979.
12. Ruhland, G. and Hinkle, A.: Malignant hyperthermia after oral and intravenous pretreatment with dantrolene in a patient susceptible to malignant hyperthermia. *Anesthesiology*, 60:159-160, February 1984.

Epidermolysis bullosa: oral management and case reports

Behjat K. Moghadam, DDS, DScD
Ronald E. Gier, DMD, MSD

Epidermolysis bullosa (EB) refers to an uncommon group of skin disorders that are either acquired or are genetically transmitted as both autosomal dominant and recessive traits. The prominent clinical characteristic of the disease is the development of bullae or vesicles in response to minor mechanical trauma. These lesions generally appear on the skin, but mucosal lesions are also common.^{1,2}

The disease EB, based on the clinical and genetic studies is divided into at least sixteen subtypes.^{1,2} The following simplified classification is used and will be discussed for clarity:

- *Epidermolysis bullosa simplex* (generalized and localized) refers to a type of EB that is inherited as an autosomal dominant trait. The disease appears at birth or shortly after and is characterized by the development of bullae primarily limited to the hands and feet. Nails and extracutaneous organs are rarely involved. The frequency of bullae development increases with heat and the lesions heal without residual scarring or pigmentation. Microscopically the bullae are formed intraepidermally at the level of basal cells. This type of EB disease has the best prognosis and usually improves at puberty.

- *Epidermolysis bullosa dystrophica* refers to a type of EB that is inherited as both autosomal dominant and recessive traits. The disease is usually seen at birth or shortly after; the onset may delay, however, until puberty.

The autosomal dominant dystrophic type has skin lesions that appear predominantly on the ankles, knees, and elbows. Oral lesions are observed in about 20 percent of the patients, but the conjunctiva is never involved.

The autosomal recessive dystrophic type has skin lesions that appear on the hands and feet. The mucosal lesions tend to heal with scar formation in the oropharynx and conjunctiva. The hair is usually sparse and the nails are either absent or dystrophic. Repeated bullae formation on the hands and feet causes digital fusion and mitten appearance of the fingers and toes.

The bullae are usually formed below the basement membrane at the sites of trauma, friction, or pressure. These lesions tend to heal with atrophy, milia and scar formation.

- *Junctional epidermolysis bullosa* is a severe form of the dystrophic recessive type with bullae formation at the basement membrane. These lesions tend to appear at birth and heal slowly without scarring, milia, or pigmentation. This form of the disease carries the worst prognosis with death occurring usually within the first two years.
- *Epidermolysis bullosa acquisita (acquired)* is a rare form of the EB in which there is no evidence of familial and hereditary transmission. The disease

Dr. Moghadam is Assistant Professor, and Dr. Gier is Professor, Department of Oral Diagnosis-Oral Radiology, School of Dentistry, University of Missouri-Kansas City, 650 E. 25th Street, Kansas City, Missouri 64108.

EB patients are susceptible to a significantly compromised nutritional status.

commonly occurs in adults with unexplained etiology. The bullae and erosions usually form at the site of trauma on the hands and feet resulting in atrophic scars. Dystrophy of nails is common and oral lesions are seen occasionally. The site of the bullae formation is beneath the basement membrane or basal lamina.

- *Nutritional and metabolic disorders in patients with EB diseases.* Children with epidermolysis bullosa are susceptible to significantly compromised nutritional status.^{3,4} This is due to the decrease in dietary intake caused by oropharyngeal lesions. These lesions tend to heal by scarring and strictures causing ankylosis, immobility of the lips, and microstomia. These pathological conditions further restrict speaking, chewing and swallowing.²

The dysplastic teeth with defective enamel also appear to limit the masticatory ability and cause further restriction in food intake.⁵⁻⁷ The pharyngeal lesions are the pathological hallmarks that cause abnormal esophageal motility, and dysphagia.⁸⁻¹⁰ Associated with the disease is the evidence of frequent diarrhea, which is believed to be related to malabsorptions caused by traumatic damages to the gastrointestinal tract.¹⁰ These disorders are more common in junctional and the autosomal recessive dystrophic forms of the disease.

CASE REPORTS

The following three reports are examples of the recessive form of EB. The last two cases are brother and sister.

Case 1

This is a six-year-old boy with the history of bullae formation beginning at age four. He had two older sisters and one younger brother who were reported not to be affected. The parents were both well and free of the disease. The skin lesions were predominant especially on his hands and feet. The nails were absent or dystrophic and the right toes were atrophic and syndactylic. Some evidences of scarring and milia were present on his face (Figure 1). The buccal and labial mucosa were eroded and a large bulla was present at the tip of the tongue. The teeth were structurally normal but some caries activity was evident. Based on the clinical observations, the diagnosis of dystrophic EB was made and confirmed by biopsy. Treatment has been initiated with establishment of oral health, prevention of trauma, and administration of a supportive regimen of soft diet, high in protein, minerals, and vitamin supplements.

Case 2

This is a six-year-old boy with the history of bullae formation beginning at age one. He had an older healthy brother and an older sister affected with the disease. Both parents were well and free of the disease. Evidences of large bullae, pigmentation and nail dystrophy were present on his hands and feet. The speaking and chewing abilities of the patient were restricted because of the bullae of the soft palate, buccal and gingival



Figure 1. Oral mucous membrane involvement with typical lesion on the tip of the tongue in Case 1. Evidence of scarring and milia are also present on his face.

mucosa. The clinical diagnosis of dystrophic EB was confirmed by biopsy. The treatment has been supportive and included oral health care, a soft diet, protein, minerals, and vitamins.

Case 3

This is a fifteen-year-old girl who is the sister of the former patient. The skin lesions first appeared when the patient was a year old. Evidences of bullae and secondary scarring were present on her hands, feet, and in the area of the head and neck (Figures 2,3). The nails were also dystrophic and the hair was sparse. The patient's growth was retarded and her skeletal pattern was generally dwarfed. Oral signs were limited to scarring of the lateral posterior surface of her tongue. The treatment procedures were the same as previous cases.

DISCUSSION

Clinical problems associated with EB diseases are the potential for the development of malnutrition, delayed wound healing, and the risk of secondary infection.¹¹ The first step in management of these patients is to establish a clean mouth with functional teeth to allow for adequate food intake. Establishment of oral health should be based on the periodic dental visits. During each visit the hopeless teeth should be removed carefully and carious teeth should be restored. Oral hygiene should be established by brushing and rinsing with warm water after each meal, to remove the debris and sloughed mucosa. A small, soft, wet tooth brush should be recommended to reduce the trauma and minimize the development of new bullae.

Literature indicates that children with EB are at high risk for development of dental caries.⁵⁻⁷ The topical application of a neutral nonflavored stannous fluoride rinse or gel is recommended.

Nutritional requirements are usually determined on the basis of body need according to age, sex, weight, and height. These patients are similar to burn patients in relation to the presence of open skin wounds accompanied by infections, fluid loss, and protein turn-over.^{3,4} Increase in the level of caloric intake is essential to adapt to the hypermetabolic status and sustain the adequate energy and normal levels of blood proteins.

Avoidance of food that can traumatize the oral mucosa and esophagus is essential. This can be accomplished with a soft diet rich in protein combined with iron and vitamins.

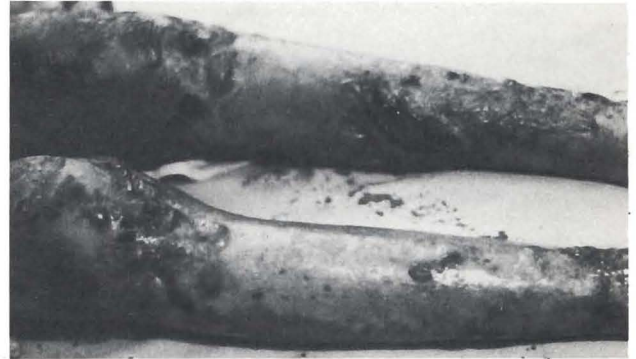


Figure 2. Clinical feature of the disease in Case 3, a sister of the former case. A dwarfed skeletal pattern indicated growth retardation.

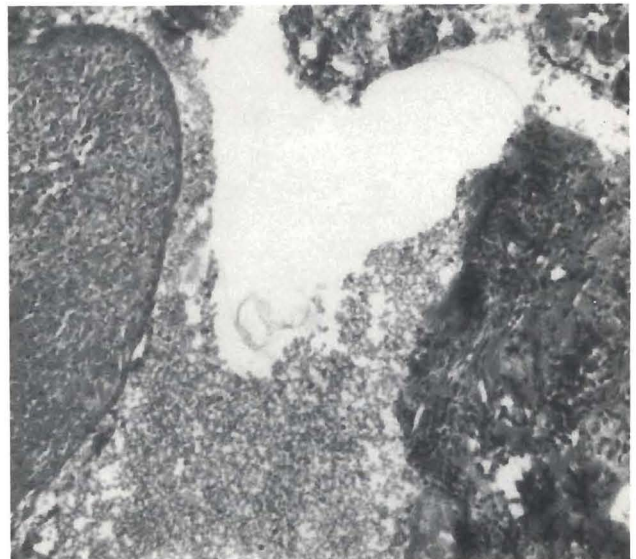


Figure 3. A biopsy of skin lesion showing space of subepidermal bulla and infiltrated inflammatory cells.

Patients with esophageal strictures may need esophageal dilatation and surgical intervention, when there is no response to conservative treatment.^{3,4,9}

Vitamin E given P.O. has been reported to decrease bullae formation in subjects with the recessive dystrophic form of EB.¹² Phenytoin has been shown to produce a 40 percent reduction in the number of bullae. Its mode of action is described as an inhibitor of collagenase enzyme production which is assumed to be secreted by fibroblast and cause bullae formation in recessive type of dystrophic EB.¹²

Administration of oral corticosteroids has been reported to decrease the frequency of bullae formation. The possibility of secondary infection, however, restricts the use of the drug on a routine basis.¹³⁻¹⁵

REFERENCES

1. Lever, W.F. and Schaumburg-Lever, G.Z.: *Histopathology of the skin*. Ed. 6. Philadelphia: J.B. Lippincott, 1983, pp 68-70.
2. Shafer, W.G.; Hine, M.K.; and Levy, B.M.: *A textbook of oral pathology*. Ed. 4. Philadelphia: W.B. Saunders, 1983, pp 838-840.
3. Gruskay, D.M.: Nutritional management in the child with epidermolysis bullosa. *Arch Dermatol*, 124:760-761, May 1988.
4. Lechner-Gruskay, D.M.; Honig, P.J.; Pereira, G. *et al*: Nutritional and metabolic profile of children with epidermolysis bullosa. *Pediatr Dermatol*, 5:22-27, February 1988.
5. Koshiha, H.; Kimura, O.; Nakata, M.: A clinical and histologic observation of enamel hypoplasia in a case of epidermolysis bullosa hereditaria. *Oral Surg Oral Med Oral Pathol*, 43:585-589, April 1977.
6. Crawford, E.G., Jr.; Burkes, E.J., Jr.; Briggaman, R.A.: Hereditary epidermolysis bullosa: oral manifestations and dental therapy. *Oral Surg Oral Med Oral Pathol*, 42:490-500, October 1976.
7. Wright, J.T. and Gantt, D.G.: Epidermolysis bullosa associated with enamel hypoplasia and taurodontism. *J Oral Pathol*, 12:73-83, April 1983.
8. Davies, H. and Atherton, D.J.: Acute laryngeal obstruction in junctional epidermolysis bullosa. *Pediatr Dermatol*, 4:98-101, August 1987.
9. Nowak, A.J.: Oropharyngeal lesions and their management in epidermolysis bullosa. *Arch Dermatol*, 124:742-745, May 1988.
10. Orlando, R.C.; Bozymski, E.M.; Briggaman, R.A. *et al*: Epidermolysis bullosa: gastrointestinal manifestations. *Ann Intern Med*, 81:203-206, August 1974.
11. Carter, D.M. and Lin, A.N.: Would healing and epidermolysis bullosa. *Arch Dermatol*, 124:732-733, May 1988.
12. Villa, J. and Sanchez, J.L.: Dermatology diagnosis. Epidermolysis bullosa dystrophica. *Bol Assoc Med P R*, 80:195-197, June 1988.
13. Domonkos, A.N.: *Andrews' diseases of the skin; clinical dermatology*. Ed. 6. Philadelphia: W.B. Saunders, 1971, pp 663-667.
14. Roenigk, H.H., Jr.; Ryan, J.G.; and Bergfeld, W.F.: Epidermolysis bullosa acquisita. Report of three cases and review of all published cases. *Arch Dermatol*, 103:1-10, January 1971.
15. Schuman, B.M. and Arciniegas, E.: The management of esophageal complications of epidermolysis bullosa. *Am J Dig Dis*, 17:875-880, October 1972.

PREVALENCE OF SEVERE PERIODONTITIS

The data support the conclusion that severe periodontitis is rare in most populations of juveniles of white Caucasian origin in Scandinavia, Europe, Great Britain and the USA, probably affecting one in every thousand. Localized juvenile periodontitis appears to be much more prevalent than GJP, and there is little evidence that other forms of severe periodontitis exist in these populations of juveniles. It is clear, however, even after taking methodological problems into account, that the prevalence of severe periodontitis in some other populations of juveniles is considerably higher and that forms of the disease other than LJP and GJP may exist. Ethnic origin is an important determinant. While Saxby (1984) found the prevalence of LJP in a population of schoolchildren of mixed ethnic origin to be 0.1 percent, the prevalences for caucasoids, Asians, and negroids were 0.02, 0.2 and 0.8 percent respectively. Likewise, Gjermo *et al* (1984) found a prevalence for LJP of 3.7 percent in Brazilian children at 15 years of age. Forms of periodontitis in juveniles other than LJP and GJP have not previously been described. It is unlikely that the kind of periodontal destruction described by Gjermo *et al* (1984), Bimstein *et al* (1988) or Wolfe & Carlos (1987) has characteristics, such as blood leucocyte abnormalities, generally accepted for LJP and GJP. The data are consistent with the notion that one or more forms of severe periodontitis other than LJP and GJP occur in juveniles, and that the aetiology, progression and response to treatment may differ greatly from those of LJP and GJP.

Johnson, N.W., Editor: *Periodontal diseases*, Vol 3.
Cambridge, England: Cambridge University Press, 1991, pp 84, 85.

Bilateral eruption sequestra: Report of case

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

Pain during tooth eruption is a common complaint. Many factors can be responsible for this, including trauma to an operculum, pericoronitis, eruption hematoma, chronic irritations, neoplasms or eruption sequestrum. The last entity, eruption sequestrum, is often forgotten in the differential diagnosis of pain due to tooth eruption.

An eruption sequestrum, as described by Starky and Shafer, is a tiny spicule of bone overlying the crown of an erupting permanent molar before or immediately after the emergence of the cuspal tips through the oral mucosa.¹ As the molar tooth erupts through the bone a small osseous fragment will occasionally separate from the contiguous bone. As the tooth continues to erupt, the cusp tips emerge and the bone fragment sequesters through the mucosa. In some instances, the mesial half of the molar erupts through the mucosa and the spicule may be found lying on the occlusal surface of the molar, in the central fossa and attached to the mesial margin of the soft tissue overlying the distal half of the occlusal surface.^{1,2} This is usually associated with

the mandibular first molars, but has been noted occurring with the maxillary first molars and mandibular second molars.¹

The eruption sequestrum may occasionally be seen radiographically as a small radiopacity coronally of the erupting tooth.³ If seen radiographically before tooth eruption, its appearance intraorally may be predicted.

Literature reports of eruption sequestra are infrequent, possibly because it exists only for a short period of time.⁴ In most instances this fragment probably undergoes resorption or exfoliation before eruption.² The purpose of this article is to present a case of bilateral eruption sequestra, their observation, identification, and treatment.

REPORT OF CASE

A twelve-year-old, black male presented with a chief complaint of "Pain behind my back bottom teeth", of two weeks duration. Upon examination, tissue was noted overlying the occlusal surfaces of the mandibular second molars (Figure 1). The tissue was hard and brittle, with an area of inflammation slightly distal to the second molars. When it was elevated a slight odor was noted, and plaque accumulation was present (Figure 2). The shape of the tissue corresponded to the occlusal anatomy of the teeth. Radiographs were taken and revealed radiopaque areas occlusal to the mandibular second molars. The tissue was excised under local anesthesia, grossly examined, and submitted for mi-

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

Currently, Dr Schuler is an orthodontic resident, University of Louisville; Dr Camm is Lt. Colonel, Wilford Hall Medical Center, Lackland A.F.B., San Antonio, TX; Dr Houston is Colonel, Wilford Hall Medical Center, Lackland A.F.B., San Antonio, TX.

Plaque accumulation
may lead to
pericoronitis
and localized swelling.

oscopic examination with a differential diagnosis of hyperkeratinized operculum or eruption sequestrum. The examination indicated that the specimens consisted of fragments of nonviable bone (Figure 3). This finding is consistent with a diagnosis of eruption sequestrum.

The teeth were examined after excision of the sequestrum. Deep pits and fissures were noted with areas of incipient decay. Preventive resin restorations were placed and the patient was placed on six-month recall.

DISCUSSION

Pain during the eruption of teeth is common. In this case, bilateral eruption sequestra were the source of pain. Eruption sequestra are seen primarily in children at the time of eruption of the mandibular first molars. The sequestrum is generally lost as the cuspal tips emerge through mucosa or it resorbs spontaneously. If the patient complains of soreness, the spicule may be removed following application of topical anesthetic or infiltration of local anesthetic.

As demonstrated by this case, the spicule may be retained by tissue covering the distal marginal ridge of the erupting tooth, and associated with erupting second molars. Of interest was plaque accumulation under each sequestrum. This plaque accumulation may lead to pericoronitis and localized swelling. Close association of acidogenic bacteria with tooth surface may also be responsible for caries during the initial eruptive phase. Retention of this attached sequestrum for a prolonged period of time may lead to demineralization and caries.

Differential diagnosis of pain during tooth eruption must include: Tissue trauma, pericoronitis, eruption



Figure 1. Intraoral photograph of tissue overlying occlusal surface of the mandibular second molar.



Figure 2. Intraoral photograph of explorer tine retracting tissue overlying the occlusal surface of the mandibular second molar.



Figure 3. High power photomicrograph demonstrating fragment of non-viable compact bone. Note: there are no osteocytes within the lacunae. (Original magnification X200, hematoxylin and eosin stain)

hematoma, eruption sequestra, developmental cysts, tumors, and Garré's osteomyelitis. Tissue trauma will present as erythematous soft tissue and will not be hard and bone-like in consistency. Pericoronitis will have associated cellulitis and will be soft tissue also. Eruption hematoma will present as a bluish swelling overlying an unerupted tooth. Cysts and tumors may be eliminated by radiographic evaluation and postoperative follow-up on the patients complaint. Garré's osteomyelitis presents as a hard swelling on the outer surface of the jaw, usually associated with a carious tooth. Histologically Garré's osteomyelitis is composed of much reactive new bone and osteoid tissue. Eruption sequestrum presents as a focal irritation associated with an erupting tooth. A hard mass usually conforming to the occlusal pattern of the erupting tooth is also noted. Histologically the hard mass will be devitalized bone.

SUMMARY

A case report of bilateral eruption sequestra was presented. The eruption sequestrum must be included in the differential diagnosis of pain during eruption. Although previously thought to have little clinical significance, the eruption sequestrum may retain plaque in close association with the newly erupting tooth. The retained eruption sequestrum may lead to pericoronitis or pit and fissure caries. While many spontaneously resorb or exfoliate, some, as in this case, may need surgical removal.

REFERENCES

1. Starkey, P.E. and Shafer, W.G.: Eruption sequestra in children. *J Dent Child*, 30:84-86, 2nd Quarter, 1963.
2. Shafer, W.G.; Hine, M.K.; and Levy, B.M.: *A textbook of oral pathology*. Ed. 4. Philadelphia: W.B. Saunders, 1983.
3. McDonald, R.E. and Avery, D.R.: *Dentistry for the child and adolescent*, Ed. 4. St. Louis: The C.V. Mosby Co., 1983.
4. Gardner, D.E. and Norwood, J.R.: Eruption sequestra: five case reports. *J Dent Child*, 45:475-476, November-December 1978.

TURNER SYNDROME

In conclusion, although TS is a congenital anomaly, the diagnosis is usually made too late, at a chronological age when a marked height deficit is present. Parental height seems to influence height, but not age at the time of diagnosis. To make an early diagnosis and eventually optimize treatment, a cytogenetic examination should be recommended in girls with small stature more than 2 SD below the mean for chronological age or below corrected midparental height (CMPH), even in the absence of dysmorphic features. In addition, it needs to be stressed that even in the presence of signs of spontaneous puberty, TS is not excluded per se and should not be overlooked.

Massa, G.G. *et al.*: Age and height at diagnosis in Turner syndrome: influence of parental height. *Pediatrics*, 88:1148-1152, December 1991.

ABSTRACTS

Siegel, Lawrence J.; Smith, Karen, E.; Cantu, George E.; Posnick, William R.: The effects of using infection control barrier techniques on young children's behavior during dental treatment. J Dent Child, 59:17-22, January-February 1992.

The purpose of the present study was to evaluate whether the use of masks in the dental operatory affected anxiety in young dental patients. Sixty-three children between the ages of three and six years of age were randomly assigned to a mask or no-mask condition. Measures of self-reported anxiety, mood, and feelings of control; observer ratings of anxiety and cooperation; and heart-rate were obtained from the children while undergoing dental restorations. The findings indicated that children who were treated by a dentist who did not wear a mask demonstrated slightly better adjustment than children who were exposed to a masked dentist based on measures of observed distress, self-report of perceived control, and heart-rate. It is concluded that wearing a mask during dental treatment represents a minimal stressor for young children with previous dental experience and that it has no appreciable impact on children's behavior during the dental session.

Pediatric dentistry; Infection control; Masks; Anxiety

Vanderas, Apostole P.: Prevalence of craniomandibular dysfunction in white children with different emotional states: Part III. A comparative study. J Dent Child, 59:23-27, January-February 1992.

This part of the study investigates the differences in the prevalence of signs, symptoms, and severity of craniomandibular dysfunction in children classified by the parents as *calm* and *not calm*. The results showed statistically significant differences in the prevalence of muscle- and TMJ tenderness, while between females the difference did not reach the level of significance. With respect to the tenderness of each

palpated muscle, differences between the two groups were found in the prevalence of lateral and medial pterygoid muscles. The tenderness of lateral pterygoid muscle was also significantly different between females of the two groups. The other differences were not significant. The study suggests that children with emotional states run a greater risk of developing TMJ and muscle tenderness.

Dysfunction, craniomandibular; TMJ; Muscle tenderness; Children; Anxiety

Honkala, E.; Kolmakow, S.; Nyysönen, V.; Kuymina, E.; Vasina, S.: Background factors affecting dental caries in permanent teeth of Finnish and Soviet children. J Dent Child, 59:28-33, January-February 1992.

The aim of this study was to analyze how some general background factors are associated with caries experience in groups of Finnish and Soviet children. A total of 1187 children, ages seven-, nine- and twelve years old, were examined in Helsinki and Kuopio, Finland and in Moscow and Leningrad, USSR. The visual-tactile method with fiberoptic light was used for clinical determination of dental caries. Information was recorded for each individual tooth surface. Background information about toothbrushing frequency, use of sweets, cakes, soft drinks, sugar-sweetened coffee and tea, and mother's education was collected in a questionnaire sent to the children's parents. The results were analyzed using bivariate analyses and log-linear regression models. In general, the associations between caries experience and the background factors studied were more consistent in all age-groups of Finnish children than in Soviet children. In Finland the multivariate analysis included age and toothbrushing frequency as the only significant variables, but in the USSR it included age and use of sweets. Except for age, the factors that explain caries experience

clearly differ in Finnish and Soviet children.

Epidemiology; Caries; Sweets and sugar; Age; Toothbrushing; Mother's education; Tooth surfaces

Waldman, H. Barry: 1990 dental health objectives for children: What is left to be done? J Dent Child, 59:34-37, January-February 1992.

A review is provided of a Public Health Service progress report on the 1990 oral health objectives for children. Major advances in improving oral health of our nation's children have been accomplished. Emphasis is placed on "what's left to be done."

Caries; Permanent teeth; Gingivitis; Risk reduction; Mouth guards; Cariogenic snacks; Public awareness; Water, fluoridated; Oral hygiene; Dental services, preventive

Waldman, H. Barry: Will there be a difference in the pediatric dentists of the future? J Dent Child, 59:38-40, January-February 1992.

A review is provided of the demographic information available from the recently introduced postdoctoral matching program (PASS) and other available sources, such as the ADA and AAPD. Significant changes in the gender and race/ethnicity representation in pediatric dentistry should be anticipated. The general trend during the last decade has been a 37 percent decrease in the size of dental school enrollments and roughly a doubling of the numbers of women and members of minority groups in pediatric dental programs enrollment and dental school applicants.

Pediatric dentistry programs; Graduates, dental school; Women; Minorities; Downsizing

Waldman, H. Barry: Now that we've gotten their attention, let's get some

more services for children. J Dent Child, 59:41-43, January-February 1992.

The media and the politicians have begun to recognize the needs of children. The evidence is in the plethora of U.S. news reports on the plight of our nation's children appearing in Spring and Summer 1991. Let's use this opportunity to get help for our children, and make them our country's number-one priority!

News media; Legislators; Well-being; Children; Pediatric dentistry

Zilberman, Yerucham; Malron, Mordecai; Shteyer, Arie: Assessment of 100 children in Jerusalem with supernumerary teeth in the premaxillary region. J Dent Child, 59:44-47, January-February 1992.

The purpose of this study was to evaluate the prevalence of supernumerary teeth in a group of Israeli schoolchildren. To that end, the patient files of 100 children (72 boys and 28 girls) who had been referred for treatment because of supernumerary teeth in the premaxillary region were reviewed. Seventy-four children had one, 23 had two, two had three, and one child had four supernumerary teeth. Of these teeth, 22 percent had erupted. Nearly 90 percent of the supernumerary teeth were located between and around the maxillary central incisors. Angle's classification, which was available for 44 children, showed 59 percent of them to be in class I; the remainder were in class II. As far as could be ascertained, no comparative figures have been published previously concerning the distribution of children with supernumerary teeth according to Angle's classification.

Supernumerary teeth; Eruption; Intervention, surgical; Pediatric dentistry; Classification, Angle's

Acs, George and Drazner, Ellen: The incidence of postoperative pain and

analgesic usage in children. J Dent Child, 59:48-52, January-February 1992.

A survey form completed by parents was used to investigate the incidence of postoperative pain and analgesic usage in children, following routine restorative dental procedures. Seventeen (31.5 percent) of the fifty-four patients undergoing such procedures reported pain. Overall, nine (16.7 percent) patients required analgesics for the relief of their pain, which represented 52.9 percent of those seventeen patients reporting pain. Although overall age was neither significantly associated with the report of postoperative pain nor with analgesic usage, female patients were significantly more likely to report pain than were male patients and 6- to 9-year-old females were more likely to require an analgesic than their male counterparts. However, when considering only those patients that reported pain, females were no more likely to require an analgesic.

Pain, postoperative; Analgesics; Children

Morabito, Annunziata and Defabianis, Patrizia: A SEM investigation on pulpal-periodontal connections in primary teeth. J Dent Child, 59:53-57, January-February 1992.

A SEM investigation of the interradiacular region of the pulp chamber of thirty (twenty-one mandibular and nine maxillary) primary molars channels on the pulpal floor. Accessory channels were found in twenty-one of the thirty teeth examined (almost 60 percent). The surface characteristics of the furcation area have been described, as well as those of the observed channels. The SEM proved to be an excellent means of evaluating the pulpal floor of human teeth. Failure of pulp treatment is often due to the presence of aberrant pulp-periodontal connections, whose treatment is almost always impossible.

Scanning electron microscopy; Pulp

chamber; Channels, accessory; Connections, pulpal-periodontal; Molars, primary

Cureton, Steven L. and Regennitter, Frederick: A direct method of earplug fabrication. J Dent Child, 59:58-61, January-February 1992.

Signs and symptoms associated with otitis media and its complications and sequelae are identified and reviewed. Diseases of the middle ear account for a high percentage of office visits in children through age five. Children with tympanotomy tubes in place in the tympanic membrane, sometimes for years, require protection of the ear from water from bathing or swimming. Contamination usually results in otitis media and discharge. This report introduces a direct method of earplug fabrication using a polyvinylsiloxane impression material.

Ear plugs; Tympanotomy tubes; Otitis media

Steelman, Robert and Holmes, Douglas: Outpatient dental treatment of pediatric patients with malignant hyperthermia: Report of three cases. J Dent Child, 59:62-65, January-February 1992.

Malignant hyperthermia is a genetically transmitted disorder of skeletal muscle. When predisposed individuals are exposed to inhalational anesthetics or succinylcholine a series of events occurs, which ultimately leads to metabolic abnormalities and a hyperthermic state that can be fatal. Susceptible patients seeking dental care have often been denied treatment because of the fear of triggering an episode of malignant hyperthermia while using local anesthetics. Denial of dental care to these patients is not warranted. Dental treatment was successfully accomplished using amide local anesthetics for three pediatric patients who were known to be at risk for developing malignant hyperthermia. No untoward sequelae occurred. It was concluded that

Continued on page 9

Busy Reader (continued from page 5)

tering the middle ear when tympanotomy tubes are in place. A fabrication technique is described.

Requests for reprints should be directed to Major Steven L. Cureton, Resident, Advanced Educational Program in Orthodontics, Craven Dental Clinic, Fort Knox, Kentucky 40121-5520.

Outpatient dental treatment of pediatric patients with malignant hyperthermia: Report of three cases—page 62

Malignant hyperthermia is a skeletal muscle disorder thought to be genetically acquired. Inhalation anesthesia presents a dangerous risk to the patient predisposed to the condition.

Requests for reprints should be directed to Dr. Robert Steelman, Assistant Professor of Pediatric Dentistry, West Virginia University Health Sciences Center, Morgantown, West Virginia 26506.

Epidermolysis bullosa: oral management and case reports—page 66

The prominent clinical characteristic of this uncommon group of skin disorders, which are acquired or are genetically transmitted, is the development of bullae or vesicles in response to minor mechanical trauma. They can either be skin or mucosal lesions. This paper reports on three cases of epidermolysis bullosa dystrophica. The significance of oral management in treating these subjects is discussed.

Requests for reprints should be directed to Dr. Behjat K. Moghadam, School of Dentistry, University of Missouri-Kansas City, 650 E. 25th Street, Kansas City, MO 64108.

Bilateral eruption sequestra: Report of case—page 70

An eruption sequestrum is a tiny spicule of bone overlying the crown of an erupting permanent molar. As the tooth continues to erupt, the bone fragment usually sequestrates through the mucosa.

Requests for reprints should be directed to Major (Dr.) John L. Schuler, 325th Medical Group/SGD, Tyndall AFB, FL 32403-5300.

Abstracts (continued from page 8)

patients who are susceptible to malignant hyperthermia can receive dental care in a normal fashion.

Hyperthermia; Muscle contraction; Anesthesia, inhalation [and] amide local; Pediatric dentistry

Moghadam, Behjat K. and Gier, Ronald E.: Epidermolysis bullosa: Oral management and case reports. J Dent Child, 59:66-69, January-February 1992.

Oropharyngeal and gastrointestinal lesions of epidermolysis bullosa (EB) tend to potentiate malnutrition and growth retardation in children with the disease. The management and treatment of these subjects is not successful without the establishment of good oral health. Dental treatment together with proper medical management prevent nutritional deficiency, help establish a normal growth pattern and promote a healthier lifestyle for the children with the disease. This paper reports on three cases of epidermolysis bullosa dystrophica. The significance of oral management in treating these subjects is discussed.

Epidermolysis bullosa; Subtypes; Lesions, skin [and] mucosal; Growth; Nutrition; Trauma

Schuler, John L.; Camm, Jeffrey H.; Houston, Glen: Bilateral eruption sequestra: Report of case. J Dent Child, 59:70-72, January-February 1992.

An eruption sequestrum is a tiny spicule of bone overlying the crown of an erupting permanent molar either before or immediately after the emergence of the cusp tips through the oral mucosa. As the tooth continues to erupt, the bone fragment usually sequestrates through the mucosa; and the spicule may be found lying on the occlusal surface of the molar, attached to the soft tissue overlying the distal half of the occlusal surface.

Eruption; Pain; Bony spicules; Occlusal surface; Oral mucosa; Eruption sequestrum