

JOURNAL OF DENTISTRY FOR CHILDREN

Nothing is more fundamental to development than pure uncontaminated curiosity. It is inextricably interrelated with the development of language, intelligence, sociability, crawling and climbing, standing and cruising.

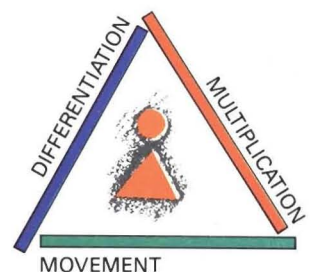


The educational developments that take place in the year that begins when a child is about eight months old (beginning of Phase V: eight months to fourteen months) are the most in need of attention of any that occur in human life.

Burton L. White--1975

THE WHOLE ART OF TEACHING IS ONLY THE ART
OF AWAKENING THE NATURAL CURIOSITY OF YOUNG MINDS
FOR THE PURPOSE OF SATISFYING IT AFTERWARDS.

Anatole France, 1844-1924





JOURNAL OF DENTISTRY FOR CHILDREN

Volume 55 Number 6 November-December 1988

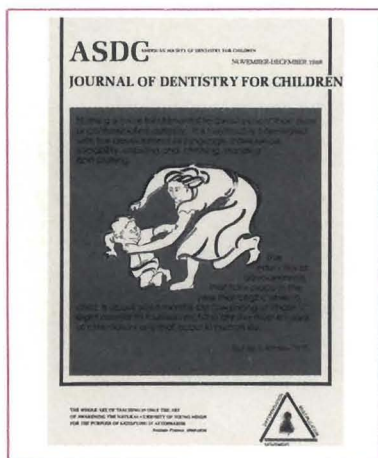
Copyright 1988 by the American Society of Dentistry for Children—ASDC JOURNAL OF DENTISTRY FOR CHILDREN, USPS #279-480. Issued bimonthly—in January-February, March-April, May-June, July-August, September-October, and November-December—at 211 E. Chicago Avenue, Suite 1430, Chicago, IL, (312) 943-1244. Second class postage paid at Chicago, IL and additional mailing office. Subscription prices: within U.S.A., individuals \$60.00 per volume, institution \$80, single copies, \$15.00; Foreign (including Canada and Mexico) individuals \$70.00 per volume, institution \$90, single copies \$20.00. Thirty dollars and fifty cents (\$30.50) 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, 730 Blaney Drive, Dyer, Indiana 46311, (219) 865-1184.

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 Executive Secretary, 211 E. Chicago Ave., Suite 1430, Chicago, Illinois 60611.



"Catch me, if you can" could be the title to our cover. The mother will quickly learn the extent of her endurance and patience. Art and design by Sharlene Nowak-Stellmach.

- | | |
|---------------------------|-----------------------------------|
| 402 Abstracts | 422 Guest editorial |
| 396 Busy reader | 469 News |
| 404 Classified ads | 470 Statement of ownership |
| 408 Editorial | |

DENTAL SERVICES

409 Medicaid and Medicaid dentistry in the Reagan years

H. Barry Waldman, DDS, MPH, PhD

Any decrease in number of recipients or in expenditures affects that segment of the population least able to afford the reduction in services.

418 An what of the children?

H. Barry Waldman, DDS, MPH, PhD

More than 12,000,000 children (20 percent) were living in poverty in 1986. There were more children younger than age six living in poverty than were elderly persons.

EPIDEMIOLOGY

423 Labial hypoplasia of primary canines in black Head Start children

William K. Duncan, DDS, MEd; Stephen L. Silberman, DMD, Dr PH; Aaron Trubman, DDS, MPH

As hypoplastic defects have much potential to become carious, the 37 percent incidence observed here points to an increased susceptibility to caries.

NUTRITION

427 Vitamin preparations as dietary supplements and as therapeutic agents

Council on Scientific Affairs, American Medical Association

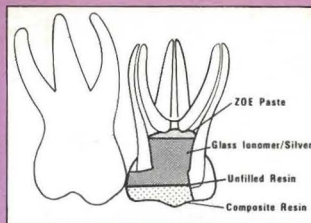
The FDA has estimated that 40 percent of the adult population uses vitamin and mineral supplements on a daily basis.

CLINIC

434 Sealant knowledge and use by pediatric dentists; 1987 Minnesota survey

Cesar D. Gonzalez, DDS, MS; P. Jean Frazier, MPH, PhD; Louise B. Masser, BSc, MDS

All respondents in this survey reported using sealants; considering the value of the procedure and the level of need, however, frequency of use is not as high as it could be.



441 Prevalence of craniomandibular dysfunction in white children with different emotional states. Part I: *Calm* group

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

Of the known etiology factors, malocclusion and oral parafunctions are considered to be the causative factors of the dysfunction in this group.

449 Clean vs sterile technique for pediatric dental patients in the operating room

Mark L. Helpin, DMD; William K. Duncan, DDS, MEd

There were no statistical differences in morbidity or postoperative complications between patients treated with clean or sterile techniques.

452 Patient and operator attitudes toward rubber dam

Colwyn M. Jones, BDS, FDS; Jones, S. Reid, BDS, FDS, PhD

Many articles list the advantages of rubber dam, but few have assessed on a significant level the reaction of either the patient or the operator.

455 Tooth-germ sequestration as a sequela of chronic periapical inflammation of the primary predecessor

Elizabeth D. Goodman-Topper, BDS, LDSRCS; Dan Gazit, DMD; Eliezer Eidelman, Dr Odont, MSD

It will be interesting to note whether the left second premolar will develop normally in an area that was chronically inflamed at a very early stage of tooth formation.

459 Comparison of Kodak D-speed and E-speed x-ray film in detection of proximal caries

William F. Waggoner, DDS, MS; James J. Ashton, MS

No difference between film types was found in the ability of dentists to diagnose interproximal decay.

463 Conservative technique for restoring primary molars after pulpotomy treatment

Joel H. Berg, DDS, MS; Kevin J. Donly, DDS, MS

This technique is particularly beneficial for situations where the access for the pulpotomy was made through only the occlusal surface, leaving all proximal surfaces intact.

CASE REPORT

465 Vitamin D-dependent rickets type II: report of three cases

Kenji Kikuchi, DDS; Tae Okamoto, DDS; Mizuho Nishino, DDS, PhD; Eiji Takeda, MD, PhD; Yasuhiro Kuroda, MD, PhD; Masuhide Miyao, MD, PhD

It is evident that normal or near normal dental development can be achieved in patients with controlled rickets, thus permitting routine treatment of carious teeth.

OFFICERS

Prem S. Sharma President
Weldon W. Crompton President-elect
Roland W. Hansen Vice President
Alfred C. Griffin Secretary-Treasurer

EDITORIAL STAFF

George W. Teuscher Editor-in-Chief
Donald W. Kohn Associate Editor
Jimmy R. Pinkham Associate Editor
Jane W. Teuscher Assistant Editor
730 Blaney Drive
Dyer, Indiana 46311

EDITORIAL AND PUBLICATIONS COMMISSION

Thomas K. Barber
Donald F. Bowers
Irving W. Eichenbaum
Donald W. Kohn
Ralph E. McDonald
John E. Nathan
Jimmy R. Pinkham
Prem S. Sharma
Robert Spedding
Paul P. Taylor

TRUSTEES

James L. Bugg, Jr.
Elliott J. Gordon
Donald W. Kohn
William H. Lieberman
Jimmy R. Pinkham
James F. Rundle
John M. Willis

EDITOR EMERITUS

Alfred E. Seyler

For the busy reader

Medicaid and Medicaid dentistry in the Reagan years—page 409

In the early years of the Reagan administration, massive cuts were proposed in federal health and social legislation. Programs for the poor were correspondingly reduced substantially. The administration's desired decreases in Medicaid expenditures and federal government responsibilities have not been produced, however. The future of the program seems to be with older and disabled populations.

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.

And what of the children?—page 418

Now that legislative efforts on behalf of the elderly have been completed, it seems appropriate to pose the question 'How have the children fared; have they once again been over-shadowed by our concern for the elderly?' In 1986, more than twelve million children—almost 20 percent of all children—lived in poverty.

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.

Labial hypoplasia of primary canines in black Head Start children—page 423

During routine examinations of 334 black Head Start children in Mississippi, many presented with areas of hypoplasia on the labial surfaces of the mandibular primary canines. Mean prevalence was 38 percent in fluoridated areas and 36 percent in areas without fluoridation. As it appears that hypoplastic defects have a strong potential to become carious, one should expect that the incidence of 25 percent reported here would continue to increase.

Requests for reprints should be directed to Dr. William

K. Duncan, Associate Professor and Acting Chairman, Department of Orthodontics and Pediatric Dentistry, University of Mississippi, School of Dentistry, 2500 North State Street, Jackson, MS 39216-4505.

Vitamin preparations as dietary supplements and as therapeutic agents—page 427

Used extensively in the practice of medicine, vitamins are valuable when used properly in given clinical situations, bearing in mind their usefulness and limitations. Nutritional adequacy in the diet is best ensured through the use of a wide variety of foods; vitamin supplements are not usually necessary.

Reprints are not available.

Sealant knowledge and use by pediatric dentists: 1987 Minnesota survey—page 434

Sealants are safe, cost-effective, and easy to apply. All of the pediatric dentists surveyed in this study reported using sealants. Only 46 percent, however, applied sealants more than ten times per week. Sealant use was most often for the six- to fourteen-year-old age-group.

Requests for reprints should be directed to Dr. Louise B. Messer, Department of Preventive Sciences, School of Dentistry, 515 Delaware Street S.E., Minneapolis, MN 55455.

Prevalence of craniomandibular dysfunction in white children with different emotional states. Part I: *Calm* group—page 441

Malocclusion, oral parafunctions, dentofacial injuries, orthodontic treatment, and emotional states are factors that have been implicated in the etiology of craniomandibular dysfunction. In a sample of 386 white children, the number of children rated by their parents as *calm* was 250 (108 boys, 142 girls). Malocclusion and oral parafunctions are considered to be the causative factors in this group.

Requests for reprints should be directed to Dr. Apostole P. Vanderas, Festou and Thessalonikis Street, Kifissia, Athens, Greece.

Clean vs sterile technique for pediatric dental patients in the operating room—page 449

Recommendations on the need for clean or sterile technique have been made based on personal experience. This retrospective analysis of 100 children and adolescents who received dental treatment in the operating room shows no statistical difference in morbidity or postoperative complications between patients treated with the different techniques.

Requests for reprints should be directed to Dr. William K. Duncan, Chairman, Department of Pediatric Dentistry, University of Mississippi, School of Dentistry, 2500 North State Street, Jackson, MS 39216-4505.

Patient and operator attitudes toward rubber dam—page 452

The increasing reliance of modern dentistry on adhesive materials, has acted as a renewed incentive for the use of rubber dam. A safe, dry field in a comfortable patient, with the teeth and colored rubber dam contrasting, are the major advantages to the operator. Few articles have assessed the reactions of either the patient or the operator; in this study, it is accepted well.

Requests for reprints should be directed to Dr. Colwyn Jones, Dept. of Prosthodontics, Glasgow Dental Hospital and School, 378 Sauchiehall Street, Glasgow G2 3JZ.

Tooth-germ sequestration as sequela of chronic periapical inflammation of the primary predecessor—page 455

In this case the permanent successor was so radiographically indistinct due to the inflammatory process that this three-year-old Arab boy might have been classified as having congenital absence of the mandibular left first premolar, if the mass had not been sent for histological section. The clinical implications are identical.

Requests for reprints should be directed to Dr. Elizabeth Goodman-Topper, Department of Pedodontics, Hadassah Faculty of Dental Medicine, POB 1172, Jerusalem, Israel.

Comparison of Kodak D-speed and E-speed x-ray film in detection of proximal caries—page 459

Due to the differences in the findings of earlier studies, it was decided to investigate further and compare the two film types. This study compared the radiographic images of proximal caries lesions on D-speed radiographic film with those seen on an E-speed radiograph. No significant difference was found in the ability of dentists to diagnose.

Requests for reprints should be directed to Dr. William F. Waggoner, 305 W. 12th Avenue, Columbus, OH 43210.

Conservative technique for restoring primary molars after pulpotomy treatment—page 463

The conservative technique provides a more esthetically pleasing result in patients where significant tooth structure remains after completion of a pulpotomy. This technique is particularly beneficial for situations where the access for the pulpotomy was made through only the occlusal surface, leaving all proximal surfaces intact.

Requests for reprints should be directed to Dr. Joel H. Berg, Assistant Professor, Department of Pediatric Dentistry, The University of Texas Dental Branch, P.O. Box 20068, Houston, TX 77225.

Vitamin D-dependent rickets type II: report of three cases—page 465

In this study the dental findings of three patients with vitamin D-dependent rickets (DDR) type II with alopecia, who were treated with large doses of vitamin D₃ derivatives, are described. Dental development that is at or near a normal level can be achieved in controlled patients, permitting routine treatment of carious teeth.

Requests for reprints should be directed to Dr. Kenji Kikuchi, Department of Pedodontics, School of Dentistry, University of Tokushima, 3 Kuramoto-cho, Tokushima 770 Japan.

Medicaid and Medicaid dentistry in the Reagan years

Dental services

H. Barry Waldman, DDS, MPH, PhD

*"In the present crisis, government is not the solution
to our problem; government is the problem."*¹

Ronald Reagan — 1st Inaugural Address

*"Many services can be provided better by state and
local governments. Over the years the federal
government has preempted many functions that
properly ought to be operated at the state
and local level."*

*"Many other programs should be reduced to a more
appropriate scale...this budget proposes reforms to
limit the costs and future growth
of Medicare and Medicaid..."*²

Ronald Reagan — 1986 Budget Message to Congress

In the early years of the Reagan administration, massive cuts were proposed in federal health and social legislation. In 1981, the President asked for a 5 percent cap on increases in the federal contribution to Medicaid; a 25 percent or more reduction in funds for a number of other health and social programs; and trims of several billion dollars in appropriations for food stamps, welfare, energy and housing programs.¹

Although the Congress balked at giving the President

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.

all he requested, programs for the poor were reduced substantially. The 1981 Omnibus Budget Reconciliation Act trimmed or totally eliminated outlays for approximately 200 programs. Medicaid matching funds were cut 3 percent for fiscal year (FY) 1982; 4 percent for FY 1983; and 4.5 percent for FY 1984. States were given increased flexibility to reduce their Medicaid programs, which they did by approximately \$300 million in FY 1982 and an additional \$250 million in FY 1983. The reductions in the number of individuals on welfare decreased the numbers on Aid to Families with Dependent Children (AFDC) rolls by 10 percent. Those individuals removed from AFDC lost their Medicaid coverage.¹

States carried forward a host of budget containment efforts to reduce their respective Medicaid appropriations. During FYs 1981 and 1982, Medicaid programs were cut severely in thirty-five states; dental services were reduced in twenty-two states; funding for drugs, prosthetic devices, medical supplies and equipment was curtailed in thirty-one states. Indeed, the list of reductions in the many states seemed endless.¹

As the Reagan administration draws to a close and Medicaid data are available for most of his presidential tenure, it is now possible to review,

- The general changes in the Medicaid program.
- The particular impact of these changes on Medicaid dentistry.

MEDICAID: WHAT IS IT?

Title XIX of the Social Security Act (known as Medicaid) provides for a program of medical assistance for certain

low-income individuals and families. The program, which became federal law in 1965, is funded jointly by the federal and state governments and is administered by states under broad federal guidelines.

The percentage paid by the federal government is determined each year by a formula using the average per capita income level of each state as compared with the national level. In 1986, the percentage varied from 50 to 78.42 percent (the average was 55 percent). The eligibility requirements, benefits structures, and the Medicaid program differ significantly from state to state. As a result of these differences, population composition and the population number, five states (New York, California, Michigan, Pennsylvania and Illinois) accounted for almost 50 percent of the Medicaid program's total expenditures in 1986.³

Eligibility

There are certain groups of individuals who must be included in a state's Medicaid plan. These mandatory "categorically needy" groups are:

- Recipients of AFDC.
- Pregnant women and children under age five who meet the AFDC rules.
- Supplemental Security Income (SSI) recipients (or aged, blind, and disabled individuals who meet more restrictive requirements for eligibility).
- Recipients of Title IV-E adoption assistance and foster care.
- Special protected groups (usually individuals who lose cash assistance because of the cash program's rules, but who keep Medicaid).

Table 1 □ Federal and state expenditures for Medicaid vendor services: selected fiscal years 1975-1987.⁶⁻⁹

Fiscal Year*	Number of persons below poverty line (in millions)	Number of recipients (in thousands)	All services				
			Expenditures (in millions)	Expenditure per recipient	Consumer price index (1967 = 100)	Constant dollars	
						Total expenditures (in millions)	Expenditures per recipient
1975	25.9	22,077	\$12,242	\$556	161.2* *	\$7,594	\$345
1980	29.3	21,605	23,311	1,078	246.8	9,445	437
Reagan administration							
1981	31.8	21,980	27,204	1,237	272.4	9,986	454
1982	34.4	21,603	29,399	1,306	289.1	10,169	471
1983	35.3	21,554	32,391	1,503	298.4	10,854	504
1984	33.7	21,607	33,891	1,568	311.1	10,893	504
1985	33.1	21,808	37,508	1,720	322.2	11,641	534
1986	32.4	22,405	40,878	1,825	328.4	12,447	556
1987	na	23,184	45,170	1,948	340.4	13,270	572

*The federal fiscal year begins on October 1. The numbered year represents the year in which it ends. Thus fiscal year 1981 runs from October 1, 1980 to September 30, 1981.

**1975 CPI is for Urban Wage Earners and Clerical Workers. All other years, CPI are for All Urban Consumers

In addition, states have the option to provide Medicaid coverage with matching federal funds for other categorically needy groups. These include:

- Children up to age twenty-one with income and resources below cash assistance program limits.
- Pregnant women, children under age five, and aged, blind and disabled persons who have incomes or assets above the "mandatory" levels, but below the federal poverty level.
- Recipients of optional state supplementary payments.
- Institutionalized individuals with income and resources below specified limits.
- Persons receiving care under home and community based waivers.
- "Medically needy" persons (an individual or family having income in excess of a state's prescribed income standard but who has incurred medical and/or remedial care expenses sufficient to establish Medicaid eligibility).³

Services

Specific basic services must be offered in any state Medicaid program. These include:

- Inpatient hospital services.
- Outpatient hospital services.
- Laboratory and x-ray services.
- Skilled nursing facility services for individuals aged twenty- one and over.
- Home health care for a person eligible for skilled nursing services.
- Physician services.
- Family planning services.
- Rural health clinic services.
- Nurse mid-wife services.
- Prenatal care.
- Early periodic screening, diagnosis and treatment (EPSDT) services for individuals under age twenty-one.

In addition, states may elect to provide up to thirty other optional services (such as dental services, hospice care, personal care, etc.) and receive federal matching funds. The most common optional services are:

- Nursing home care in intermediate care facilities (ICF) for the aged and disabled.
- ICF care for the mentally retarded.
- Skilled nursing care for those under age twenty-one.
- Emergency hospital services.
- Prescription drugs.

- Clinic services.
- Optometric services.
- Eyeglasses.³

Cost-sharing by recipients

States may impose a small copayment, deductible and/or coinsurance on Medicaid recipients (except for children under age eighteen, hospital or nursing home patients and categorically needy HMO enrollees) for some services. As of 1986, twenty-six states had instituted some form of cost sharing program.³

Medicaid-Medicare relationship

Medicaid supplements the Medicare program coverage and provides several basic services for the elderly and disabled dual-eligibility person. Federal guidelines require states to pay for specific items for a dual-eligibility person, including: the deductible and copayment amounts for the part A portion of Medicare (Hospital Insurance) and to "buy-in" (i.e. pay the premiums) for the Part B portion of Medicare (Supplementary Medicare Insurance).

Payments

Medicaid operates as a vendor payment program. Payments are made directly to the providers of services. Providers must accept the Medicaid reimbursement as payment in full.

MEDICAID TRENDS

The Medicaid program was established primarily as a program to provide medical services for poor children and their single mothers. In the almost twenty-five years since its establishment, however, Medicaid has evolved into a far more complex program. Expenditures for nursing homes (skilled, intermediate care and care for the mentally retarded) have increased far in excess of all other services. For example:

- Approximately a half of Medicaid recipients nationwide are children, making them the single largest coverage population. In FY 1985, ten million children received Medicaid services. The \$5 billion expended for these children, however, constituted only 13 percent of the overall Medicaid budget.⁴
- In FY 1986, long-term care services were provided to 14.5 percent of the total Medicaid population, but they accounted for 42.7 percent of all Medicaid expenditures.³

MEDICAID RECIPIENTS AND EXPENDITURES

The Reagan administration early years

Since the start of the Medicaid program in 1966, there has been dramatic growth in the overall payment for health-care services. The expenditure of \$.3 billion in the first year of the program, increased to \$45.1 billion to provide services to 23.1 million people in FY 1987 (Table 1).

The programmatic changes developed to control federal Medicaid expenditures during the first years of the Reagan administration occurred at a time when there was an annual increase in the number of persons below the federally defined poverty line (reflecting the changing economics during the last recession in the late 1970s and early 1980s). Thus, despite an increase in the number of poor people in the country between FYs 1981 and 1983, (from 31.8 million to 35.3 million individuals) the number of people who received Medicaid services decreased from almost 22 million to 21.5 million individuals (Table 1).

In addition, after an increase between calendar 1980 and 1981 in the federal government's share of Medicaid expenditures, in the following year, the federal government's share of Medicaid matching funds shrank from 55.2 percent to 52.2 percent (Table 2). This was reflected in a decrease between FYs 1981 and 1982 in constant dollar (i.e. removing the effects of inflation) total federal expenditures for Medicaid (Table 3). By FYs 1983 and 1984, constant dollar expenditures per recipient did not change. Current and constant dollar total federal, state and local Medicaid expenditures, however, did continue to increase (Table 1). Thus, in the early years of the presidency, despite an increase in the number of poor

people in the country and an inability to hold down total national program costs, the Reagan administration was able to meet some of its goals: reduction in the number of recipients, holding the line on expenditures (at least on a per recipient basis) and some shifting of the financial burden to the state and local governments.

The Reagan administration later years

The "success" of the efforts in the early 1980s, however, to control and reshape the Medicaid program did not continue into the later years of the presidency. For example:

- Despite a progressive decrease between FYs 1983 and 1986, in the number of individuals below the poverty line, the number of Medicaid recipients increased.
- Each year since FY 1982, the federal share of Medicaid expenditures has increased.
- Each year since FY 1984, the constant dollar expenditure per recipient has increased.
- During each year of the presidency, total federal, state and local government constant dollar expenditures have increased; and most important from the administration's perspective,
- Since FY 1983, federal government constant dollar expenditures have increased (Tables 1-3).

ELIGIBILITY AND SERVICE EMPHASIS

By the time the Reagan administration attempted modifications to establish control over the burgeoning Medicaid program, the transformation already had occurred from a system to provide medical services for poor children and their single mothers, to one that emphasized

Table 2 □ Total Medicaid personal health service expenditures by federal, state and local sources of funds and percent federal expenditures: calendar year 1980-1986.¹⁰⁻¹⁵

Calendar year	Expenditures			Percent federal
	Federal	State & local	Total	
(In billions)				
Reagan administration				
1980*	\$13.6	\$11.6	\$25.2	53.9%
1981	16.4	13.3	29.7	55.2
1982	16.9	15.5	32.4	52.2
1983	18.1	15.8	33.9	53.4
1984	19.7	17.0	36.7	53.7
1985	21.9	17.9	39.8	55.0
1986	24.2	19.3	43.5	55.6

*Much of fiscal operations for calendar year 1980 would have been established during the final stages of the Carter administration.

Table 3 □ Current and constant dollar federal Medicaid expenditures for selected fiscal years: 1975-1987.⁸

Fiscal year	(In millions)	
	Current dollars	Constant dollars
1975	\$ 6,184	\$4,248
1980	14,028	5,684
Reagan administration		
1981	16,948	6,222
1982	17,391	6,016
1983	18,985	6,362
1984	20,061	6,448
1985	24,995	7,611
1986	26,700	7,844
1987*	26,700	7,844

*Estimates

Table 4 □ The percent distribution of federal and state Medicaid expenditures by eligibility category: selected fiscal years: 1975-1986.⁶⁻⁹

Fiscal year	Aged 65 & over	Blind	Disability	Dependent child (< 21 yrs)	Adult in family with dep. child	Other	Total
1975	35.6%	0.8%	24.9%	17.8%	16.8%	4.0%	99.9%
1980	37.5	0.5	32.2	13.4	13.9	2.6	100.1
Reagan administration							
1981	36.5	0.6	34.2	12.9	13.8	2.0	100.0
1986	36.9	0.7	35.7	12.5	11.9	2.4	100.1
1987	35.7	0.7	36.5	12.3	12.4	2.4	100.0

Table 5 □ The percent distribution of total federal and state Medicaid benefit expenditures by type of service: fiscal years 1975, 1981, 1987; and percent change between 1975-1981 and 1981-87.⁶⁻⁹

Service category	FY	FY	FY	Percent change	
	1975	1981	1987	1975-1981	1981-1987
Gen. hosp in-patient	27.5	26.4%	25.0%	- 4.0%	- 5.3%
Intermediate care facil.	18.5	27.8	28.7	50.2	3.2
Skilled nursing home	19.8	14.8	13.2	-25.3	-10.8
Physician services	10.0	7.7	6.2	-23.0	-19.4
Dental services	2.8	1.9	1.2	-32.1	-36.8
Prescribed drugs	6.7	5.6	6.6	-16.4	17.9
Other services*	14.7	15.8	19.1	7.5	20.9
Total	100.0%	100.0%	100.0%		

*Includes services in or associated with the following categories: mental hospitals, other practitioners, clinics, laboratories, home health, family planning and other care.

Table 6 □ Federal and state constant dollar expenditures for various Medicaid vendor services per recipient: selected fiscal years: 1975-1987.^{6,7,9}

Fiscal year	Constant dollars				
	Physician services	Skilled nursing homes	Intermediate care facilities	Inpatient general hospital	Prescribed drugs
1975	\$50.00	\$2,396	\$1,220	\$610	\$35.71
1980	55.19	2,463	2,757	706	38.96
Reagan administration					
1981	53.55	2,378	3,017	713	39.53
1982	51.93	2,739	3,196	752	40.83
1983	51.86	2,698	3,358	799	43.22
1984	50.27	2,766	3,458	820	45.40
1985	50.60	2,878	3,490	854	51.16
1986	52.33	3,019	3,688	891	55.74
1987	53.27	3,058	3,846	878	58.23

long-term care services. By FY 1980, 37.5 percent of all Medicaid expenditures were provided for the aged, 32.2 percent for the disabled, and 13.4 percent for services provided to dependent children under twenty-one years. Throughout the Reagan years, the proportionate distribution of funds for aged recipients remained relatively constant; continued the long-term increase for the disabled; and continued the long-term decrease for dental services (Tables 4,5).

Similarly, the distribution in the type of services provided had undergone significant changes prior to the Reagan administration. In the six years preceding the Reagan presidency, the share of funds for intermediate care facilities had increased by 50.2 percent. During the same period, the dental service share of funds was reduced by 32.1 percent; physician services share was reduced by 23.0 percent; skilled nursing home care by

25.3 percent; and prescribed drugs by 16.4 percent. Changes continued in the service proportion of Medicaid funds expended during a comparable period in the Reagan years. These changes, however, generally were smaller or in those categories for which lesser funds were involved (Table 5).

Finally, reflecting the changing emphasis in the eligibility categories during the Reagan years, constant dollar expenditures per recipient for physician services fluctuated slightly; but increased markedly for skilled nursing service, intermediate care facilities, inpatient general hospital care and prescribed drugs (Table 6).

MEDICAID DENTISTRY

Since the mid-1970s, dental service expenditures have represented the smallest of the identified service cate-

Table 7 □ Federal and state expenditures for Medicaid vendor services: selected fiscal years 1975-1987.^{6,7,9}

Fiscal year	Expenditures (in millions)	Number of recipients (in thousands)	Dental services		
			Expenditures per recipient	Constant dollars	
				Total expenditure (in millions)	Expenditure per recipient
1975	\$339	3,944	\$ 85.95	\$210.3	\$53.32
1980	462	4,652	99.31	187.2	40.23
Reagan administration					
1981	543	5,173	104.97	199.3	38.53
1982	492	4,868	101.07	170.1	34.96
1983	467	4,940	94.53	156.5	31.68
1984	469	4,942	94.90	150.8	30.50
1985	458	4,634	98.83	142.1	30.67
1986	529	5,143	102.85	161.0	31.31
1987	541	5,120	105.66	158.9	31.04

gories. Yet, in FYs 1975-1981 (the Ford and Carter presidencies) and FYs 1981-1987 (the Reagan presidency), as compared to all other service categories, the dental service share of total Medicaid expenditures experienced the greatest percent loss (-32.1 percent and -36.8 percent respectively) (Table 5).

While spending for Medicaid dentistry constitutes a minor component of total national dental expenditures (in calendar year 1986, total Medicaid dental spending represented 1.8 percent of national dental expenditures), it must be emphasized that the Medicaid program was established to provide increased access to the poor.¹⁴ Thus any decrease in number of recipients or in expenditures affects that segment of the population which can least afford the reduction in services. And the decreases in Medicaid dental services have been significant. Between FYs 1981 and 1985, there were decreases in

- The number of recipients.
- Total constant dollar expenditures.
- Constant dollar expenditures per recipient.

In fact, between FYs 1981 and 1984, there was an annual decrease in current dollar total expenditures and expenditures per recipient. Only between FYs 1985 and 1986 has there been a noticeable constant dollar increase in expenditures; and this decreased in the following year (Table 7).

Added to (or because of) the evolving spending pattern for dental services, has been a variety of difficulties in providing dental services under the Medicaid program. For example, the State of New York (which annually has expended more total funds than any other state for all Medicaid services and more funds for total Medicaid services per recipient) did not increase its

dental fee schedule between 1966 and 1985.^{16,17}

Yet, as we consider the realities of Medicaid dentistry in the years of the Reagan administration, we should recall the events (almost twenty-five years ago) when the American Dental Association lobbied "successfully" for the inclusion of dentistry within the Medicaid program rather than the Medicare program.

In the middle of the 1960s, during the Congressional review of the then pending Medicare and Medicaid legislation, the American Dental Association opposed the inclusion of dental care under the national Medicare program.

"At a time of major expansion of federal legislation into health and social welfare programs... the Association preferred, for the then perceived long-term political, professional, and community health benefits, to follow the path of optional, individual, state initiated programs under the umbrella of Medicaid."¹⁸

Looking back with almost twenty-five years of hindsight, we may wonder whether the profession selected the wrong option at a crucial point in the nation's legislative history and hence may have contributed to the difficulties currently facing the profession. For example, if dentists had joined their medical colleagues in their reluctant involvement with the Medicare program, "denturism in the United States may never have gained public support as an economic solution to the dental needs of the elderly..."¹⁸

On a state-by-state basis

As a result of differences in state Medicaid programs, state population size and state population composition, there are marked variations in the Medicaid dental pro-

Table 8 □ Fiscal year 1987 current dollar expenditures and percent change for constant dollar expenditures FYs 1981-1987 per Medicaid dental recipient by state; and number of children who received dental service in fiscal years 1987 and percent change in number of children who received care in FYs 1981-1987.^{7,9,19}

	Current dollar expenditure per dental recipient	Percent change constant dollar expenditure per dental recipient	Medicaid dental recipients percent change	
			Children	
			Adults and children	Children
	FY 1987	FYs 1981-1987	FY 1987	FYs 1981-1987
United States	\$105.66	-19.4%	na	na
Alabama	93.1	-34.5	37,431	-13.5%
Alaska	372.38	41.7	5,857**	4.1
Arizona*	—	—	—	—
Arkansas	121.76	-20.1	25,908	-34.7
California	85.76	-49.9	630,594**	4.6
Colorado	63.45***	-40.4***	24,477	4.4
Connecticut	73.53	-34.3	38,569	na
Delaware	79.52	-11.0	4,439	-46.2
Dist. of Col.	70.16	-48.1	10,342	- 2.9
Florida	96.30	-35.3	52,994	- 9.0
Georgia	135.26	0.2	74,406	4.6
Hawaii	154.25	-41.6	na	na
Idaho	103.61	-35.7	20,685	93.9
Illinois	94.47	-36.3	na	na
Indiana	144.01	- 7.5	20,000	-53.2
Iowa	160.19	-23.6	na	na
Kansas	155.08	-13.9	62,253	na
Kentucky	88.48	-27.3	54,732	na
Louisiana	158.49	-19.8	59,999	na
Maine	77.78	-19.6	30,449	- 3.7
Maryland	63.12	-28.2	49,805**	- 9.9
Massachusetts	127.36	-10.9	na	na
Michigan	95.91	-31.3	209,482	na
Minnesota	105.79	-27.5	69,683**	na
Mississippi	85.96	-13.4	187,496***	327.6
Missouri	87.64	-53.8	na	na
Montana	161.79	-29.7	3,063	-64.4
Nebraska	93.30	-34.5	16,674	37.7
Nevada	304.78	5.3	2,248**	-40.8
New Hampshire	68.47	-34.2	4,401	-46.9
New Jersey	122.51	-13.4	112,579**	-14.4
New Mexico	326.59	155.9	12,190	-20.6
New York	122.19	31.1	119,136****	na
North Carolina	126.76	-26.9	52,398	-13.0
North Dakota	184.48	-39.4	6,151	-12.1
Ohio	102.47	8.8	na	na
Oklahoma	102.24	-45.9	16,173**	-46.1
Oregon	109.75	-47.7	na	na
Pennsylvania	80.03	-39.7	na	na
Rhode Island	75.64	-44.0	na	na
South Carolina	82.96	-34.9	35,031	- 2.6
South Dakota	99.82	-41.9	5,265	na
Tennessee	132.81	6.6	56,615	53.7
Texas	70.47	-61.6	106,618	83.7
Utah	105.68	-35.3	12,000	853.1
Vermont	85.39	-17.8	10,873	-17.4
Virgin Islands	57.51	78.5	na	na
Virginia	85.20	-28.6	50,077	-18.7
Washington	146.51	-36.9	63,283	-21.3
West Virginia	98.70	2.8	55,622	83.3
Wisconsin	67.54	-52.3	70,315	-34.8
Wyoming	156.99	-35.5	5,759	82.7

*The State of Arizona established a competitive bid per capita system which differs from other traditional Medicaid state programs.

**Fiscal or calendar year 1985.

***Fiscal or calendar year 1986.

****Fiscal year 1984.

grams. In FY 1987,

- The number of recipients of Medicaid dentistry varied from: Virgin Islands, 1,487; and Wyoming, 5,697 to: New York, 742,069; and California, 968,100.
- Total expenditures for Medicaid dentistry varied from: Virgin Islands, \$85,516; and Idaho, \$663,002 to: California, \$83.0 mil; and New York, \$90.7 mil.

- Expenditures per recipient for Medicaid dentistry varied from: Virgin Islands, \$57.51; and Maryland, \$63.12 to: New Mexico, \$326.59; Alaska, \$327.38⁹ (Table 8).

Between FYs 1981 and 1987, there was a 19 percent national decrease in constant dollar expenditures per dental recipient (Table 8). This decrease in Medicaid dentistry was reflected in the changes in state Medicaid

dental programs. Between FYs 1981 and 1987:

- Twenty-two states and the District of Columbia decreased current dollar expenditures per Medicaid dentistry recipient.
- Forty-one states and the District of Columbia decreased constant dollar expenditures per Medicaid dentistry recipient.
- Some states reported large increases in the number of children receiving Medicaid dental services (e.g. Utah and Mississippi). Twenty-one and thirty-three states, however, (for which FYs 1981 and 1987 data are available from the American Dental Association) reported decreases in the number of children receiving Medicaid dental services.

In addition, by FY 1987, twenty-five states, the District of Columbia and the Virgin Islands expended less than \$100 per Medicaid dentistry recipient (adult and/or child) (Table 8).

Future prospects for Medicaid dentistry

Overall national expenditures for dental services are expected to reach \$42 billion in 1990 and \$90 billion in the year 2000, up from approximately \$30 billion in 1986 (or an average annual growth of 8.2 percent). It is expected that private health insurance will continue to finance a relatively constant share of costs and that the number of dentists per capita will remain relatively constant.¹⁵

Between 1981 and 1986, federal, state and local government annual expenditures for Medicaid dental services were approximately \$500 million. In addition, approximately another one hundred million dollars were spent annually for other public health dental programs. In all, government annual expenditures for dental services have represented an outlay of approximately \$600 million, or less than 2 percent of national dental expenditures.¹⁰⁻¹⁴

Between 1990 and 2000, minimal changes are expected in total government outlay for dental services. In 1990, total government outlay for all dental services is expected to reach \$.8 billion; \$.9 billion in 1995; and \$1.1 billion in 2000. But these minor increases in expenditures will progressively represent a smaller percent of the total national dental expenditure. In 1986, total government spending for dental services represented 1.8 percent of total national expenditures for dental services. By 2000, government expenditures for dental services are expected to decrease to 1.2 percent of total national dental expenditures.¹⁵

GENERAL PERSPECTIVE AND COMMENTARY

"In the present crisis...government is the problem." (1981) "...this budget proposes reforms to limit the costs and future growth of ... Medicaid ..." (1986)^{1,2} Despite these words by President Reagan, the projections through the rest of the twentieth century indicate that the Reagan administration has been unable to curtail significantly the growth of the Medicaid program. During the next decade Medicaid funding will continue to cover the same approximate 10 percent of national health expenditures.¹⁵

A major effort was made by the administration in 1982 to increase state and local responsibility for the Medicaid program. "New Federalism" was to be a \$20 billion exchange, with the federal government assuming responsibility for Medicaid, and the states taking over welfare and food stamps and accepting a "turnback" of forty-three federal programs. After a year of tough bargaining between the federal and state governments, efforts to establish "New Federalism" exchange failed.¹

While published Health Care Financing Administration projections do not differentiate between Medicare, Medicaid and other public health expenditures, the overall federal share of national health spending is projected to rise from 29.4 percent in 1986 to 32.6 percent in 2000. The state and local share is projected to continue to decline from 12.0 percent in 1986 to 9.9 percent in 2000.¹⁵ This increase in the federal share, to some degree, reflects the aging of the population and federal government's burden under the Medicare program. State and local governments, however, will continue their responsibilities under the Medicaid program.

As this material is being prepared in mid-1988, Congress is considering a major revision of the nation's approach to welfare programs. Whether the legislation is enacted and significantly affects the numbers of welfare recipients, it would seem that the effects on the Medicaid program will not be substantial. The proposed legislation is essentially a "work-fare" program for the younger end of the age spectrum, while Medicaid increasingly affects long-term care and the older population.

The impact of the Reagan administration on Medicaid dentistry has been both real and subtle. At times, specific efforts to limit federal expenditures has resulted in real cutbacks on dental services at the state level. But of more significance has been the setting of a climate which encourages and permits reductions of dental services for the poor, for whom dental services traditionally have been limited and for whom there are few if any alternatives.

Since the early 1960s, reports from the National Health Interview Survey have documented the disparity in dental visits reported for children from low-income families. For example, in 1986, between 50 and 60 percent fewer children from low-income families, than children from high-income families, had visited a dentist in the previous year.²⁰ The difference must be considered in light of the reports from the 1986-1987 national study of dental disease, which continue to demonstrate that there were higher decay rates among poor children.²¹

But Medicaid dentistry could be moving in a new direction. As the program increasingly provides services to the aged and those with long-term service needs, the able lobbying activities of the American Association of Retired People (AARP) and other advocate groups for older population, may be directed to support dentistry for their constituency under the Medicaid program. "... a program designed by the rich to tax the middle class to fund services (just) for the poor is not likely to enjoy long-term political attractiveness."²³

Such efforts directed at the state level (the point at which elective Medicaid services are initiated) could be more successful than the American Dental Association's effort to encourage the Congress to increase government support for dentistry under the Medicare program.

In summary, the efforts by the Reagan administration have not produced the desired decreases in Medicaid expenditures and federal government responsibilities. Instead the future of Medicaid ("...the single most important health program for low-income children, accounting at one time for over 55 percent of all public health expenditures for children ...") has changed.²² The future of the program would seem to be with the older and disabled populations. But what of Medicaid dentistry? And what of the 12.3 million children who live below the federally defined poverty line?

REFERENCES

1. Reagan, R.W.: First Inaugural Address; in Dallek, G. Who cares for health care? The first two years of Reagan Administration health policy. *Health/Pac Bull*, 14:7-17, January- February, 1983.
2. New York Times, February 6, 1986, p B12.
3. Social Security Administration. Medicaid program summary (as of July 1, 1987). *Social Security Bulletin, Annual Statistical Supplement*, 1987. Washington, D.C., Government Printing Office, December, 1987, pp 40-41.
4. Rymer, M.P. and Adler, G.S.: Children and Medicaid: the experience in four states. *Health Care Fin Rev*, 9:20, Fall, 1987.
5. U.S. Department of Health, Education and Welfare. Data on the Medicaid Program: Eligibility, Services, Expenditures: Fiscal Years 1966-78. Pub. No. (HCFA) 78-24523. Washington, D.C., Institute for Medicaid Management, 1978.
6. Social Security Administration. *Social Security Bulletin: Annual Statistical Supplement*, 1987. *Statistical Tables*: pp 252-255. Washington, D.C., Government Printing Office, December, 1987.
7. *Social Security Bulletin. Statistical Tables*. 51:63-64, April, 1988.
8. U.S. Department of Commerce. *Statistical Abstract of the United States*: 1985; 1986; 1987; 1988. Washington, D.C., Government Printing Office, December 1984; 1985; 1986; 1987.
9. U.S. Department of Health and Human Services, Health Care Financing Administration. Medicaid Recipient and Expenditures Data Tables for FY 1981 and 1987 submitted on the annual HCFA-2082 report. Personal Communication with the Medicaid Statistics Branch, June, 1988.
10. Gibson, R.M. and Waldo, D.R.: National health expenditures, 1980; 1981; 1982. *Health Care Fin Rev*, 3:1-54, September, 1981; 4:1-35, Fall, 1982; 5:1-31, Fall, 1983.
11. Gibson, R.M. *et al*: National health expenditures, 1983. *Health Care Fin Rev*, 6:1-29, Winter, 1984.
12. Levit, K.R. *et al*: National health expenditures, 1984. *Health Care Fin Rev*, 7:1-35, Fall, 1984.
13. Lazenby, H. *et al*: National health expenditures, 1985. *Health Care Financing Notes*, No. 6. HCFA Pub. No. 03232, September, 1986.
14. HHS News. June 23, 1987.
15. Division of National Cost Estimates. National Health expenditures, 1986-2000. *Health Care Fin Rev*, 8:1-36, Summer, 1987.
16. DSSNY Capitol Report: Medicaid fee increase implemented. *NY State Dent J*, 51:178, March, 1985.
17. U.S. Department of Health and Human Services. Grants and Contracts Report; short-term evaluation of Medicaid: selected issues. Pub. No. HCFA 03186. Baltimore, Health Care Financing Administration, 1984; in Donabedian, A. *et al. Medical Care Chart Book*, Eighth Edition. Ann Arbor, Health Administration Press, 1986.
18. Waldman, H.B.: Denturism in the 1980s: an irony of history? *JADA*, 100:17-21, January, 1980.
19. Council on Dental Care Programs. *Dental Programs in Medicaid: Report of a Survey*. Chicago: American Dental Association, 1982; 1987.
20. U.S. Department of Health Interview Survey: United States, 1986. Data from the National Health Interview Survey, Series 10, No. 164. DHHS Pub. No. (PHS) 86-1250. Washington, D.C., Government Printing Office, October, 1987. (Additional unpublished data from the 1986 study were supplied to the author by the National Center for Health Statistics.)
21. Leary, W.: Survey finds sharp drop in tooth decay in young. *New York Times*, June 22, 1988, A1.
22. Rosenbaum, S. and Johnson, K.: Providing health care for low-income children; reconciling child health goals with child health financing realities. *Milbank Mem Quart*, 64:442-478, 1986.
23. Friedman, E.: Indigent care: where the market place fails. *Hospitals*, 59:48-52, August 1, 1985.

Table 1 □ Number and percent of poor persons by age: 1975, 1980, 1983, 1986.^{2,3}

	Number (in millions)				Percent			
	1975	1980	1983	1986	1975	1980	1983	1986
Total population	25.9	29.3	35.3	32.4	12.3%	13.0%	15.2%	13.6%
Children under 18	10.9	11.1	13.3	12.3	16.8	17.9	21.7	19.8
In families with:								
Male householder*	5.3	5.2	6.6	5.3	9.8	10.4	13.4	10.8
Female householder	5.6	5.9	6.7	6.9	52.7	50.8	55.4	54.4
18-54 years	9.7	12.2	15.8	14.5	9.2	10.5	13.0	11.4
55-64	2.0	2.1	2.4	2.2	10.2	9.5	10.9	10.0
65 and over	3.3	3.9	3.7	3.5	15.3	15.7	14.1	12.4
In families	1.2	1.4	1.4	1.2	8.0	8.5	8.1	6.2
Unrelated individuals:								
Men	.4	.4	.4	.4	27.7	24.4	22.1	19.6
Women	1.7	2.0	1.9	1.9	31.9	32.3	27.7	26.8
Less than 6 years								22.1
6-17 years								8.1

*Includes children in families with both spouses present and in families with male householder with no spouse present.

Table 2 □ Percent of the population below the poverty line by age, race and Hispanic origin: 1986.²

Age	All	White	Black	Hispanic*
Less than 16 yrs	21.0%	16.5%	43.8%	38.4%
16-21 yrs	16.6	13.2	34.7	27.7
22-44 yrs	10.8	9.0	23.4	21.4
45-64 yrs	9.1	6.6	22.3	19.1
65 & over	12.4	10.7	31.0	22.5
Total	13.6	11.0	31.1	27.3

*May be of any race

children are one-and-one half to three times more likely to die in childhood.⁷⁴

HEALTH ECONOMICS AND POLITICS

"Elderly middle-class Americans and their families will be the first to benefit from legislation meant to shield Medicare recipients from ruin by huge medical bills..."⁷⁵

"...from ruin by huge medical bills..." This single phrase has been the driving force behind almost twenty-five years of the Medicare program. And yet, until the 1988 passage of the catastrophic expense extension to the Medicare program, limited attention had been directed to the wide variations in the economic stability of the sixty-five-and-over population. Only now will there be some correlation between income and Medicare insurance premiums.

But what of the children? "Unfortunately," children do not vote; young adults seldom exercise the franchise; and the elderly do cast their ballots on the first Tuesday after the first Monday of November. In the last presidential election in 1984, 68 percent of those over sixty-five years voted, compared to 37 percent of those under twenty-one years. In 1986, comparable voting rates were 61 percent and 19 percent.² One should not be surprised that legislative attention has been directed to the elderly.

MEDICAL SERVICES

And what of the children? Well, there is always Medicaid. "Ten years ago, Medicaid covered nearly two-thirds of those whose income fell below the poverty level. Now, Medicaid covers less than 40 percent of the poor."⁷⁴ Medicaid, title XIX of the Social Security Act, was established to provide a program of medical assistance for certain low income individuals and families, in particular, poor children and their single mothers.

In 1986, 25 percent of all children (seventeen million children) had no health insurance. In addition, 25 percent of women in the "key child bearing years" had no

insurance.⁴ The lack of adequate insurance, and in turn, "...health care during pregnancy increases the risk that a baby will be born below normal birthweight by 300 percent."⁷⁴ Children born to mothers who receive no prenatal care are three times more likely to die in their first year.⁴

Efforts during the early years of the Reagan administration resulted in a substantial reduction of programs for the poor and a continuation of changes that had been initiated during the 1970s. The result has been a redirection of the program: such that expenditures for nursing homes (skilled, intermediate care and care for the mentally retarded) have increased far in excess of all other services. For example:

- Approximately a half of Medicaid recipients nationwide are children, making them the single largest coverage population. In fiscal year (FY) 1985, 10 million children received Medicaid services. The \$5 billion expanded for these children, however, constituted only 13 percent of the overall Medicaid budget.⁶
- In FY 1986, long-term-care services were provided to 14.5 percent of the total Medicaid population, but they accounted for 42.7 percent of all Medicaid expenditures.³

It is significant to note that in most federal reports, there is a direct relationship between increasing income and use of health services, except for families with incomes between \$10,000 and \$19,999. The decreases in the use of services by this economic group may reflect the economic difficulties faced by those families with incomes slightly above Medicaid income limits. Thus children in low-income families may receive more needed health services that are unavailable to children in slightly higher income families.

GENERAL MEDICAL NEEDS AND PREVENTIVE SERVICES

Improvements have occurred in the many areas of health services. Nevertheless:

- While infant mortality rates continued to decline between 1980 and 1985, the black infant mortality rate in 1985 remained higher than the 1970 rate for white infants.²
- Substantial variations in infant mortality rates continue to exist amongst the states. In 1985, the black infant mortality rate ranged from 12.4 deaths per 1,000 live births in the State of Arizona to 25.8 deaths per 1,000 live births in the State of Delaware. The comparable mortality range for whites was 8.1 in the State of Rhode Island to 12.2 in the State of Wyoming. Thus, the lowest black infant mortality rates were higher than the highest white rates.²
- In 1985, a third or more of white children and more than a half of nonwhite children between one and four years of age had not received measles, mumps, rubella, polio, and diphtheria-tetanus-pertussis immunizations.² Between 1983 and 1984, there was a 69 percent increase in the number of cases of measles reported. The Center for Disease Control estimated that three quarters of the cases among children sixteen months to four years of age were preventable.⁴
- The number of children below thirteen years of age with AIDS increased from thirteen new cases in 1982 to 317 new cases in 1987.⁷
- In 1986, the 303 acute medical conditions per 100 children under fifteen years of age was more than two and a half times the rate for the sixty-five and over population.⁷
- In 1986, children in poorer families, as compared to children in higher income families, had fewer physician contacts, had more admissions to hospitals, and fewer were reported to be in "excellent health".⁸

AND WHAT OF DENTISTRY?

Again, there have been improvements, but:

- Between FYs 1981 and 1987, twenty-one of thirty-three states (for which data are available from the American Dental Association) reported decreases in the number of children receiving Medicaid dental service.⁹
- In 1986, between 50 and 60 percent fewer children from low income families, than children from higher income families, had a dental visit in the previous year.⁸
- From 1983 to 1986, a greater percent of white children, as compared to their black counterparts, had dental visits in the previous year. In 1986, despite

Table 3 □ Percent of all children with a dental visit within the past year by race and age: 1983 and 1986.^{8,10}

	1983	1986
Race		
White		
2-4 yrs	29.2%	32.1%
5-11 yrs	69.7	73.4
12-17 yrs	70.2	72.9
Black		
2-4yrs	25.4	26.0
5-11 yrs	53.8	57.2
12-17 yrs	48.4	54.6

an increase in the percent of white and black children with reported dental visits in the previous year, a smaller percent of black children had reported dental visits than their white counterparts had reported in 1983 (Table 3).

- Many of the children eligible for Medicaid dental services did not receive necessary care. For example, in FY 1984, only 15.5 percent of the more than 70 thousand children in the District of Columbia who were eligible for dental care received at least one service.⁹
- In FY 1987, twenty-four states, the District of Columbia and the Virgin Islands expended less than a hundred dollars per Medicaid dental recipient.¹¹
- Between FYs 1981 and 1987, forty-one states and the District of Columbia decreased their constant dollar (i.e. removing the effects of inflation) expenditures per Medicaid dental recipient.¹¹

And finally, reports from the 1986-87 study of dental disease indicate that despite marked decreases in the rates of dental caries, poor children continue to demonstrate higher decay rates than children from higher income families.¹²

GENERAL CONCERNS

Children's health issues are but a part of the general fabric of concern:

Changing home environment. In 1986, the majority of children five years older or younger lived in households where both parents, or the only present parent, were employed. A majority of women with infants under a year of age were in the workforce.¹³

Child neglect and/or abuse. In 1985, there were 1.3 million reports (may include more than one child per family) of child neglect and/or abuse. In addition, between 1980 and 1985, the rate of child neglect and/or abuse per 1,000 children increased by 150 percent.²

High school dropout. In 1985, there were 176,000 high school dropouts between fourteen and fifteen years

of age; 455,000 between sixteen and seventeen years of age.²

Teenage unemployment. In 1986, almost 40 percent of blacks between sixteen and nineteen years were unemployed.²

Teenage pregnancy and abortions. In 1983, 16,000 females under fifteen years of age had a legal abortion; 411,000, between fifteen and nineteen years of age. In 1985, 9,400 unmarried women less than fifteen years of age gave birth.²

Drug use. In 1985, reports on children between twelve and seventeen years indicated that:

- Almost one quarter of children had used marijuana; 12.5 were current users.
- Fifty-six percent had used alcohol; 31.5 percent were current users.
- Forty-five percent had smoked cigarettes; 15 percent were current users.
- Five percent had used cocaine; 1.8 percent were current users.
- Nine percent had used inhalants; 3.6 percent were current users.²

Automobile accidents. In 1986, more teenagers were killed in car crashes than any other group.⁴

GENERAL THOUGHTS

Perhaps three to five years of additional information is an insufficient period of time to expect significant changes in the many complex health and social issues that affect children. But so much legislative effort has been directed to the needs of the elderly, one could have hoped that this time, (in this election year) it would be the turn of another age-group. I keep forgetting, however, that children do not vote and a lot of the elderly do.

So it does not matter politically that in 1986, 12.3 million children (almost 20 percent of all children below eighteen years) lived in families with incomes below the poverty line. Nor does it seem to matter politically that "low-income" children suffer disproportionately with higher rates of chronic disability, consume poorer nutritional diets and have a lower utilization of medical and dental benefits.^{13,14} Nor does it seem critical that two thirds of seriously disturbed children and adolescents do not get the mental health services they need.⁴

"A list of the concerns about children could be endless, extending to areas of child kidnapping, nutritional status, teenage suicide, child pornography, handicapping conditions, the impact of divorces, etc."¹

But, an extensive array of government and private agencies are directed to improve and maintain the

health, social and economic state of the child and adolescent. In addition, most families direct unceasing energies and uncounted resources to rearing and assuring the well-being of their children. So why the clamor?

The federal government increasingly has recognized the value and need for a uniform national insurance program to respond to the essential requirements of the elderly. So the government, too, should eliminate the "crazy-quilt" approach that exists to provide for the health, social and economic well-being of the youngsters in our nation. Maybe the best approach would be a variant of Medicare — Kiddiecare.

REFERENCES

1. Waldman, H.B.: Are the unmet needs of children overshadowed by our concerns for the aged? *J Dent Child*, 53:267-270, July-August, 1986.
2. U.S. Department of Commerce. *Statistical Abstracts of the United States: 1988*. Washington, D.C.: Government Printing Office, December, 1987.
3. U.S. Department of Health and Human Services. *Social Security Bulletin, Annual Statistical Supplement, 1987*. Washington, D.C.: Government Printing Office, 1987.
4. *Barriers to Health Care/Children's Health*. Hearings before the Committee on Labor and Human Resources, United States Senate, Ninety-Ninth Congress. Washington, D.C.: Government Printing Office, July, 1986.
5. Tolchin, M.: For many, help is near on health costs. *New York Times*, May 31, 1988, p A1.
6. Rymer, M.P. and Adler, G.S.: Children and Medicaid: the experience of four states. *Health Care Fin Rev*, 9:1-20, Fall, 1987.
7. U.S. Department of Health and Human Services. *Health United States, 1987*. DHHS Pub. No. (PHS) 88-1232. Washington, D.C.: Government Printing Office, March, 1988.
8. U.S. Department of Health and Human Services. *Current Estimates from the National Health Interview Survey: United States, 1986*. Series 10, No. 164. DHHS Pub. No. (PHS) 86-1250. Washington, D.C.: Government Printing Office, October, 1987. (Additional unpublished data from the 1986 study were supplied to the author by the National Center for Health Statistics.)
9. Council on Dental Care Programs. *Dental Programs in Medicaid: Report of a Survey*. Chicago: American Dental Association, 1982; 1985; 1987.
10. Jack, S.S.: *Use of Dental Services: United States, 1983*. Advance Data from Vital and Health Statistics, No. 122 DHHS Pub. No. 86-1250. Washington, D.C.: Government Printing Office, August, 8, 1986.
11. U.S. Department of Health and Human Services. *Health Care Financing Administration. Medicaid Recipients and Expenditures Data Tables for FYs 1981 and 1987* submitted on the annual HCFA-2082 report. Personal Communication with the Medicaid Statistics Branch, June, 1988.
12. Leary, W.: Survey finds sharp drop in tooth decay in young. *New York Times*, June 22, 1988, p A1.
13. U.S. Children and Their Families: *Current Conditions and Recent Trends, 1987*. A Report Together with Additional Views of the Select Committee on Children, Youth, and Families. U.S. House of Representatives, One Hundredth Congress. Washington, D.C.: Government Printing Office, March, 1987.
14. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *Nutrition Monitoring in the United States*. DHHS Pub. No. (PHS) 86-1255. Washington, D.C.: Government Printing Office, July, 1986.

Guest Editorial

Once again — and what of the children? An editorial commentary

In 1987, the National Committee to Preserve Social Security (which has fought proposed cutbacks in Social Security and Medicare) led all lobbying groups in expenditures — much of it for direct mailing campaigns aimed at Congressional offices. The \$2.9 million that were expended was only slightly below the \$3 million spent in the previous year.¹ In 1988, the Medicare program was extended to include coverage for catastrophic expenses.²

The Bureau of the Census reported that in 1987, children under eighteen years, made up 40 percent of the general population living in poverty. Individuals sixty-five years and older represented 10 percent of population living in poverty.³ The share of the nonaged population lacking health insurance has grown from 14.6 percent in 1979 to 17.5 percent in 1987. The most significant change was the decline in coverage rates for spouses and children.⁴

A reporting of the efforts to maintain and increase health and social services for the older population could be endless; as would a listing of programs to ensure the safety and well being of our children. But the overall approach of these program efforts is different. Since the mid-1960s, the expansion of the Medicare program has been the cornerstone in our efforts to develop a systematic national approach to meet the needs of the elderly. On the other hand, the efforts by federal, state and local agencies to provide for the necessary services of the young have not evolved into a single unifying program about which the many advocates for the children in our communities can come together, and exert needed lobbying efforts for their constituency.

True, our news media continue to sensationalize the abuse of our children and the absence of needed health and social services by the youth of our nation. And yes, varying layers of our government continue to augment the existing programs and initiate new approaches to ameliorate and/or eliminate the deficiencies faced by the young.

But until such time that a unifying and identifiable national program for the children in our nation is established, most of the efforts to aid our youths will founder in the bureaucracy of conflicting interests.

Call it what you will, "Medicare (for) Junior" or "Kiddiecare" or whatever, the need is for a rallying point for the many advocates of the health and social services for our children. Only by such an approach can we develop the necessary lobbying strength before the legislative and executive branches. How about a National Committee to Preserve Our Children?

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

REFERENCES

1. Lobbyists spend over \$63 million in '87. *New York Times*, August 22, 1988.
2. Tolchin, M.: For many, help is near on health costs. *New York Times*, May 31, 1988.
3. Tolchin, M.: Minority poverty on rise but white poor decline. *New York Times*, August 31, 1988.
4. Health insurance and the uninsured: background data and analysis. *Medical Benefits*, August 15, 1988.

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.

Labial hypoplasia of primary canines in black Head Start children

Epidemiology

William K. Duncan, DDS, MEd
Stephen L. Silberman, DMD, Dr. PH
Aaron Trubman, DDS, MPH

During routine examinations of Mississippi Head Start children, a substantial number of children presented with areas of hypoplasia on the labial surfaces of the mandibular primary canines. Enamel hypoplasia in the primary dentition is quite common.¹⁻⁷ Two localized types of enamel hypoplasia affecting the primary teeth have been described in the literature. The first is a transverse encircling groove often referred to as linear enamel hypoplasia in maxillary primary teeth.^{4,5,7} The prevalence of this lesion in primary maxillary incisors has been recorded as 31 percent by Infante and Gillespie and 43 percent by Sweeney *et al.*^{5,7} The second affects labial surfaces of primary canines and has a different appearance.¹⁻³ Skinner described the defect as a roughly circular hypoplastic enamel patch approximately 1-2 mm in diameter with flat bottom extending partially or completely through the enamel (Figure 1).³ The lesion occurs on the labial surfaces of primary canines at approximately the junction of the gingival and middle thirds of the tooth. Badger found 45 percent of the children he examined had a hypoplastic defect on at least one primary canine with no statistical differences between males and females.¹ Brown and Smith found an

Dr. Duncan is Associate Professor and Chairman, Department of Orthodontics and Pediatric Dentistry; Dr. Silberman is Professor, Department of Diagnostic Sciences; Dr. Trubman is Associate Professor, Department of Diagnostic Sciences, University of Mississippi, School of Dentistry.

overall prevalence of 36 percent, and a higher prevalence in males.² In addition, they found this lesion affected the mandibular canine twice as frequently as the maxillary canine.

The literature on the etiology of this disorder is scarce and confusing. Hypoplasia can result if an injury occurs during the matrix formation of the enamel. Once calcification has occurred no such defect can be produced. Shafer, Hine, and Levy stated that a number of different factors were capable of producing injury to ameloblasts resulting in hypoplasia: for example, nutritional deficiency, exanthematous diseases, congenital syphilis, hypocalcemia, birth injury, prematurity, Rh hemolytic disease, local infection or trauma, ingestion of chemicals, and idiopathic causes.⁸ Linear type hypoplasia has been associated with nutritional deficiency, infections during the first thirty-five days postpartum and premature births, and a possible familial tendency.^{4,5,7} Mellanden *et al* found no significant difference in the prevalence of mineralization defects in primary teeth between low birthweight infants and a reference group.⁶ Noren studied general midsagittal sections of enamel in teeth with macroscopically detectable hypoplasia.⁹ He found the hypoplasia closely associated with the neonatal line and associated it with severe neonatal hypocalcemia. The etiology of labial hypoplasia of primary canines, however, is unique since it is isolated to canines and separate from any similar defect on other primary teeth.^{2,10} Skinner stated that the defect appears to begin at birth, to form over a five-month period, and to be considerably more common in the mandibular teeth. He hypothesized that a systemic etiology would produce hypoplasia on all crowns forming at that time and that a genetic etiology was not supported for two reasons: (1) there was no evidence of the lesion in permanent teeth, and (2) the lesion was relatively ubiquitous. He postulated the cause to be local trauma and related it to the extreme labial position of the developing canine crown, the unusual thinness of the overlying alveolar bone, and the stage of development (about 50 percent formed at birth) of the crown. Physical trauma, beginning at birth, creates the lesion as the labial wall of the alveolar crypt is ineffective in protecting the developing labial surface.

Hypoplastic lesions can become carious (Figure 2). The relationship between hypoplasia and dental caries and the effects of fluoride on this relationship, however, are unclear. The literature on linear hypoplasia has shown a strong correlation between the defect and the development of dental caries.^{1,4,7,10} Johnsen *et al*, however, found only 6.5 percent of the children they examined in fluoridated communities had caries lesions

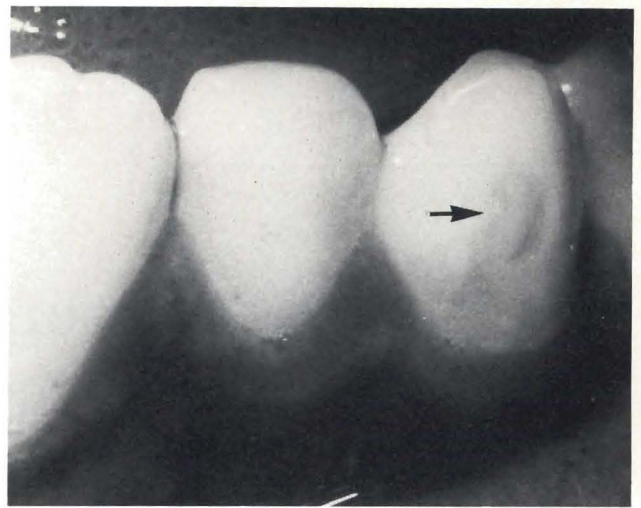


Figure 1. Hypoplastic lesions are characteristically circular with flat bottoms, extending partially or completely through the enamel. The one shown is in a primary mandibular canine tooth.

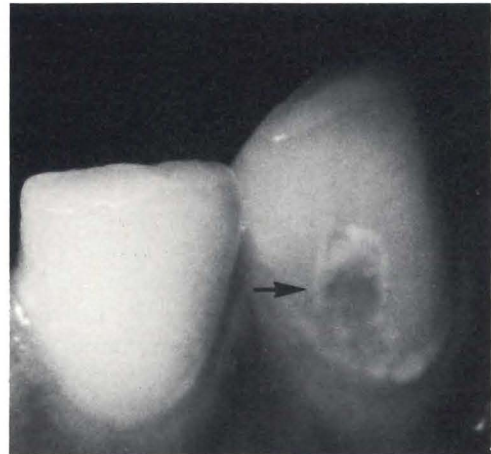


Figure 2. Hypoplastic lesion in a primary canine that has become carious.

in hypoplastic defects.¹¹ In a later study, Johnsen *et al* found similar percentages (5-7 percent) of hypoplastic defects had become carious in four sample groups (urban fluoridated, urban nonfluoridated, non-urban fluoridated, non-urban nonfluoridated).¹²

Johnsen argues that the documentation of the hypoplastic defect on the mandibular primary canine is not sufficient.¹¹ Since areas of hypoplasia may affect the prevalence of caries, this preliminary study is being reported. The purpose of the study is to provide additional documentation to the literature, to determine the prevalence of hypoplasia on the labial surfaces of mandibular primary canines in a black Head Start population, and to report the number of carious hypoplastic lesions in both fluoridated and nonfluoridated communities.

METHODS AND MATERIALS

The population consisted of 334 black Head Start children from four fluoridated and six nonfluoridated communities in Mississippi who presented for needs-assessment examinations. All examinations were performed by the same examiner using a dental mouth mirror, explorer and a light, with the child in a prone position. There were 185 males and 149 females who ranged from three to five years of age. As part of the regimen, the children were examined for hypoplasia of the labial surfaces of the mandibular primary canines. In addition, it was noted whether or not there was caries associated with the lesion. Children were excluded from this study, if restorations were present, as it would be difficult to determine whether hypoplasia had been present.

This study was a substudy of a general dental needs-assessment of Mississippi Head Start children. The Head Start centers chosen for the general study were derived randomly from all centers in Mississippi. This substudy derived its population randomly, i.e., the site was included only when the same examiner and recorder were present.

Two assumptions were made by the authors in regard to fluoridated and nonfluoridated designations of children based on knowledge of the Head Start population in the state. Since the migrating patterns of this sociocultural group are static and residence histories were unavailable, the first assumption was the family had not moved during the child's life. The child in a fluoridated area, therefore, received both systemic and topical effects of water fluoridation throughout his life. The second assumption was the family did not have a water supply independent of the fluoridated community supply. It should also be noted that all children attending a fluoridated Head Start center received the benefits of water fluoridation during the hours at the center.

RESULTS

The results of this study are presented in Tables 1, 2, and 3. Table 1 shows the prevalence of labial hypoplasia in mandibular primary canines of black Head Start children in four fluoridated and six nonfluoridated communities. The prevalence ranges from 28 to 55 percent in fluoridated areas with a mean prevalence of 38 percent. The prevalence in nonfluoridated communities ranges from 25 percent to 45 percent with a mean of 36 percent. Combining all data results in a total of 124 children with the defect and a prevalence of 37 percent.

The prevalence of this lesion for males and females in

Table 1 □ Prevalence of hypoplastic defect by community.

Community	Fluoridated	Defect/Total	Percent
Winona	Yes	13/35	37
Lexington	Yes	5/15	33
Carthage	Yes	15/54	28
Canton	Yes	22/40	55
Total fluoridated		55/144	38
Bruce	No	10/38	26
Fayette	No	24/53	45
Crosby	No	8/19	42
Goodman	No	12/30	40
West	No	5/20	25
McCarley	No	10/30	33
Total nonfluoridated		69/190	36
Grand total		124/334	37

Table 2 □ Prevalence of labial-surface hypoplasia by sex.

	Fluoridated	Non-fluoridated	Total
Males	39%	36%	37%
Females	37%	37%	37%

Table 3 □ Caries associated with the hypoplastic defect.

	Hypoplastic defect	Decayed defect	Percent
Fluoridated	55	14	25
Nonfluoridated	69	18	26
Total	124	32	26

fluoridated and nonfluoridated areas is shown in Table 2. Males demonstrate a 39 percent prevalence in fluoridated areas, 36 percent in nonfluoridated areas, and 37 percent overall. Females demonstrate a 37 percent prevalence in fluoridated areas, 37 percent in nonfluoridated, and 37 percent overall.

The prevalence of caries associated with this hypoplastic lesion is shown in Table 3. In fluoridated communities, 25 percent of the hypoplastic defects became carious; and in nonfluoridated areas, 26 percent of the hypoplastic areas became carious. Combining these data results in thirty-two of 124 defects with caries, for an overall prevalence of 26 percent.

DISCUSSION

The 37 percent prevalence of labial hypoplasia for mandibular primary canines in a sample of black Head-Start children in Mississippi appears to be consistent with the 45 percent prevalence found by Badger and the 36 percent found by Brown and Smith.² This study would also seem to confirm Badger's findings of equal distribution between males and females.

The primary dentition has a pattern of susceptibility

to dental caries which includes in order of decreasing prevalence, the mandibular molars, maxillary molars, maxillary anteriors.¹³ Rarely are the mandibular anterior teeth involved, except in cases of rampant caries. One would expect to find, therefore, a low caries rate of the labial surfaces of mandibular primary canines. There were 210 children in this study who did not have hypoplasia on the labial surfaces of the mandibular primary canines. Eight of these (4 percent) had caries on this surface. This is compared with the data in Table 3, which show that of those children with hypoplasia, 25 percent in fluoridated and 26 percent in nonfluoridated communities had caries on the labial surfaces of the primary canines. Because it appears that the hypoplastic defects have a strong potential to become carious, one should expect the percentage of defects to become carious would continue to increase.

The tables indicate that the presence of communal fluoride has little effect on either the prevalence of the hypoplastic lesion or the potential for the lesion to become carious. There could be long-term effects of communal fluoride, however, which were not shown in this study. The absolute effects could only be determined, if residence histories were obtained and sources of drinking water determined.

CONCLUSIONS

- The prevalence of hypoplasia on the labial surfaces of mandibular primary canines in a black Head Start population is 37 percent.
- These hypoplastic lesions are more susceptible to caries than normal enamel in the same environment.
- Fluoridation appeared to have no effect on the prevalence of this lesion or its subsequent cariogenicity. A more detailed study including a more accurate

history of fluoride experience, however, is needed to draw definitive conclusions.

- Additional cross-sectional data for various ages and races are needed.
- Further investigation is needed to determine causality and effective means of prevention and/or treatment.

REFERENCES

1. Badger, G.R.: Incidence of enamel hypoplasia in primary canines. *J Dent Child*, 52:57-58, January-February, 1985.
2. Brown, J.D. and Smith, C.E.: Facial surface hypoplasia in primary cuspids. *J Ind Dent Assoc*, 65:13-14, July-August, 1986.
3. Skinner, M.F.: An enigmatic hypoplastic defect of the deciduous canine. *Am J Phys Anthropol*, 69:59-69, January, 1986.
4. Infante, P.F. and Gillespie, G.M.: Enamel hypoplasia in relation to caries in Guatemalan children. *J Dent Res*, 56:493-498, May, 1977.
5. Sweeney, E.A.; Cabrera, J.; Urrutia, J. *et al*: Factors associated with linear hypoplasia of human deciduous incisors. *J Dent Res*, 48:1275-1279, November-December, 1969.
6. Mellander, M.; Noren, J.S.; Freden, H. *et al*: Mineralization defects in deciduous teeth of low birthweight infants. *Acta Paediatr Scand*, 71:727-733, September, 1982.
7. Infante, P.F. and Gillespie, G.M.: An epidemiologic study of linear enamel hypoplasia of deciduous anterior teeth in Guatemalan children. *Arch Oral Biol*, 19:1055-1061, November, 1974.
8. Shafer, W.G.; Hine, M.K.; Levy, B.M.: *A textbook of oral pathology*, ed. 3. Philadelphia: W. B. Saunders Company, 1974, p 49.
9. Noren, J.C.: Enamel structure in deciduous teeth from low-birthweight infants. *Acta Odontol Scand*, 41:355-362, December, 1983.
10. Johnsen, D.C.: Dental caries patterns in preschool children. *Dent Clin North Am*, 28:3-20, January, 1984.
11. Johnsen, D.C.; Schultz, D.W.; Schubot, D.B. *et al*: Caries patterns in head start children in a fluoridated community. *J Public Health Dent*, 44:61-66, Spring, 1984.
12. Johnsen, D.C.; Bhat, M.; Kim, M.T. *et al*: Caries levels and patterns in Head Start children in fluoridated and non-fluoridated, urban and non-urban sites in Ohio, USA. *Community Dent Oral Epidemiol*, 14:206-210, August, 1986.
13. McDonald, R.E. and Avery, D.R.: *Dentistry for the child and adolescent*. ed. 4. St. Louis: C.V. Mosby Company, 1983, p 163.

Vitamin preparations as dietary supplements and as therapeutic agents

Nutrition

Vitamin preparations are used extensively in the practice of medicine and are valuable when used properly. It is important that a clear distinction be made between vitamins as dietary supplements and vitamins as therapeutic agents. It is also important for the practitioner to understand the usefulness and the limitations of given vitamin preparations in given clinical situations....

DEFINITIONS

Recommended dietary allowances (RDA)

The RDA are "the levels of intake of essential nutrients considered, in the judgment of the Committee on Dietary Allowances of the Food and Nutrition Board on the basis of available scientific knowledge, to be adequate to meet the known nutritional needs of practically all healthy persons."¹ (The abbreviation RDA is used for both the singular and plural of the term in accordance with National Academy of Sciences' usage.¹) The RDA are not requirements for an individual, but recommendations for the daily amounts of nutrients that populations should consume over a period of time to protect all members of that population. With exception of the allowances for energy, RDA are estimated to exceed the requirements of most individuals to ensure that the needs of nearly all members of a population will be met. In this country, RDA are set approximately two standard deviations (SDs) above the mean requirement and will, therefore, encompass the needs of 97 percent of the population. Allowances are established for a wide range

Prepared by the Council on Scientific Affairs, American Medical Association.

of age, weight and sex groups and for pregnancy and lactation.

The RDA have not been set for all recognized essential nutrients. In the ninth edition of Recommended Dietary Allowances, issued in 1980, RDA were set for only ten of the thirteen known vitamins.¹ Because of the lack of information on which to base allowances, the RDA committee established ranges of Estimated Safe and Adequate Daily Dietary Intakes for vitamin K, pantothenic acid and biotin.

Since the RDA are established for healthy people, they do not cover special needs for nutrients by persons with specific clinical problems, such as premature birth, inherited metabolic disorders, infections, catabolic states including weight reduction, chronic diseases and drug therapy, all of which may alter requirements for given vitamins.

U.S. recommended daily allowances (U.S. RDA)

These standards were developed by the Food and Drug Administration (FDA) for use in the nutrition labeling of the general food supply and for labeling dietary supplements and special dietary foods.² They are based mainly on the 1968 RDA. For practical purposes, the U.S. RDA use only four population groups (compared with twenty-six groups listed in the 1968 RDA and seventeen in the 1980 RDA editions).

Generally, the highest values for the ages combined in a U.S. RDA were used. For example, the U.S. RDA for the population group incorporating adults and children over four years of age are representative, generally, of the RDA recommended for a teenage boy. The U.S. RDA also include estimates for allowances of biotin and pantothenic acid. The U.S. RDA for vitamins are shown in the Table.

Adequate diet

A nutritionally adequate diet is composed of foods that meet an individual's vitamin and other nutrient requirements and meet but do not exceed his or her energy requirement. Nutritional adequacy is best ensured through the use of a wide variety of foods³... The current guide developed by the U.S. Department of Agriculture allows people to plan adequate diets by selecting foods rather than calculating nutrients.⁴

Commonly eaten foods are divided into five groups on the basis of similarity in composition and nutritive value... fruit/vegetable, bread/cereal, milk/cheese, meat/poultry/fish/beans, fats/sweets/alcohol⁴.... Adher-

Table □ U.S. Recommended Daily Allowances (U.S. RDA) for Vitamins²

Vitamins	Infants	Children Age 1 to 4 y	Adults and Children Age ≥ 4 y	Pregnant or Lactating Women
Vitamin A, IU	1500	2500	5000	8000
Vitamin D, IU	400	400	400	400
Vitamin E, IU	5.0	10	30	30
Ascorbic acid (vitamin C), mg	35	40	60	60
Folic acid, mg	0.1	0.2	0.4	0.8
Thiamin, mg	0.5	0.7	1.5	1.7
Riboflavin, mg	0.6	0.8	1.7	2.0
Niacin, mg	8.0	9.0	20	20
Vitamin B ₆ , mg	0.4	0.7	2.0	2.5
Vitamin B ₁₂ , µg	2.0	3.0	6.0	8.0
Biotin, mg	0.05	0.15	0.3	0.3
Pantothenic acid, mg	3.0	5.0	10	10

ing literally to the minimum number and size of servings recommended provides about 1200 kcal (5040kJ), adequate protein and most of the vitamins and minerals needed daily.⁴ Individuals can increase their nutrient and total energy intake by consuming larger portions and more servings and by selecting food from the fifth food group. If the total energy intake falls below 1200 Kcal (5040kJ), it becomes increasingly difficult to obtain all of the protective nutrients in adequate amounts and supplements may be needed.

Dietary Guidelines for Americans, issued by the U.S. Departments of Agriculture and Health and Human Services, also recommends eating a variety of foods from the major food groups to obtain a "well-balanced diet"; the guidelines do not specify the number and size of servings.⁵

VITAMINS AS DIETARY SUPPLEMENTS

A vitamin preparation used as a dietary supplement is one designed to increase the dietary intake of one or more essential vitamins. Such preparations ordinarily contain given vitamins in amounts of 50 percent to 150 percent of the U.S. RDA.

Healthy adult men and healthy adult nonpregnant, nonlactating women consuming a usual, varied diet do not need vitamin supplements. Infants may need dietary supplements at given times, as may pregnant and lactating women. Occasionally, vitamin supplements may be useful for people with unusual lifestyles or modified diets, including certain weight reduction regimens and strict vegetarian diets (i.e., one that excludes all foods of animal origin).

Infants and children

The normal breast-fed infant of a well-nourished mother receives sufficient quantities of all vitamins except vitamins K and D. Concerning vitamin K, newborns have sterile intestines and cannot initially synthesize menaquinones. Since human milk contains minimal phyloquinone (vitamin K₁)... it is recommended that all newborns receive a single intramuscular dose of 0.5 to 1.0 mg of phyloquinone as prophylaxis against hemor-

rhagic disease of the newborn.⁶ Low birth-weight infants may require a second injection at about one week of age. Because the vitamin D content of human milk is extremely low (about 22 IU/L), breast-fed infants may need supplemental vitamin D (400 IU/d) if they have limited exposure to sunlight.⁷ Breast-fed infants whose mothers are strict vegetarians require supplemental vitamin B₁₂.⁷

The Infant Formula Act of 1980 mandates adequate levels of vitamins and other nutrients in commercial infant formulas. Home-prepared evaporated milk or pasteurized cow's milk formulas should be supplemented with vitamins C and D.⁷

By the time the infant reaches one year of age, the diet should be composed of a variety of foods. A convenient guide to foods is the revised food guide or any similar set of guidelines to promote variety in the diet.^{4,5} Application of sound dietary practices should eliminate any need for supplemental vitamins after infancy in essentially all healthy children.

Adults

Healthy adults, eighteen years of age and older, receiving adequate diets should have no need for supplementary vitamins. Dietary practices in the United States, however, have changed in ways that may have reduced the overall vitamin delivery from the diet.⁸ Since the turn of the century, consumption of processed foods has increased, many more meals are eaten away from home and a greater portion of the diet is consumed as between-meal snacks. In some instances, poverty may limit the amount and quality of foods consumed, which may necessitate supplemental vitamins. Before deciding whether a vitamin supplement should be recommended to an adult, however, a history regarding the adequacy of dietary intake, usual dietary practices and specific issues of life-style and life situation must be carefully evaluated. If the individual appears not to be meeting his or her recommended intake of vitamins in the diet, an attempt to correct the situation by improving the selection of foods and the pattern of eating should be made.

As regards the elderly, neither the Food and Nutrition Board of the National Academy of Sciences/National Research Council nor the World Health Organization recognizes any need for increasing the vitamin and mineral allowances for healthy elderly individuals above those recommended for healthy young adults.^{1,9} In fact, the Food and Nutrition Board recommends a slightly decreased daily allowance for men over the age of fifty-one years for niacin, riboflavin and thiamin.¹ This reduc-

tion is related to an overall decrease in energy exchange by the elderly, particularly elderly men.

Although requirements for vitamins are not increased by age, socioeconomic conditions and reduced physical activity among the aged may lead to a curtailment in total food intake. Under such restriction, the use of a vitamin preparation in the prevention of deficiency may be indicated. When such is the case, the doses of vitamins (50 percent to 150 percent of the U.S. RDA) recommended elsewhere in this report as effective in the prevention and treatment of specific deficiency states or multiple-deficiency states in most adults are adequate for use in the elderly population.

A specific instance in which supplemental vitamins are very often indicated is for the pregnant or lactating woman. The physiologic demand for vitamins during pregnancy over and above the normal requirements are shown in the Table. Even though appetite and dietary recommendations for pregnant and lactating women encourage a greater intake of food, the recommended increases in vitamin intake above basal requirements may not be achieved. For this reason, vitamin supplements are often prescribed for pregnant and lactating women. Surveys among less privileged segments of the U.S. population reveal deficits in vitamin intakes relative to requirements during pregnancy and lactation.¹⁰

Vegetarianism has provoked concern about vitamin adequacy, particularly for strict vegetarian diets (these diets exclude all foods of animal origin). Vitamins B₁₂, D and riboflavin may be deficient in diets of strict vegetarian (vegans) infants and children. Intake of these vitamins will be adequate if appropriately fortified soy formula or fortified soybean milk drink is used.¹¹ Adequate vitamin B₁₂ can be a problem for adult vegans. Adequate intake can be provided by supplementation of the diet with vitamin B₁₂. Inadequate vitamin intake is not a problem for persons who consume lactovegetarian diets (these diets include milk or milk products) or lactoovoovegetarian diets (these diets include dairy products and eggs).

Certain weight-reduction diets may lead to inadequate vitamin intakes.¹² Even with a sound approach to slimming, it may be difficult to meet recommended vitamin intakes at an energy level of 800 to 1000 kcal/d (3360 to 4200 kJ/d) and hence a modest supplement may be recommended. The addition of a supplemental vitamin preparation to a very low-energy weight reduction program, however, will not necessarily make the diet safe. The overall metabolic status of persons consuming a low-energy diet should be periodically evaluated by a physician.

Emotional disturbances can also alter dietary patterns

and energy intake. Depression is associated with a variety of eating disturbances. Patients with anorexia nervosa and the binge-purge syndrome (bulimia) usually have very low net energy intakes. Vitamin intakes may be insufficient but, once again, the clinical situation requires a more comprehensive analysis and solution than the addition of a vitamin supplement to an otherwise insufficient diet.

VITAMINS AS THERAPEUTIC AGENTS

The vitamin preparations used for the treatment of deficiency diseases or other pathologic conditions should be clearly labeled for that purpose. They should not be used as dietary supplements. They should be recommended by physicians according to specific medical indications. The amounts of each vitamin in such vitamin preparations should not exceed two to ten times the RDA, depending on the vitamin.

Vitamins in therapeutic amounts are indicated only for the treatment of deficiency states or pathologic conditions in which absorption and utilization of vitamins are reduced or requirements increased and for certain nonnutritional disease processes... The decision to employ vitamin preparations in therapeutic amounts clearly rests with the physician and the importance of medical supervision when such amounts are administered is emphasized. Therapeutic vitamin mixtures should be so labeled and should not be used as dietary supplements.

The quantities of vitamins included in mixtures intended for therapeutic use should not exceed two to ten times the U.S. RDA, depending on the vitamin. Vitamins, like all biologically active substances, may cause qualitatively different responses at different dose levels.

When a vitamin is recommended in the therapeutic range, the dose will vary for different indications... The following conditions justify the use of therapeutic vitamins: deficiency diseases..., malabsorption..., prolonged illness..., enteral and parenteral nutrition..., alcoholism..., burns..., renal failure and dialysis..., vitamin-nutrient and drug-vitamin interactions..., genetic diseases....

Misuses of vitamins

The FDA has estimated that 40 percent of the adult population uses vitamin and mineral supplements on a daily basis¹³... With such widespread use of vitamins by the American public, there is ample opportunity for misuse. Misuse of vitamins is considered any application

of a vitamin or vitamins in a dose that is inappropriate or for a purpose that has no basis in established scientific practice. The rationales are often based on myths or distortions of experimental studies in laboratory animals. Some vitamins, such as A, E, C and B₆, are abused more commonly than others.¹⁴ Some persons have taken large doses of multivitamins in the belief that vitamins combat the chronic degenerative diseases or extend life. No objective benefits, however, have been demonstrated.

Some of the most frequently encountered examples of vitamin misuse include the following: vitamin E has been taken in large quantities in pursuit of rejuvenation, increased libido and improved sexual performance. Under the rubric of "orthomolecular psychiatry", large doses of niacin have been given for the treatment of a variety of mental disorders without measurable effect. Large doses of vitamin B₆ have been promoted for the treatment of carpal tunnel syndrome, premenstrual tension and mental disorders without established benefit.¹⁴ One of the most widely misused vitamins is ascorbic acid. There is not reliable evidence that large doses of ascorbic acid prevent colds or shorten their duration.¹⁵

Several vitamins have been heralded as anticancer agents, supposedly preventing the development of many types of malignancies. Although epidemiological studies have suggested that certain types of cancer are associated with a low intake of yellow and green vegetables and low plasma vitamin A levels, there is no evidence that taking large doses of vitamin A or carotene will prevent cancer in man.¹⁶ Vitamins with antioxidant properties, such as ascorbic acid and vitamin E, are often misused in an attempt to prevent cancer. Moreover, two randomized double-blind trials demonstrated the failure of large doses of ascorbic acid to alter the rate of death in patients with terminal cancer.^{17,18}

Other substances claimed to be vitamins have been misused for both their supposed nutrient effects and therapeutic effects. No essential nutrient function has been reported for laetrile (wrongly referred to as vitamin B₁₇), pangamic acid (wrongly referred to as vitamin B₁₅) or the bioflavonoids, rutin and hesperidin (the so-called vitamin P factors). No evidence has been presented indicating that these substances are effective for any disorder. Choline, inositol and p-aminobenzoic acid have been listed as vitamins for some species in the past. They are not required by man and have no established vitamin function in man although they are nutrients and can be metabolized in the human body.

TOXIC EFFECTS OF VITAMINS

Undesirable effects ranging from trivial to major have been reported in association with use of inappropriately high doses of vitamins....

While an excessive dose of a vitamin is generally defined as ten or more times the RDA, toxic effects from long-term daily ingestion of vitamin A have been reported with supplements ranging from five to twenty-five times the U.S. RDA.¹⁹ The specific toxic effects of fat-soluble and water-soluble vitamins are discussed below.

Fat-soluble vitamins

As a general rule, fat-soluble vitamins tend to cause toxic reactions at lower multiples of the RDA than do water-soluble vitamins. This is because fat-soluble vitamins tend to be stored in the body, rather than excreted, when ingested in excess. Some fat-soluble vitamins in excess of the concentration of the carrier proteins are taken up by membranes, with pathologic results.

The prolonged use of vitamin A in excessive doses can cause a variety of symptoms, including those related to skin and bone disorders, disturbed blood clotting with hemorrhage and other symptoms. In children, anorexia, pruritus and failure to gain weight are followed by irritability, bone pain and the limitation of joint motion. Large doses of vitamin A, furthermore, are teratogenic.²⁰⁻²²

Vitamin D is the most likely of all vitamins to cause overt toxic reactions in small multiples of the U.S. RDA. An epidemic of "idiopathic hypercalcemia" in infants, with anorexia, vomiting, hypertension, renal insufficiency and failure to thrive, occurred in England in the 1950s. It was traced to an intake of vitamin D between 2,000 and 3,000 IU/d.²³ In adults, dosages of 10,000 IU/d for several months have resulted in marked disturbances in calcium metabolism...

Relatively large amounts of vitamin E, in the range of 400 to 800 IU/d, have been taken for months to years without causing any apparent harm²⁴... The most significant toxic effect of vitamin E at dosages exceeding 1,000 IU/d is the antagonism to vitamin K action and the enhancement of the effect of oral coumarin anti-coagulant drugs with overt hemorrhage.²⁵

Phylloquinone (vitamin K₁) has no reported toxic effects at 500 times its Estimated Safe and Adequate Daily Dietary Intake... Menadione and its water-soluble derivatives which require alkylation *in vivo* for vitamin K action should not be administered to patients as a source of vitamin K.

Water-soluble vitamins

Thiamin, riboflavin, vitamin B₁₂, pantothenic acid and biotin do not seem to cause toxic reactions in man when taken in large doses by mouth. On the other hand, niacin, vitamin B₆ and ascorbic acid are associated with well-documented toxicity syndromes.

Dosages of niacin (nicotinic acid) in excess of 5 g/d can cause severe flushing, itching, liver damage, skin disorders, gout, ulcers and impaired glucose tolerance.¹⁴ Recent evidence indicates that large dosages of vitamin B₆ in excess of 1.0 g/d over a period of months, can exert a direct toxic action on the peripheral nervous system²⁶ Symptoms from this sensory neuropathy include unsteady gait and numbness of hands and feet.

Prolonged intake of ascorbic acid (vitamin C) in excess of 1.0 g/d may cause oxaluria, uricosuria and acidification of the urine. As a result, urinary stone formers appear to be at higher risk for calculi if they take large doses of ascorbic acid daily.²⁷ Ascorbic acid at these large doses can also produce false-positive results for glucose in urine and false-negative tests for blood in the stools, thereby confusing early detection of diabetes mellitus and gastrointestinal diseases, including cancer. In addition, excess ascorbic acid may produce diarrhea, alter the bactericidal activity of white blood cells and provoke "rebound scurvy" in adults who abruptly stop or reduce high long-term intakes. Rebound scurvy has also been reported in newborn infants of mothers who took large doses of ascorbic acid during pregnancy.¹⁴

FORMULATIONS OF VITAMIN PREPARATIONS

Bioavailability

For a vitamin preparation to be effective, the vitamin ingredients must be bioavailable, i.e., they must be released in the intestine so as to be transported into the bloodstream for circulation to the tissues. There the biologically active form of the vitamin will achieve the desired metabolic effect. Bioavailability depends not only on the basic chemical characteristics of the vitamin but also on which ingredient form of the vitamin is administered and possibly on the physical form of the dosage. Bioavailability of vitamins and minerals may also be affected by the presence and amounts of other vitamins or minerals, e.g., the presence of ascorbic acid may enhance absorption of inorganic iron. On the other hand, zinc may precipitate folic acid and vice versa.

All products marketed as single ingredients or combination products should be in a form in which all active ingredients are biologically available. To ensure this,

however, the current level of technology for determining the absorption of vitamins and minerals, singly or in combination, must be expanded. It is an important responsibility of the industry and the FDA to ensure that the necessary research is done to establish specific testing requirements for appropriate bioavailability of all active ingredients in vitamin products.

Rational combinations

Restricted dietary intake, increased requirements as in pregnancy, or impaired absorption rarely affect a single nutrient. Thus, combinations of vitamins may often be the rational means of preventing or treating vitamin deficiencies. The following statement about vitamin combinations follows very closely the recommendations made in the monograph by the FDA's Expert Panel on Vitamin and Mineral Drug Products.²⁸

Multiple vitamin preparations that claim effectiveness for prevention or treatment of vitamin deficiencies should be formulated on the basis of supplying all those vitamins whose combined deficiencies may be expected in a significant target population. When multiple deficiencies are present or are at increased risk of occurring, it would not be rational or safe to use preparations containing only two or three vitamins for the observed symptoms or deficiencies and thus unwittingly neglect therapy for other deficiencies. Therefore, a product containing only the fat-soluble vitamins is not recommended since the conditions of diet and intestinal disease that may predispose to depletion of some of these vitamins are more rationally treated with preparations that contain all needed fat-soluble and water-soluble vitamins (vitamin A, D, E and C, plus thiamin, riboflavin, niacin, pantothenate, vitamin B₆, folate and vitamin B₁₂). Vitamin K and biotin are not recommended in these products. Vitamin K deficiency rarely, if ever, occurs in this country because of dietary inadequacy, except in the newborn. Moreover, vitamin K could be hazardous for many patients receiving anticoagulant therapy. Biotin deficiency is virtually nonexistent in the U.S. population. Because the water-soluble vitamins (the B vitamins and vitamin C) are less well stored in the body than the fat-soluble vitamins and may be depleted more rapidly in the presence of altered intake or disease and because several B vitamins occur together in the same foods, a preparation containing all B vitamins with

or without vitamin C to prevent or reverse disease in man is recommended.

These vitamins should be combined in amounts from 50 percent to 150 percent of the U.S. RDA for supplements to prevent nutritional disease and in amounts two to ten times the U.S. RDA to treat disease.... Where there is evidence that the combination of ingredients at certain levels may influence bioavailability of any other ingredient, careful testing is required.

Multivitamin formulations for total parenteral nutrition are described in a statement by the Nutrition Advisory Group of the American Medical Association²⁹....

CONCLUSIONS

This report makes specific recommendations about the use of vitamins as supplements and therapeutic agents.

Vitamins and vitamin mixtures, other than those discussed herein, may be demonstrated to be useful as dietary supplements or as therapeutic agents by further research. Until their value is established by convincing scientific evidence, however, such new preparations should not be advocated for general use.

Public health nutrition will be served best by the insistence on a scientifically sound basis for vitamin supplementation and therapy. All health practitioners should emphasize repeatedly that properly selected diets are the primary basis for good nutrition.

REFERENCES

1. *Recommended Dietary Allowances*, Edition 9, Food and Nutrition Board, National Research Council, National Academy of Sciences, Washington, D.C., 1980.
2. *FDA Consumer Memo: Nutrition Labels and U.S. RDA*, Publication (FDA) 81-2146, U.S. Department of Health and Human Services, 1981.
3. *Council on Foods and Nutrition, Vitamin Preparations as Dietary Supplements and as Therapeutic Agents*, JAMA, 169:41-45, 1959.
4. *Food: The hassle-free guide to a better diet*, Home and Garden bulletin 328, U.S. Department of Agriculture, 1979.
5. *Nutrition and your health: dietary guidelines for Americans*, Home Garden bulletin 232, U.S. Department of Agriculture, 1985.
6. Olson, R.E.: Function and metabolism of vitamin K. *Annu Rev Nutr*, 4:281-337, 1984.
7. *Committee on Nutrition: Pediatric Nutrition Handbook*, Edition 2, American Academy of Pediatrics, Elk Grove Village, IL, 1985, pp 37-48, 185,186.
8. Welsh, S.O.; Marston, R.M.: Review of trends in food use in the United States, 1909-1980. *J Am Diet Assoc*, 81:120-128, 1982.
9. *FAO/WHO Handbook on Human Nutritional Requirements*, Monograph Service 61, World Health Organization, Geneva, 1974.
10. Butte, N.F.; Calloway, D.H.; Van Duzen, J.L.: Nutritional assessment of pregnant and lactating Navajo women. *Am J Clin Nutr*, 34:2216-2228, 1981.
11. American Dietetic Association: *Position Paper on Vegetarian Approach to Eating*. *J Am Diet Assoc*, 77:61-69, 1980.

Excerpts, Council Report, Journal of the American Medical Association 257:1929-1936, April 10, 1987. "Copyright 1988, American Medical Association."

12. Mirkin, G.B.; Shore, R.N.: The Beverly Hills diet: dangers of the newest weight loss fad. *JAMA*, 246: 2235-2237, 1981.
13. Stewart, M.L.; McDonal, J.T.; Levy, A.S. *et al*: Vitamin/mineral supplement use: a telephone survey of adults in the United States. *J Am Diet Assoc*, 85: 1585-1590, 1985.
14. Wooliscroft, J.O.: Megavitamins: fact and fancy. *DM*, 29: 1-56, 1983.
15. Chalmers, T.C.: Effects of ascorbic acid on the common cold: an evaluation of the evidence. *Am J Med*, 58:532-536, 1975.
16. Doll, R.; Peto, R.: The causes of cancer: quantitative estimates of avoidable risks of cancer in the U.S. today. *JCNI*, 66:1192-1308, 1981.
17. Creagan, E.T.; Moertel, C.G.; O'Fallon, J.R. *et al*: Failure of high-dose vitamin C (ascorbic acid) therapy to benefit patients with advanced cancer. *N Engl J Med*, 301:687-690, 1979.
18. Moertel, C.G.; Fleming, T.R.; Creagan, E.T. *et al*: High dose vitamin C versus placebo in the treatment of patients who have had no prior chemotherapy: a randomized double-blind comparison. *N Engl J Med*, 312:131-147, 1985.
19. Herbert, V.: Toxicity of 25,000 IU vitamin A supplements in 'health food' users. *Am J Clin Nutr*, 36:185-186, 1982.
20. Muentner, M.D.; Perry, H.O.; Ludwig, J.: Chronic vitamin A intoxication in adults. *Am J Med*, 50:129-136, 1971.
21. Goodman, D.S.: Vitamin A and retinoids in health and disease. *N Engl J Med*, 310:1023-1031, 1984.
22. Lammer, E.J.; Chen, D.T.; Hoar, R.M. *et al*: Retinoic acid embryopathy. *N Engl J Med*, 313:837-841, 1985.
23. Forfar, J.O.; Balf, C.L.; Maxwell, G.M. *et al*: Idiopathic hypercalcemia of infancy: clinical and methodological studies and special reference to the etiological role of vitamin D. *Lancet* 1:982-985, 1956.
24. Farrel, P.M.; Bieri, J.G.: Megavitamin E supplementation in man. *Am J Clin Nutr*, 28:1381-1386, 1975.
25. Bieri, J.G.; Corash, L.; Hubbard, V.S.: Medical uses of vitamin E. *N Engl J Med*, 308:1063-1071, 1983.
26. Schaumburg, H.; Kaplan, J.; Windebank, A. *et al*: Sensory neuropathy from pyridoxine abuse: a new megavitamin syndrome. *N Engl J Med*, 309:445-448, 1983.
27. DiPalma, J.R.; Richie, D.M.: Vitamin toxicity. *Annu Rev Pharmacol Toxicol*, 17:133-148, 1977.
28. *Establishment of a monograph: vitamin and mineral drug products for over-the-counter human use*. Federal Register, 44:16126-16201, March 16, 1979.
29. American Medical Association, Department of Foods and Nutrition. *Multivitamin preparations for parenteral use: a statement by the Nutrition Advisory Group*. *JPEN*, 3:258-262, 1979.

Reprinted by permission of General Mills Nutrition Department.

INFANT FEEDING EFFECTS ON ADIPOSITY

All infants were weaned to the same diet, containing 40 percent of calories as saturated fat (lard) and 1.7 mg/kcal cholesterol. By one year of age, body weights among the four infant-diet groups were equal. At three years (the onset of puberty), the females that had been overfed as infants became heavier than the underfed and normally fed groups; at five years of age, they weighed 28 percent more than those that had been underfed or normally fed as infants. We autopsied the animals at five years and measured adipocyte number and volume in each of ten fat depots. The greater body weight of the females that had been overfed was due almost entirely to a 40 percent greater fat mass. Each of the ten fat depots of females from the overfed group was larger than the corresponding depot in the normally fed or underfed groups. The difference in each depot (with one exception) was due almost entirely to greater adipocyte volume, which averaged two to five times larger in the females that had been overfed. The only depots with more adipocytes among the overfed females were three relatively small ones that accounted for only 6 percent of the total fat-depot mass. Thus, the obesity in adult female baboons associated with prior infant overfeeding was almost exclusively hypertrophic rather than hyperplastic, contrary to the previous observations in rats.

Adult male baboons that had been overfed as infants showed a trend toward greater fat-depot mass, but the differences were not nearly as great as in the females and were statistically significant in only four of the ten depots. The lesser effect of infant overfeeding on males may have been because they do not attain full adult size until about seven years of age.

McGill, Jr., H.C. *et al*: Deferred effects of preweaning nutrition on lipid metabolism and atherosclerosis. In *Prevention of adult atherosclerosis during childhood*. Columbus: Ross Laboratories, 1988, pp 63,64

Sealant knowledge and use by pediatric dentists: 1987 Minnesota survey

Cesar D. Gonzalez, DDS, MS
P. Jean Frazier, MPH, PhD
Louise B. Messer, BDS, MSc

The successful use of pit and fissure sealants in the prevention of occlusal caries has been well documented.¹⁻⁶ Sealants are safe, cost-effective, and easy to apply.⁶⁻⁸ Nevertheless, the incorporation of the appropriate and routine use of sealants in dental practice has been slow, as demonstrated in national and state studies conducted between 1975 and 1984.^{9-13,17}

For example, in a 1974 study, only 38 percent of general practitioners and 51 percent of pediatric dentists reported using sealants at that time.⁹ In a 1982 national study, 44 percent of the dentists surveyed were sealant users.¹⁰ Jerrell and Bennett in a 1984 national study involving pediatric dentists only, reported that 84 percent used sealants at least some of the time, but that only 29 percent considered themselves to be "routine users" of the procedure.¹¹ Morawa and Straffon in a 1981 survey of pediatric dentists in the state of Michigan, reported that 73 percent of the respondents were using sealants.¹² In a 1984 survey in the state of Iowa, it was found that approximately one-third of the general dentists and half of the pediatric dentists reported using sealants regularly.¹³

Recent evidence suggests that the use of sealants by general practitioners and pediatric dentists has increased. At the same time, frequency of use, when

The authors are with the Department of Preventive Sciences and Dr. Messer is with the Postdoctoral Research Training Program in Dental Caries directed by NIH.

reported, remains low. Faine and Dennen reported in 1985 that 81 percent of dentists surveyed in the state of Washington indicated they used sealants, but that two-thirds of these respondents applied sealants to only one to five patients per week.

Rubenstein and Dinius reported in 1985 that sealants were in use by 73 percent of the general practitioners and 97 percent of the pediatric dentists studied in the state of Virginia.¹⁵ In the most recent national survey (1985), Cohen, LaBelle and Romberg reported that over 75 percent of the general practitioners and 97 percent of the pediatric dentist respondents were sealant users.¹⁶ Sixty-two percent of the general practitioners stated that less than 20 percent of their patients aged eighteen years and younger, however, received sealants, while 55 percent of the pediatric dentists surveyed used sealants for less than half of their patients aged eighteen years and younger.¹⁶

Three earlier studies of sealant use in Minnesota have been reported. Simonsen, in 1978, found only 7 percent of the general practitioners to be routine users of sealants.¹⁷ A second study (1983) focused on sealant application by dental hygienists.¹⁸ Sealants were being used in 62 percent of offices in which these respondents were employed, although the frequency of use per week was low for both the dentist (the employer) and the respondent dental hygienist.¹⁸ Martens, Glasrud, and Gambucci documented a relatively large increase in sealant use by general practitioners in Minnesota during the period 1980-84, and attributed this in part to increased professional and public awareness of the caries-preventive value of the sealant procedure.¹⁹ None of these Minnesota studies focused on pediatric dentists. The goal, therefore, of the present study was to examine pediatric dentists as a separate group, because these practitioners serve primarily young patients who derive the greatest benefit from sealant application.

This report presents results of a 1987 study of knowledge, opinions, and use of sealants by pediatric dentists in Minnesota. These data were collected as part of a larger study that included general practitioners as well.²⁰

MATERIALS AND METHODS

Data Collection Procedures

The population of forty-five resident and licensed pediatric dentists in Minnesota was surveyed in the summer

of 1987. The survey instrument consisted of a thirty-seven-item mail questionnaire†, designed to measure the level of sealant use, knowledge and opinions about dental caries preventive methods, as well as office structure characteristics, length of professional experience, extent of professional participation, demographic characteristics, dental school experience with sealants, and sources of information about sealants.

The questionnaire was pretested with fifteen general practitioners. After necessary revisions, the questionnaire was mailed in May of 1987, accompanied by a cover letter and self-addressed, stamped return envelope. Following procedures outlined by Dillman, a follow-up reminder postcard was sent to all forty-five pediatric dentists one week later.²¹ A third mailing, including a duplicate questionnaire, a revised cover letter, and a self-addressed, stamped envelope was mailed to nonrespondents, three weeks after the original mailing. Returned questionnaires were reviewed and edited, and data were keypunched onto computer cards for analysis using the computer program entitled Statistical Package for the Social Sciences.

RESULTS

Response and characteristics

Of the forty-five questionnaires mailed, thirty-six were completed and returned (80 percent response) and deemed usable. Half of the respondents had graduated before 1970 (1943-1969), and half graduated between 1970 and 1984. Eighty-one percent were male; over half (53 percent) had practices located in a city with a population over 100,000. Forty-four percent reported working in a solo practice, while 39 percent were employed as partners or by another dentist. Half the respondents stated that they did not employ a dental hygienist, and 44 percent employed more than three dental assistants. Almost all respondents (94 percent) had practices with 90 percent of patients aged eighteen years or younger.

Knowledge of sealants and caries prevention

Table 1 shows the percent of respondents who agreed or disagreed with eleven statements about sealants and fluoride. Responses were recoded to reflect correct and incorrect answers in accordance with current textbooks and information on preventive and pediatric dentistry.²²⁻²⁴ All respondents answered correctly to the sealant item "a", and almost all were correct on items "b" and "e". Three-quarters of respondents answered correctly to items "c" and "d". Just over half (60 percent) of

†A copy of the mail questionnaire is available from the authors on request.

the respondents answered correctly to item "f". Only one-third of the respondents were correct on item "g".

Regarding fluoride items, almost all respondents answered correctly to item "i". Three-quarters were correct in their responses to item "h". Two-thirds (66 percent) answered correctly to item "j". Only three percent of the pediatric dentists surveyed answered all eleven statements correctly, and 28 percent answered correctly to all seven sealant items. Only 8 percent gave correct responses to all four fluoride items.

Table 2 shows respondent rating of the perceived effectiveness of methods to prevent dental caries in children. Again, ideal responses are indicated, in accordance with current textbooks and information on preventive and pediatric dentistry.²²⁻²⁴ Almost all respondents reported believing that community water fluoridation is a "very effective" method of preventing dental caries in children. Fewer than one-quarter, however, believed that fluoride supplements or dentifrices were "very effective", and only one-third believed fluoride rinses were "very effective". Fifty-eight percent stated that sealants were "very effective" in preventing dental caries. At the same time, more than half (53 percent) also believed that restoring a tooth was "very effective" in preventing dental caries (item "j"), and 39 percent thought that tooth-brushing and flossing were "very effective" in preventing dental caries in children.

Opinions about sealants and caries prevention

Table 3 shows the percentage of respondents who agreed or disagreed with nine opinion statements about sealants. Nearly all agreed that it is possible to prevent most caries lesions, using fluoride and sealants (item "h"), and that greater efforts should be made by the dental profes-

Table 1 □ Distribution of correct and incorrect responses to eleven statements regarding knowledge of caries prevention (N = 36 respondents).

Statements	Percent Responses	
	Correct*	Incorrect
a. Sealants are not needed if patients drink fluoridated water and receive topical fluorides. (disagree = correct)	100	0
b. Sealants are not effective in preventing occlusal caries. (disagree = correct)	97	3
c. Loss of sealant is due to incorrect application technique. (agree = correct)	74	26
d. Sealants are somewhat risky because caries may be sealed. (disagree = correct)	74	26
e. Newly-erupted permanent molars are the most important candidates for sealants. (agree = correct)	97	3
f. A small amount of caries can be sealed without further progression. (agree = correct)	60	40
g. Research has shown that the average amalgam lasts at least three times as long as the average sealant. (disagree = correct)	34	66
h. Incipient carious lesions can be remineralized with fluoride. (agree = correct)	77	23
i. Fluoride provides caries-reduction benefits to adults as well as to children. (agree = correct)	89	11
j. The most important mechanism of action of fluoride is that it is incorporated into the developing tooth to make it more resistant to caries. (disagree = correct)	17	83
k. Dilute, frequently administered fluoride is more effective in preventing caries than concentrated, less frequently administered fluoride. (agree = correct)	66	34

*In accord with current information on preventive dentistry.²²⁻²⁴

sion to promote sealants (item "b"). Over half (53 percent) did not agree that dental assistants should be allowed to apply sealants (item "g"), even though all respondents (100 percent) believed that their dental staff was interested in using pit and fissure sealants. Responses to items "a", "c", and "f" indicate that pediatric dentists in this state believe that sealants are cost-effective, that the time is worth the cost, and that they consider sealants are valuable in comparison with amalgams.

Use of sealants

All pediatric dentists responding to the survey reported using sealants, but less than half (46 percent) applied

Table 2 □ Perceived effectiveness of methods to prevent dental caries in children (N = 36 Respondents).

Methods	Percent distribution of responses			
	Very effective	Effective	Somewhat effective	Not effective
a. School water fluoridation	36	19*	42	3
b. Dietary fluoride supplements (drops or tablets)	22*	47	28	3
c. Fluoride dentifrices	22	39*	36	3
d. Community water fluoridation	97*	3	0	0
e. Topical fluorides (operator-applied)	17	44*	33	6
f. Fluoride rinses	30	42*	28	0
g. Infrequent sugar consumption	36	36*	22	6
h. Pit and fissure sealants	58*	28	14	0
i. Professional oral prophylaxis	11	25	15	19*
j. Restoration of carious teeth	53	25	19	3*
k. Toothbrushing	39	33	25	3*
l. Flossing	39	39	22*	0

*Ideal responses in accord with current information on preventive dentistry.²²⁻²⁴

Table 3 □ Distribution of agree/disagree responses to nine opinion statements regarding sealants (N = 36 Respondents).

Opinion statements	Percent responses		
	Agree	Disagree	Not sure
a. Sealants are not cost-effective. Placing amalgams is more economical in the long run.	14	81 [†]	6*
b. More effort should be made by the profession to increase public demand for sealants.	83 [†]	9	9*
c. It takes too much time for the cost of the procedure.	19	72 [†]	8*
d. I am confused about the many types of pit and fissure sealants.	3	92 [†]	6*
e. My staff is not interested in using sealants.	0	100 [†]	0
f. I am not convinced of the value of sealants compared to amalgams.	9	89 [†]	3*
g. Dental assistants should be allowed by state dental practice acts to apply sealants.	30 [†]	53	17
h. With the combined use of systemic and topical fluoride and sealants, it is possible to prevent most carious lesions.	92 [†]	0	8
i. More effort should be made by sealant manufactures to increase the public demand for sealants.	61 [†]	14	25

*Slight error due to rounding.

[†]Responses considered favorable to sealant use.

sealants more than ten times per week. Nearly two-thirds reported that they had been using sealants for more than eight years. Among dental hygienists employed in pediatric dentistry practices, 41 percent were not applying pit and fissure sealants, according to the questionnaire respondents.

The mean percent of patients receiving sealants in the respondent's practice, by age-group, was highest for the six to fourteen year-old age-group (mean \pm standard deviation: 72 \pm 27); and very low for the other age-groups: two to five years (7 \pm 11), fifteen to eighteen years (16 \pm 24), and over eighteen years of age (2 \pm 6). The sealant products used most often by these respondents were Helioseal[‡] (58 percent respondents), Concise* white sealant (22 percent), and Prisma-Shield** (14 percent).

The majority of respondents (92 percent) reported following the recommended procedure for sealant application (i.e. perform prophylaxis, etch, wash, dry and apply sealant).²⁵ Concerning the prophylaxis procedure, two-thirds of the respondents (67 percent) reported using only a brush or cup, while only about one-third used the recommended brush or cup with a pumice slurry.²⁵

Educational experience

Fifty-three percent of the pediatric dentists surveyed reported that they had attended a continuing education

course (CDE) on sealants. These respondents estimated that 73 percent of their employed hygienists and 55 percent of their employed dental assistants also had attended a CDE course on sealants. One-quarter of these respondents stated that they received instruction on how to apply sealants during their undergraduate dental education. All of these respondents reported having had close clinical supervision during the application of sealants in dental school, and most (89 percent) stated that the faculty had presented criteria for selecting teeth to be sealed. These respondents also were asked whether their dental school faculty and fellow students appeared to regard sealant application as a valuable technique. All thought that faculty members, and 78 percent thought that fellow students, regarded sealant application as a "valuable/very valuable" technique.

Patient/public information about sealants

Fifty-eight percent of the responding pediatric dentists stated that their patients "often" initiated discussion about sealants, and 94 percent of respondents reported having up to 70 percent of their patients accept sealants when suggested by the dentist. The majority of pediatric dentists in the study reported noticing at least "some" advertising about sealants in lay magazines and professional dental journals. Nearly two-thirds of the respondents agreed that "more effort should be made by sealant manufacturers to increase the public demand for sealants".

DISCUSSION

All of the pediatric dentists surveyed in this study reported using sealants. Only 46 percent, however, ap-

[‡]Vivadent (U.S.A.), Inc., Tonowanda, NY 14150.

*Minnesota Mining and Manufacturing Company, St. Paul, MN 55144.

**L.D. Caulk Company, Division of Dentsply International, Inc., Milford, DE 19963.

plied sealants more than ten times per week. This observation concurs with recent national and state studies, and confirms that while sealant use "at all" may be relatively high, the frequency of use by dental practitioners, including pediatric dentists, remains lower than might be expected, based on the demonstrated scientific value of and need for the technique.^{15,16,26,27}

Pit and fissure sealants were used primarily in the six- to- fourteen- year-old age-group. This supports the opinion of 95 percent of the respondents in this study who agreed with the statement that "newly erupted permanent molars are the most important candidates for sealants". An early recommendation by the ADA Council on Dental Research was that first permanent molars should be sealed only within four years of eruption.²⁸ Ripa recently reported a relatively constant rate of caries attack in occlusal surfaces of first molars, however, for up to ten years after eruption.²⁹ A similar pattern was also evident in the 1979-80 national study of caries prevalence in U.S. children.³⁰ Current evidence indicates, therefore, that efforts should be made to promote the use of sealants for patients beyond fourteen years of age, in addition to maintaining sealant use in the six- to- fourteen- year-old age-group.

The selection of dental personnel to perform the sealant application is an important component of cost-effectiveness of the procedure. In this study, 50 percent of the pediatric dentists employed a dental hygienist, and 59 percent of these respondents were delegating the application of sealants to the hygienist. This finding is higher than that of Morawa and Straffon in a 1981 survey of pediatric dentists in the state of Michigan, where 9 percent of dental hygienists working in a pediatric dental office were applying sealants.¹² Jerrell and Bennett, in the 1984 national survey of pediatric dentists, reported that dental hygienists, dental assistants, or a combination of staff, performed the procedure 20 percent or less of the time.¹¹ Rubenstein (1985) reported reasons given for the lack of delegation of this procedure in the Virginia study.¹⁵ Among dental hygienists, lack of time and failure of the dentist to delegate the procedure were the two most common reasons given. Among both general and pediatric dentists, the reasons cited were as follows: dentists prefer to apply sealants themselves; the office did not employ a dental hygienist; and auxiliaries lack the time and knowledge to perform the procedure.¹⁵ Nevertheless, studies have demonstrated that sealants can be applied successfully by dental auxiliaries.^{5,31-33} Duffy *et al*, in a 1983 survey of 563 practicing dental hygienists in Minnesota and Wisconsin, reported that dental hygienists' use of sealants was relatively low,

even though they appeared generally knowledgeable and had positive opinions toward sealants.¹⁸ The dental practice act in the state of Minnesota has allowed dental hygienists to apply sealants for nearly fifteen years; delegation of the sealant application procedure to dental hygienists in this state, however, continues to appear low among pediatric dentists.

Eighty-one percent of the respondents disagreed (correctly) with the statement that "...placing an amalgam is more economical over a long period of time." Several studies have shown that the average life span of an amalgam restoration in a permanent tooth is four to eight years.³⁴⁻³⁶ Other investigators have been shown that when sealants are properly placed, efficacy can be as high as 94, 88, 83, 73, 67 and 58 percent after one, two, three, four, five and six years, respectively.⁴ The discrepancy between these data and the observed belief of two-thirds of the pediatric dentists surveyed in the present study "... that the average amalgam lasts at least three times as long as the average sealant", suggests that there is still a lack of communication between the research community and the dental practitioners. Nearly three-quarters of the pediatric dentists in this study (74 percent) disagreed (correctly) with the statement that "... sealants are risky because caries may be sealed". This figure was more positive concerning this aspect of sealant use in contrast to responses to similar questions used in other recent studies, and suggests that the favorable prognosis of sealants is becoming better recognized among pediatric dentists.^{10,11,14,16}

Pediatric dentist respondents in this study were clearly aware of the importance of community water fluoridation for preventing dental caries in children. At the same time, however, they tended to underrate the effectiveness of all other methods of fluoride delivery (school water fluoridation, dietary fluoride supplements, fluoride dentifrices, fluoride rinses and operator-applied topical fluorides) and to greatly overrate the effectiveness of oral hygiene procedures (toothbrushing and flossing) and restorations. These findings are similar to those observed in national studies of dentists, and indicate a need to increase dental professionals' understanding of the relative effectiveness of methods for the primary prevention of dental caries in children.¹⁰

Respondents were generally knowledgeable about caries prevention, with three-quarters or more answering correctly to seven of eleven statements about sealants and fluorides. Specific aspects of both procedures, however, were problematic for these respondents. For example, over a third were not aware that a small amount of caries can be sealed without further progression of the

lesion. Two-thirds were not aware of current scientific evidence regarding the longevity of sealants in comparison to amalgam restoration. Over 80 percent were incorrect when they agreed that "the most important mechanism of action of fluoride is that it is incorporated into the developing tooth...". While this mechanism of action remains important, new scientific evidence reported over the past decade clearly indicates the equally important role of frequently applied, dilute topical fluoride in promoting remineralization of porous enamel.^{22,24} This finding was consistent in that a third of these respondents disagreed (incorrectly) that "dilute, frequently administered fluoride is more effective in preventing caries than concentrated, less frequently administered fluoride".^{22,24} On the other hand, three-quarters of the respondents correctly agreed with the statement that "incipient carious lesions can be remineralized with fluoride." While the majority of respondents answered correctly to most knowledge items, responses to these items suggest, therefore, a need for more in-depth educational efforts focusing on current research related to specific aspects of both sealants and fluoride.

CONCLUSIONS

Pediatric dentists surveyed in Minnesota in 1987 appeared generally knowledgeable and had positive attitudes toward sealants and other caries-preventive procedures. All respondents in this survey reported using sealants; frequency of use is not as high as it could be, however, considering the value of the sealant procedure and the level of need, as demonstrated in other studies. Sealant use was highest for the six- to fourteen-year-old age-group. Delegation to dental hygienists appears low in pediatric dentistry practices. Finally, pediatric dentists in Minnesota indicated that more effort should be made by manufacturers and the dental profession to increase public demand for sealants.

REFERENCES

- Horowitz, H.S.; Heifetz, S.B.; and Poulsen, S.: Retention and effectiveness of a single application of an adhesive sealant in preventing occlusal caries: A final report after five years of a study in Kalispell, Montana. *J Am Dent Assoc*, 45:1133-1139, December, 1977.
- Simonsen, R.J.: The clinical effectiveness of a colored pit and fissure sealant at 36 months. *J Am Dent Assoc*, 102:323-327, March, 1981.
- Mertz-Fairhurst, E.J.; Fairhurst, C.W.; Williams, J.E. *et al*: A comparative clinical study of two pit and fissure sealants: Six-year results in Augusta, GA. *J Am Dent Assoc*, 105:237-239, August, 1982.
- Houpt, M. and Shey, Z.: The effectiveness of a fissure sealant after six years. *Pediatric Dent*, 5:104-106, 1983.
- Whyte, R.J.; Leake, J.L.; and Howley, T.P.: Two-year follow-up of 11,000 dental sealants in first permanent molars in the Saskatchewan Health Dental Plan. *J Pub Health Dent*, 47:177-181, Fall, 1987.
- Simonsen, R.J.: Five-year results of sealant effects on caries prevalence and treatment cost. *J Dent Res*, 61 (Special Issue A):332, IADR Abstract, 1982.
- Leverett, D.H.; Handelman, S.L.; Brenner, C.M. *et al*: Use of sealants in the prevention and early treatment of carious lesions: Cost analysis. *J Am Dent Assoc*, 106:39-42, January, 1983.
- Burt, B.A. and Tonn, E.M.: The cost-effectiveness of sealant application in private practice. In *Council on Dental Materials, Instruments and Equipment. Conference on Pit and Fissure Sealants: Why their limited usage?* Chicago: American Dental Association, 1981.
- Gift, H.C.; Frew, R.; and Hefferren, J.J.: Attitudes toward and use of pit and fissure sealants. *J Dent Child*, 42:460-466, November-December, 1975.
- Gift, H.C. and Frew, R.A.: Sealants: Changing patterns. *J Am Dent Assoc*, 112:391-392, March, 1986.
- Jerrell, R.G. and Bennett, C.G.: Utilization of sealants by practicing pedodontists. *J Pedod*, 8:378-386, 1984.
- Morawa, A.P. and Straffon, L.H.: A survey on the use of sealants. *J Mich Dent Assoc*, 66:63-67, 1984.
- Hunt, R.J.; Kohout, F.J.; and Beck, J.D.: The use of pit and fissure sealants in private dental practices. *J Dent Child*, 51:29-33, January-February, 1984.
- Faine, R.C. and Dennen, T.: Survey of private dental practitioners' utilization of dental sealants in Washington state. *J Dent Child*, 53:337-342, September-October, 1986.
- Rubenstein, L.K. and Dinius, A.: Dental sealant usage in Virginia. *J Pub Health Dent*, 46:147-151, Summer, 1986.
- Cohen, L.; LaBelle, A.; and Romberg, E.: Strategies for increasing the use of pit and fissure sealants in dental practice. Prepared by: Department of Oral Health Care Delivery, Baltimore, 666 West Baltimore Street, Baltimore, Maryland 21201, 1985.
- Simonsen, R.J.: Pit and fissure sealants: Attitudes toward and use by dentists in Minnesota: 1978. *Quintessence International*, 4:473-479, April, 1983.
- Duffy, M.B.; Bernet, J.K.; Chovanec, G.K. *et al*: Dental hygienists' knowledge, opinions, and use of pit and fissure sealants. A comparison of two states. *J Pub Health Dent*, 47:121-133, 1987.
- Martens, L.V.; Glasrud, P.H.; and Gambucci, J.R.: Changes in sealant use by private general practitioners. *Quintessence International*, 4:53-57, 1987.
- Gonzalez, C.D.; Frazier, P.J.; and Messer, L.B.: Dentists' use of sealants: A 1987 Minnesota study. *J Dent Res*, 67 (Special Issue):635 IADR Abstract, 1988.
- Dillman, D.A.: *Mail and telephone surveys: The total design method*. New York: John Wiley & Sons, 1978, pp 160-199.
- Melberg, J.R.; Ripa, L.W.; and Leske, G.S.: *Fluoride in preventive dentistry: Theory and clinical applications*. Chicago: Quintessence Publishing Company, 1983, Chapters 2, 4, 5, 7, 8 and 9.
- MacDonald, R.E. and Avery, D.R.: *Dentistry for the child and adolescent*. 5th Edition, St. Louis: C.V. Mosby Company, 1987, Chapters 11, 12 and 17.
- Ripa, L.W.: A clinical basis for fluoride dentifrice use by children. Update in *Pediatric Dentistry*, 1:1-11, September, 1987.

This study was supported in part by a grant from the Johnson and Johnson Dental Care Company. This study formed part of a thesis completed by Dr. Gonzalez in partial fulfillment of the requirement for the master's degree at the University of Minnesota.

25. Preventing pit and fissure caries: A guide to sealant use. Massachusetts Department of Public Health. Division of Dental Health, 150 Tremont Avenue, Boston, Massachusetts 02111, 1986.
26. National Institute of Dental Research and Office of Medical Applications of Research. Proceedings: National Institutes of Health Consensus Development Conference, Dental Sealants In the Prevention of Tooth Decay 1983 Dec 5-7. *J Dent Educ*, 1984 Feb; 48 (Suppl 2).
27. American Dental Association. "Research Shows Caries Disappearing in Children". *ADA News*, July 4, 1988, pp 3,10.
28. Council on Dental Research: Cost-effectiveness of sealants in private practice and standards for use in prepaid dental care. *J Am Dent Assoc*, 110:103-107, January, 1985.
29. Ripa, L.W.; Leske, G.S.; and Varma, A.O.: Longitudinal study of the caries susceptibility of occlusal and proximal surfaces of first permanent molars. *J Pub Health Dent*, 48:8-13, Winter, 1988.
30. National Institute of Dental Research, National Caries Program: The prevalence of dental caries in United States Children, 1979-80: The national caries prevalence survey. DHHS, PHS Publ. No. NIH 82-2245. Washington: U.S. Government Printing Office, 1981.
31. Ferreira, M.R.: Retention of sealant applied by oral hygiene students: Results at six months. *J Dent Res*, 56 (Special Issue A): 351 IADR Abstract, 1977.
32. Stiles, H.M.; Ward, G.T.; Woodridge, E.D. *et al*: Adhesive sealant clinical trial: Comparative results of application by a dentist or dental auxiliaries. *J Prev Dent*, 3:9-19, 1976.
33. Leske, G.S.; Pollard, S.; and Cons, N.: The effectiveness of dental hygienist teams in applying pit and fissure sealants. *J Prev Dent*, 3:33-38, 1976.
34. Robinson, A.D.: The life of a filling. *Brit Dent J*, 130:206-208, 1971.
35. Allan, N.A.: A longitudinal study of dental restorations. *Brit Dent J*, 143:87-89, 1977.
36. Cecil, J.C.; Cohen, M.E.; Schroeder, D.C. *et al*: Longevity of amalgam restorations: A retrospective review. *J Dent Res*, 61 (Special issue A): 56 IADR Abstract, 1982.

DMF AND RESIDENCY HISTORY

Unquestionably the most readily available form of fluoride is in dentifrices, and it has been suggested by Hargreaves et al [1983] that increased use of fluoride-containing dentifrices was responsible for the caries decrease in children of the Island of Lewis (Scotland) where other forms of fluoride were not readily available. At least six other studies have suggested that fluoride dentifrices provide some additional anticaries benefit to that obtained from water fluoridation [Melberg and Ripa, 1983], and this could, in part, explain the slight caries decrease in fluoridated Wetaskiwin. Moreover, fluoride ingestion is known to occur accidentally during toothbrushing: Barnhart et al [1974] suggested that children aged 2-4 may ingest as much as 35 percent of toothpaste used, whereas adults are likely to ingest only 3 percent. Therefore, the combination of systemic and topical fluoride protection seems likely to be a major factor in the reduction of caries in Camrose children.

This study showed that residency could play a significant role when comparing a fluoridated with a non-fluoridated community. With all the available sources of fluoride through beverages, dentifrices, mouthrinses, supplementation regimens, and professional application of topical fluoride by dental personnel, it is not possible to classify a community as being fluoridated or non-fluoridated with the same authority as was possible ten years ago. All sources of fluoride and the length of residency should be taken into account when comparing communities with regard to access to fluoride and oral health status.

Clovis, J; Hargreaves, J.A.; Thompson, G.W.: Caries prevalence and length of residency in fluoridated and non-fluoridated communities. *Caries Res*, 22: 311-315, September-October, 1988.

Part I: *Calm* group Prevalence of craniomandibular dysfunction in white children with different emotional states

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

The multifactorial etiology of craniomandibular dysfunction suggests that several interlocking factors act at the same time upon the masticatory system.¹ Malocclusion, oral parafunctions, dentofacial injuries, orthodontic treatment, and emotional states are the factors that have been implicated in the etiology of craniomandibular dysfunction. The central question, however, is how much each of these etiologic factors contributes to the development of craniomandibular dysfunction.² No attempt has been made by the studies conducted on children and adolescents to investigate this question.³ An approach to this problem is to study the prevalence of craniomandibular dysfunction separately for patients subject to different etiologic factors.

The purpose of this investigation was to determine the prevalence of craniomandibular dysfunction in white children classified by the parents as *calm*.

METHODS AND MATERIALS

The sample

The sample consisted 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. Children who were present in the dental clinics for a check-up, for routine dental treatment, or for orthodontic evaluation and who met the requirements of the

study were examined. In the Children's Hospital only outpatients were included in the study. None of the examined subjects had had an intraoral injection prior to the examination. Twenty children were randomly reexamined within three months from the first examination and an intrajudge reliability test was conducted.

Definitions

In this study, craniomandibular dysfunction was defined as a set of symptoms. These symptoms were divided into subjective symptoms (those reported by the patients) and objective symptoms (those detected clinically). The objective symptoms are described in the subsection of clinical examination, while the subjective in the subsection of patient interview. Children with one or more of these symptoms met the criterion of craniomandibular dysfunction. This operational definition was based on the assumption that any of the symptoms might be the initiation of a more serious situation later in life.

Differential diagnosis

Since craniomandibular dysfunction can be a separate entity as well as a manifestation of organic disease, a differential diagnosis was necessary.⁴⁻⁷ Thus, children with a history of juvenile rheumatoid arthritis, psoriatic arthritis, muscle diseases, and tumors of the neck and face were not included in this study. Also, children with a current history of toothache (pulpitis, pericoronitis) and upper respiratory infections were excluded. Children who received any type of orthodontic treatment

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

before or during the research examination period were excluded from the sample, since it has yet to be determined definitely whether orthodontic treatment increases or decreases the signs and symptoms of craniomandibular dysfunction.^{8,9}

The parents were asked to evaluate the psychological qualities of the child as well as whether the child was under stress during the research examination period. The subjects were classified by the parents into 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. Furthermore, it was explained to the parents that the psychological evaluation of the children referred to their general life and not associated with the visit to the dentist. Children with a history of head injuries at birth, dentofacial trauma, or fractures of the head were identified from the appropriate answers of the parents to a questionnaire. The information concerning the differential diagnosis was collected by means of a questionnaire distributed to the parents before the examination. At the end of the examination, the answers were checked by the investigator and additional questions were asked where necessary.

It should be mentioned, however, that no attempt was made to differentiate between dysfunction produced by developmental abnormalities such as agenesis, aplasia, or hyperplasia of the condyle and craniomandibular dysfunction as a separate entity, because a radiographic examination was not included in this study.

The examiner

The examiner attended a one-day training course, which included clinical examinations of actual patients, to standardize the procedure of the study. The examinations were performed in a reclining dental chair containing a standard dental light source. Each child was examined clinically followed by an interview. The data were recorded on forms specifically designed to ensure consistency of data collection¹⁰

Clinical examination

The objective symptoms of craniomandibular dysfunction used in this study closely follow those proposed by

Helkimo (1974), Ingerval *et al* (1980), Nilner and Lassing (1981), and Brandt (1985).¹¹⁻¹⁴ The following items were included:

MANDIBULAR MOVEMENTS

- Maximal opening was determined by measuring the distance from the tip of the interdental papilla of maxillary central incisors to the tip of the interdental papilla of the mandibular central incisors with a Boley gauge.^{†15} The subjects were asked to open their jaws as wide as possible and then "a little bit more."^{13,14} As an indication of limited mouth opening, the value of 44 mm was considered.¹⁵
- Maximal lateral movement was measured to the right and left with the aid of pencil markings on the labial surfaces of maxillary and mandibular incisors and a Boley gauge. Any lateral movement less than 5 mm was considered restricted.¹⁶
- Maximal protrusion was determined by measuring the distance between labial surfaces of maxillary and mandibular central incisors, plus the overjet. Reduced protrusion was recorded, if the distance was less than 5 mm.¹⁶

All measurements were performed twice and the highest value was recorded. All values were rounded to the nearest millimeter or half millimeter.[‡] The lower limits of the mandibular movements have been determined statistically.^{15,16} It was not clear, however, whether these values were the values under which pathologic symptoms of craniomandibular dysfunction were present.

TEMPOROMANDIBULAR JOINT FUNCTION

- Deflection of the mandible on maximal opening. Deflection was determined to the left or right by measuring the distance of the midline between the lower central incisors in relation to the upper midline; a pencil marker, a ruler, and a Boley gauge were used. In cases in which midline deviation was present in centric occlusion because of tooth movement, the appropriate position of the midline was marked with a pencil marker. Any deviation of 2 mm or more was recorded as a sign of craniomandibular dysfunction.⁸
- Temporomandibular joint sounds, like clicking and crepitation, were determined by using a stethoscope.* The subjects were asked to open their mouths wide and slowly close them.

[†] European Orthodontic Products.

[‡] Decimal values ≤ 0.25 mm or ≤ 0.75 mm were rounded to 0 and 0.50 mm respectively and values ≥ 0.25 mm or ≥ 0.75 mm were rounded to 0.50 or 1.00 mm respectively.

* Premature stethoscope model H-01516.

TEMPOROMANDIBULAR JOINT AND MUSCLE PALPATION

- Temporomandibular joint tenderness was determined by palpating from the side (laterally) and from behind (via the auditory meatus). It was recorded if the subject felt a difference between the right and left sides, or described the palpation as painful, or the pain caused guarding or a palpebral reflex.¹¹⁻¹⁴
- Muscle tenderness was determined by palpation and it was recorded in the same way as temporomandibular joint tenderness. The following muscle sites were palpated: the anterior and posterior portions of the temporal muscle, the superficial portion of the masseter muscle, and the lateral and medial pterygoid muscles. The palpation was carried out bilaterally except for the lateral and medial pterygoid muscles, which were palpated individually.

Unilateral palpation of the lateral and medial pterygoid muscles was accomplished in the following manner: the lateral pterygoid muscles were palpated by placing the examiner's index finger posterior to the maxillary tuberosity in a manner similar to that used when a posterosuperior alveolar injection is given.¹⁷ The patient was asked to move his jaw to the side being palpated to allow more space for the fingertip and then firm pressure was placed in a direction toward the infratemporal space. Although the muscle cannot be palpated directly by this means, indirect pressure was exerted on the myofascial structures attached to the lateral pterygoid plate.¹⁸ The medial pterygoid muscles were palpated by placing the examiner's fingertip in the floor of the mouth near the third molar area. The gonial angle was supported extraorally by the other hand, and the examiner's finger was able to apply pressure sublingually on the medial pterygoid insertion to the inner surface of the mandible.

Patient interview

Three hundred eighty six subjects, six to ten years of age, were interviewed by the examiner after the clinical examination. The questions were designed to gain information about headaches which occurred once a week or more, pain in the temple region or when the mouth was opened wide or chewing, difficulties in opening wide, as well as the occurrence of temporomandibular joint sounds and locking and luxation of the mandible on movement. Only headaches of unknown etiology were

recorded. Locking was defined as a temporary fixation of short duration in one or both temporomandibular joints. Luxation was defined as anterior displacement of the condylar head out of the fossa. The questions related to locking and luxation were addressed to the subjects by asking them whether "their jaw gets stuck or out of its place." Questions not understood were explained. Care was taken not to influence the subject's answers. Parents were asked only when the child could not answer. In cases of uncertainty, the answers were not recorded.

Statistical methods

The data were computerized and the SPSS/PC+ statistical package was used for their analysis. The prevalence of craniomandibular dysfunction was calculated in percentage. Correlations between objective and subjective symptoms as well as the differences between age and sex groups were tested by the chi-square test. The 95 percent probability level was used. The intrajudge agreement for the questionnaire, clinical examination, and interview was calculated in percentages; while for the mandibular movements (maximal opening, right and left lateral movements, and mandibular protrusion) the 2-tail Student's t-test was used.

RESULTS

Statistically significant differences were found between subjects with and without dentofacial injuries (blows on the face, falls) regarding the prevalence of TMJ tenderness ($p = .006$) and mean values of right ($p < .04$) and left ($p = .002$) mandibular movements. Moreover, statistically significant differences were found between the subjects rated as calm and those rated as tense, anxious, nervous, or under stress in the prevalence of muscle ($p = .0005$) and TMJ tenderness ($p = .02$). Since these differences might be associated with the presence of different etiologic factors, the entire sample ($N = 386$) 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 (blows on the face, falls) ($N = 25$).

Six subjects had toothache or upper respiratory infection during the examination and were excluded from the sample. None of the children had any organic disease that could cause craniomandibular dysfunction. Since

the number of subjects with dentofacial injuries was small, it was excluded from the study.

This paper deals with the prevalence of objective and subjective symptoms of craniomandibular dysfunction in the *calm* group (108 males and 142 females). The statistical analysis of this group provided the following results.

Prevalence of objective symptoms of craniomandibular dysfunction

The overall prevalence of objective symptoms in this group (N=250) was 54 percent (Table 1). The corresponding prevalence for males and females was 49 and 57.5 percent, respectively (Table 1). There was no statistically significant difference in the prevalence of objective symptoms between males and females ($X^2 = .606$). The prevalence of each objective symptom was as follows:

- *Temporomandibular joint sounds.* The prevalence of clicking sounds in the temporomandibular joint (TMJ) in the entire group (N=250) was 14.4 percent (Table 1). Females had higher frequency of TMJ clicking sounds than males. No statistically significant difference was found between males and females for both sides ($X^2 = 3.375$) or for the left side ($X^2 = 3.218$). The difference was found to be statistically significant ($p < .05$), however, on the right side. Crepitation was found in only one subject.
- *Temporomandibular joint tenderness.* The prevalence of TMJ tenderness in the entire group was 7.2 percent (Table 1). The corresponding prevalence for males and females was 6.5 and 7.7 percent, respectively (Table 1). No statistically significant differences were found between males and females ($X^2 = .019$), or between males and females on the right ($X^2 = .164$) or left ($X^2 = .07$) sides.

- *Muscle tenderness.* The prevalence of muscle tenderness in the entire group was 46.8 percent (Table 1). The corresponding values for males and females were 43.5 and 49.3 percent, respectively (Table 1). Females had higher frequency of muscle tenderness than males. No statistically significant differences between males and females ($X^2 = .606$), or between males and females on the right ($X^2 = .942$) or left ($X^2 = .664$) sides were found.
- *Limited mandibular movements.* Three subjects had values of mandibular movements smaller than those defined in this study as minimal. Two of these patients had smaller values in maximal mouth opening and one in mandibular protrusion. Of the three patients, two were found to have no objective symptoms, while one had muscle and TMJ tenderness.
- *Deflection on maximal opening.* The prevalence of deflection found on opening was 5.6 percent in the entire group of 250 patients. No statistically significant difference was found between males and females ($X^2 = .672$). In all subjects, the deflection occurred to the left side.

Prevalence of objective symptoms by age and sex

The distribution of the subjects with each objective symptom by age is given in Table 2. The distribution of the subjects with one or more objective symptoms by age is shown in Figure 1. Statistically significant differences by age were not found. Further statistical analysis of the relationship between males and females with each objective symptom by age was not feasible, because of the small number of the subjects in each category.

Table 1 □ Overall and by sex prevalence of each objective symptom.

Prevalence	Objective symptoms									
	TMJ* sounds		TMJ* tenderness		Muscle tenderness		Limited maximal opening		Total One or more symptoms	
	#	%	#	%	#	%	#	%	#	%
Overall	(36/250)	14.4	(18/250)	7.2	(117/250)	46.8	(2/250)	0.8	(135/250)	54
Males	(10/108)	9.2	(7/108)	6.5	(47/108)	43.5	(2/108)	1.8	(53/108)	49
Females	(26/142)	18.3	(11/142)	7.7	(70/142)	49.3	—	—	(82/142)	57.7

*TMJ stands for temporomandibular joint

Note: The ratio in parentheses are the number of subjects with the symptom divided by the total number of subjects in each group

Table 2 □ Distribution of the subjects with each objective symptom by age.

Objective symptoms	Age (years)				
	6	7	8	9	10
	N = 46	N = 54	N = 55	N = 49	N = 46
	Percent				
TMJ sounds	10.9	16.7	12.7	10.2	21.7
Muscle tenderness	45.7	40.7	43.6	51.0	54.3
TMJ tenderness	6.5	7.4	5.5	6.1	10.9
Limited maximal opening	2.2	—	1.8	—	—

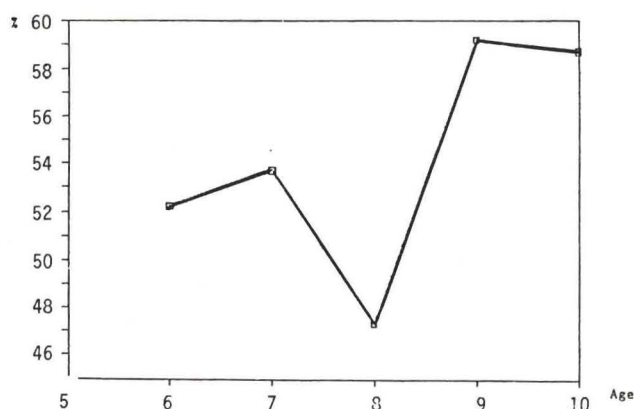


Figure 1. Distribution of the subjects with one or more objective symptoms by age.

Correlations between objective symptoms

Correlation between muscle tenderness and TMJ tenderness was found at $p = .0001$, while the correlation between muscle tenderness and TMJ sounds was significant at $p < .05$.

Prevalence of subjective symptoms of craniomandibular dysfunction

The prevalence of subjective symptoms in the entire group of 250 patients was 36.4 percent (Table 3). The corresponding prevalence for males and females was 34.2 and 38 percent, respectively (Table 3). Clicking sounds were reported by 6.4 percent of the subjects. Four subjects reported TMJ clicking sounds which were not detected clinically. Locking and luxation of the mandible were not reported by any of the subjects. The chi-square test showed no significant difference between males and females with respect to any of the subjective symptoms.

Prevalence of subjective symptoms by age and sex

The prevalence of each subjective symptom by age is given in Table 4. The distribution of the subjects with one or more symptoms by age is presented in Figure 2. There was no significant difference for each subjective symptom by age. Further statistical analysis of the sub-

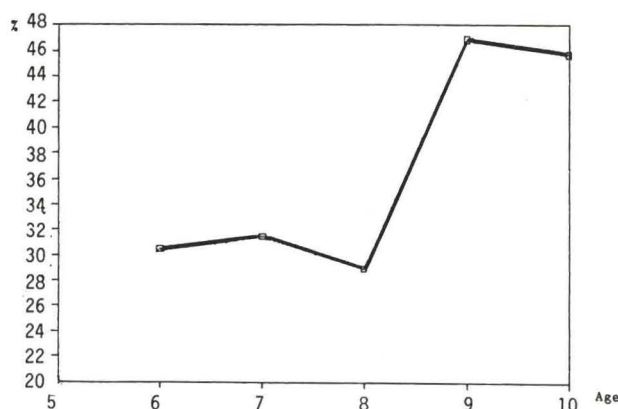


Figure 2. Distribution of the subjects with one or more subjective symptoms by age.

Table 4 □ Distribution of the subjects with each subjective symptom by age.

Subjective symptoms	Age (years)				
	6	7	8	9	10
	N = 46	N = 54	N = 55	N = 49	N = 46
	Percent				
Headaches	6.5	7.4	9.1	14.3	17.4
Difficulties in opening wide	13.0	13.0	7.3	14.3	13.1
Pain in temple region	4.3	5.6	9.1	6.1	10.9
Pain in opening wide	17.4	14.8	14.5	24.5	15.2
Pain in chewing	4.3	5.6	5.5	10.2	10.9
Reported clicking	4.3	1.9	7.3	8.2	10.9

Table 3 □ Overall and by sex prevalence of each subjective symptoms.

Prevalence	Headaches		Difficulties in opening wide		Pain in temple region		Pain in opening wide		Pain in chewing		Reported clicking		Total One or more symptoms	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
	Overall	(27/250)	10.8	(30/250)	12.0	(18/250)	7.2	(43/250)	17.2	(18/250)	7.2	(16/250)	6.4	(91/250)
Males	(10/108)	9.2	(11/108)	10.2	(9/108)	8.3	(21/108)	19.4	(7/108)	6.5	(4/108)	3.7	(37/108)	34.2
Females	(17/142)	11.9	(19/142)	13.4	(9/142)	6.3	(22/142)	15.5	(11/142)	7.8	(12/108)	8.5	(54/142)	38.0

Note: The ratios in parentheses are the number of subjects with the symptom divided by the total number of subjects in each group.

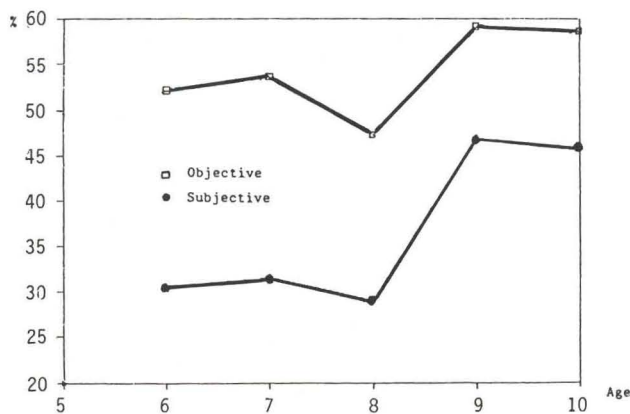


Figure 3. Relationship between objective and subjective symptoms by age in the calm group.

jective symptoms by age and sex was not feasible due to the small number of subjects in each category.

Correlations between objective and subjective symptoms

Figure 3 presents the relationship between objective and subjective symptoms by age. The chi-square test showed correlations between muscle tenderness and each of the following variables: *difficulties in opening wide* ($p < .0001$), *pain in temple region* ($p = .002$), *pain on movements* ($p < .0001$), and *reported TMJ sounds* ($p < .002$). Clinically detected TMJ sounds were correlated with reported TMJ sounds ($p < .0001$), while TMJ tenderness was correlated with difficulties in opening wide ($p = .01$) and pain in temple region ($p < .04$). No significant correlation was found between headaches and muscle tenderness ($X^2 = 1.862$).

Intrajudge reliability test

The intrajudge reliability test showed that the percentage of agreement between the first and second examinations in twenty subjects was ninety for the questionnaire, ninety for the clinical examination, and ninety-five for the interview. The Student's *t*-test revealed that the correlation between the first and the second examinations ranged from .998 to .985 with respect to the mandibular movements.

DISCUSSION

This was a cross-sectional epidemiologic study to examine the prevalence of craniomandibular dysfunction in white children six to ten years of age classified by the

parents as *calm*. The differential diagnosis related to etiologic factors introduced in this study attempts to show the extent to which these factors contribute to the development of craniomandibular dysfunction. Of the known etiologic factors, malocclusion and oral parafunctions are considered to be the causative factors of the dysfunction in this group.

The role of race in the development of craniomandibular dysfunction has not been investigated yet. There is evidence, however, that skeletofacial pattern might affect the function of the masticatory system.¹⁹ This study was the first one to take race into account by including only white children in the sample.

Methods

The methods used in this study are generally accepted in the literature for the evaluation of the masticatory system.^{8,13,14} In the clinical examination, TMJ sounds were recorded for the right and left sides separately; TMJ tenderness was recorded laterally and posteriorly for the right and left sides; and muscle tenderness was recorded for each palpated muscle and right and left sides separately. During the analysis of the data, a subject was considered to have muscle tenderness when one or more muscles of the right and/or left sides were tender to palpation and TMJ tenderness, when tenderness to palpation was present laterally and/or posteriorly for each or both sides. A subject was considered to have TMJ sounds when sounds were present on the right and/or left sides.

Prevalence of craniomandibular dysfunction

Among the objective symptoms of dysfunction, the most frequently observed in this group was muscle tenderness to palpation followed by TMJ sounds and TMJ tenderness (Table 1). Regarding the severity of these symptoms, muscle and TMJ tenderness were slight. Since, however, a healthy muscle does not elicit sensations of tenderness or pain when palpated, the slight tenderness shows a disturbance of the function of the masticatory system. The muscles more tender to palpation were the lateral and medial pterygoids. There were no statistically significant differences in muscle and TMJ tenderness between males and females, although the frequency of these symptoms in females was higher. Changes in the prevalence of muscle and TMJ tenderness by age took place in this group, but the differences were not statistically significant.

The frequency of TMJ sounds (clicking) was higher in females, yet no statistically significant difference was

found when both sides were taken into consideration. When each side was analyzed separately, however, females turned out to have statistically higher frequency of TMJ sounds on the right side. No possible explanation for this sex difference could be found. The higher occurrence of TMJ sounds on the right side may be attributed to parafunctional activity taking place on this side, malocclusion or combination of them; this side might also be the most preferable side of chewing or biting for these subjects.

Traditionally, in epidemiologic studies conducted in children, dysfunctional opening has been considered to be the inability of the patient to open the mouth 40 mm or more. This approach, however, presents two disadvantages: first, it is not accurate to apply rigid standards to every group of individuals; and second, it does not take into account the age of the examined subjects. In the present study, the minimal values of mandibular movements were those determined statistically in children without craniomandibular dysfunction.^{15,16} Of the three subjects with values of mandibular movements smaller than the statistically determined minimal values, only one had muscle and TMJ tenderness. Moreover, subjects with muscle and TMJ tenderness did not have limited mouth opening although their ability to open the mouth and to move the mandible to the right, left, and forward could have been reduced. It should be pointed out, therefore, that a limited mouth opening may be dysfunctional, while a dysfunctional opening may not be limited.

The predominant occurrence of the deflection on opening to the left side is a finding reported also by other studies conducted on children and adolescents.^{13,20}

With respect to the subjective symptoms, a steady increase of the prevalence of recurrent headaches with age was observed (Table 4). This difference was not statistically significant. The frequency of recurrent headaches in females was higher than that in males (Table 3). In this study, only recurrent headaches of unknown etiology were recorded. Headaches of this nature were attributed to the contraction of the muscles of the head and neck caused by parafunctional activities.²¹ No significant correlation was found between muscle tenderness and recurrent headaches in this group. A possible explanation for this finding was that the muscle tenderness was slight enough to cause imbalance of the muscles of the head. The majority of recurrent headaches reported by the children in the present study were confirmed by the parents, thus providing a more reliable prevalence value especially for the young children.

A number of subjects reported TMJ clicking sounds

not detected clinically. Other studies that reported the same finding attributed it to the intermittent nature of TMJ clicking sounds.^{13,14} In this study an additional explanation was found. Some of the children presented clicking sounds by moving the mandible laterally which cannot be detected during the mouth opening. The occurrence of these sounds might be explained by a displacement of the disc more medially. The severity of the rest of the subjective symptoms was mild. An increase of the prevalence of subjective symptoms by age was observed. The distribution of the subjects with symptoms (Figures 1,2,3) in this group was regular, which suggests that the etiologic factors of these symptoms were constant.

The correlations found between muscle and TMJ tenderness and muscle tenderness and TMJ sounds showed that these symptoms were interrelated. It was not possible, however, to determine which one causes the other. A possible explanation was that the susceptibility of each part of the masticatory system differs among individuals. The correlations found between objective and subjective symptoms in this group revealed that these subjects were aware of the dysfunction of the masticatory system and confirmed the presence of the clinically detected symptoms.

This study showed low prevalence of TMJ tenderness (7.2 percent), TMJ sounds (14.4 percent), limited maximal opening (0.8 percent), deflection on maximal opening (5.6 percent), and headaches (10.8 percent), but a high prevalence of muscle tenderness (46.8 percent). The lengthening of the muscles during the development of the stomatognathic system may account for this high frequency of muscle tenderness.

Compared with Nilner's and Kopp's study on subjects of corresponding ages, the present study revealed lower prevalence of TMJ (7.2 percent vs 39 percent) and muscle tenderness (46.8 percent vs 64 percent), and headaches (10.8 percent vs 14 percent).²² This difference can be attributed to the differential diagnosis related to etiologic factors introduced in this study, since similar definitions of the criteria of craniomandibular dysfunction were used in both studies. The rest of the studies were conducted on subjects of different ages or race and, thus, were not comparable.

Given that the severity of the symptoms in this group was mild, their occurrence does not necessarily indicate a need for treatment. Finally, because the known etiologic factors, malocclusion and oral parafunctions, are considered to be the causative factors of the symptoms in this group, their relationship needs further investigation.

REFERENCES

1. Rugh, J.D. and Solberg, W.K.: Psychological implications in temporomandibular pain and dysfunction. *Oral Sci Rev*, 1:3-20, 1976.
2. 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.
3. Vanderas, A.P.: Prevalence of craniomandibular dysfunction in children and adolescents: a review. *Pediatr Dent*, 9:312-316, December, 1987.
4. Schwartz, L.L.: Pain associated with the temporomandibular joint. *J Am Dent Assoc*, 51:394-397, October, 1955.
5. Bell, W.E.: Clinical diagnosis of the pain dysfunction syndrome. *J Am Dent Assoc*, 79:154-160, July, 1969.
6. Morawa, A.P.; Loos, P.J.; and Easton, J.W.: Temporomandibular joint dysfunction in children and adolescents: incidence, diagnosis, and treatment. *Quint Intern*, 11:771-777, November, 1985.
7. Delbalso, M.A.; Sweeney, A.T.; and Kapur, S.: An unusual cause of facial trismus in a child: report of a case. *J Am Dent Assoc*, 112:207-209, February, 1986.
8. Egermark-Eriksson, I.: Mandibular dysfunction in children and individuals with dual bite. *Swed Dent J*, Supp 10, 1982.
9. Moyers, E.R.: The development of occlusion and temporomandibular joint disorders. 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 53-69.
10. Vanderas, A.P.: Prevalence of temporomandibular dysfunction in white children 6-10 years of age in a dental school population: a cross-sectional study. Thesis, University of Pittsburgh, 1987, pp vii, 127.
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. Ingerval, B.; Mohlin, B.; and Thilander, B.: Prevalence of symptoms of functional disturbances of the masticatory system in Swedish men. *J Oral Rehab*, 7:185-197, 1980.
13. Nilner, M. and Lassing, S.A.: Prevalence of functional disturbances and diseases of the stomatognathic system in 7-14 years old. *Swed Dent J*, 5:173-187, 1981.
14. 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.
15. Landtving, K.: Evaluation of the normal range of vertical mandibular opening in children and adolescents with special reference to age and stature. *J Maxillofac Surg*, 6:157-162, 1978.
16. Agerberg, G.: Maximal mandibular movements in children. *Acta Odont Scand*, 32:147-159, 1974.
17. Williamson, E.H.: Temporomandibular dysfunction in pretreatment adolescent patients. *Am J Orthodont*, 72:429-433, October, 1977.
18. Solberg, W.K.; Woo, M.; and Houston, T.: Prevalence of mandibular dysfunction in young adults. *J Am Dent Assoc*, 98:25-34, January, 1979.
19. Dibbets, J.; Van der weele, L.; and Boering, G.: Craniofacial morphology and temporomandibular joint dysfunction 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 151-182.
20. Grosfeld, O. and Czarnecka, B.: Musculo-articular disorders of the stomatognathic system in school children examined according to clinical criteria. *J Oral Rehab*, 4:193-200, 1977.
21. Okeson, P.J.: Signs and symptoms of temporomandibular disorders. In: *Fundamentals of occlusion and temporomandibular disorders*. Mosby Co., 1985, pp 164-237.
22. 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.

I would like to thank my committee members, Dr. R. Rapp, Dr. T. Zullo, Dr. M. Elliott, Dr. Y. Ismail, Dr. R. Mundell of the University of Pittsburgh, and Dr. R. Sears of Georgetown University, for their advice, guidance, and constructive comments during the course of this research.

This article is part of a thesis submitted in partial fulfillment of the requirement for the degree of Master of Dental Science at the University of Pittsburgh, School of Dental Medicine, Department of Pediatric Dentistry.

GENETIC CONTROL OF CHOLESTEROL AND LIPOPROTEIN METABOLISM

The experimental design permitted genetic analyses of the variables related to cholesterol and lipoprotein metabolism. Estimates of heritability of VLDL + LDL cholesterol concentration were 0.32 and for HDL cholesterol concentration, 0.78. There was a strong negative genetic correlation ($r_g = -0.95$) between serum apolipoprotein A-1 (apo A-1) concentration and cholesterol turnover. There also were significant genetic correlations between serum cholesterol concentration and cholesterol turnover and production rates. HDL cholesterol concentrations among sire-progeny groups were correlated with several indicators of cholesterol metabolism. These results provided further evidence for the strong genetic control of cholesterol and lipoprotein metabolism.

McGill, Jr., H.C. *et al*: Deferred effects of preweaning nutrition on lipid metabolism and atherosclerosis. In *Prevention of adult atherosclerosis during childhood*. Columbus: Ross Laboratories, 1988, pp 65,66.

Clean vs sterile technique for pediatric dental patients in the operating room

Mark L. Helpin, DMD
William K. Duncan, DDS, MEd

There are conflicting opinions concerning the need for sterile technique for restorative dentistry in the operating room¹. Neither the medical nor dental literature documents that sterile technique offers any advantages over modified sterile or clean techniques for restorative dentistry.² While all reviewed authors advocate scrub suits and a surgical scrub of the hands and arms, most do not state that gowning and gloving are necessary for restorative dentistry. The preferred *clean* technique is justified by the fact that it is impossible to sterilize the oral cavity and that intraoral procedures are considered *clean* or *clean-contaminated* in the operating room setting.²⁻⁷

Although Tocchini describes gowning and gloving for all dental treatment in the operating room, most authors agree with Roberts that the choice of *clean vs sterile technique* should be determined by the treatment required, preoperative conditions, and hospital policy. Those procedures which can be done in sterile fashion, for example, major surgery or soft tissue procedures, should be so performed.^{1-3,8,9} Compromises between *clean* and *sterile* techniques have been suggested. Roberts and Biederman advocate gloving, but not gowning for operative dentistry; Matthewson and others point out that some hospitals require gloving.^{3,6,8} King and Nelson state that *clean* technique is acceptable for the

restorative portion of treatment, but the operator should rescrub, gown, and glove for extractions.¹⁰ Biederman stresses that although sterility in the mouth is impossible, precautions must still be taken to prevent infection.⁶

Stewart and Troutman state that there is a lack of firm evidence supporting the need for strict aseptic technique for restorative dentistry in the operating room.¹

Several studies have been published investigating complications in pediatric general anesthesia. Enger and Mourino in a review of 200 pediatric dental general anesthesia cases found nausea and vomiting (35.5 percent) followed by fever (11.5 percent) to be the most common complications.¹¹ In a study of 600 developmentally disabled patients who underwent general anesthesia, Libman *et al* found postoperative fever to be the most common complication.¹² In eighty general anesthesia cases Nazif also found postoperative fever (25 percent) to be the most common complication.¹³ Although postoperative complications are itemized and used as a means to compare *sterile* and *clean* technique in this study, a thorough investigation of complications was not included in this paper. The purpose of this retrospective study was to compare the incidence of postoperative morbidity for a *sterile vs clean* surgical technique.

MATERIALS AND METHODS

The medical charts of 100 randomly selected children and adolescents who received dental treatment in the

Dr. Helpin now practices in Putnam, Connecticut; at the time this paper was prepared, he was Professor of Pediatric Dentistry at the University of Mississippi, School of Dentistry. Dr. Duncan is Chairman, Pediatric Dentistry, University of Mississippi, School of Dentistry.

operating room were reviewed simultaneously by the authors. Treatment for all patients was performed over a three-year-period by the same operator (MLH). Analysis included age, race, sex, treatment performed, length of treatment time, *clean* vs *sterile* vs *modified sterile* technique, postoperative complications, complications following discharge, and administration of antibiotics. Length of time was recorded in the medical record by the anesthetist, with starting time noted when either radiographic examination began or, if no films were taken, when the patient was draped.

During the postoperative period, transient conditions which resolved themselves without intervention, in a short time, for example, slight temperature elevation (below 100.5 rectally) or a single episode of nausea and/or vomiting, were not recorded as complications.

Procedures were classified as *clean* when the operator wore a scrub suit and performed a surgical scrub. This was done whenever restorative procedures were performed, either alone or in a combination with simple oral surgical procedures; no change in classification was made, if gloves were worn. Restorative procedures included amalgam and composite restorations, stainless steel crowns, and pulp therapy. Those procedures in which gown and gloves were worn were categorized as *sterile*, if no restorative treatment was performed: for example, extractions alone, gingivectomy alone, or gingivectomy with extractions. A category of *modified sterile* was used to describe those instances in which gown and gloves were used, but restorative procedures preceded treatment which would, by itself, have been completed in a sterile manner: for example, restorations and gingivectomy, or restorations and complex oral surgery procedures (impaction removal or flap procedures). In modified sterile cases, after the restorative portion of treatment was completed, the operators regloved and the patient's head was redraped.

FINDINGS

Analysis revealed a study population consisting of sixty-one males and thirty-nine females. There were fifty-two black children, forty-one white children, and seven American Indian children. The age range was one to seventeen years with a mean age of 6.1 years. Seventy-four percent of the population was medically compromised with problems such as neurological deficit and/or seizure disorder (34/74) or congenital heart disease (15/74). The remaining 26 percent of the population was healthy. Patients were treated in the operating room due to their inability to cooperate in the out-patient setting

and/or the extensive nature of their treatment needs. There are eighty-two procedures which were classified as *clean*, fourteen procedures which were classified as *sterile*, and four procedures which were considered *modified sterile* (Table 1). Treatment time ranged from 21-220 minutes with a mean of 117 minutes.

Fifteen of the 100 cases developed postoperative complications. All fifteen complications presented while the patients were in the hospital before discharge. No patients developed complications following discharge. Table 2 presents an analysis of the fifteen complications. Two of three patients with fever responded quickly to acetaminophen; neither required any delay in discharge. The only patient who required postponement of anticipated discharge time was a fifteen-year-old female with a seizure disorder, who received a gingivectomy. Postoperatively the patient demonstrated persistent fever, which was associated with atelectasis. The patient was started on erythromycin (200 mg/5 cc; 1 teaspoon qid). On the third postoperative morning, the patient was doing well and the temperature had returned to normal. The patient was discharged that afternoon on continued erythromycin therapy.

An examination of the fifteen patients with complications in relation to their classification according to the surgical technique employed, revealed that twelve were *clean*, three were *sterile*, and none was *modified sterile* (Table 3). The percentage of clean cases with complications was, then, 15 percent (12/82), while the combined groups of *sterile* and *modified sterile* showed a 17 percent (3/18) incidence of complication. Although one can readily see that these percentages do not differ substantially, the incidence of complications between the *clean* and *sterile/modified sterile* groups were compared using a 2x2 Chi Square analysis. The difference between the two groups was not significant, with a $X^2 = .05$ and a probability of $p = .823$.

Antibiotics were employed in thirty-six of the 100 cases reviewed. The indications for antibiotic therapy were oral infection, SBE prophylaxis, medical indications (example: chronic urinary tract infection), and major gingival surgery.^{3,6,11,16} There were no patients in this study who experienced postoperative infection. Analysis showed that 17 percent (6/36) of those who had received antibiotics and 14 percent (9/64) of those who did not receive antibiotics showed postoperative complications. A 2x2 Chi Square analysis resulted in a $X^2 = .12$ and a probability of $p = .73$ showing there was not sufficient difference in the incidence of complications between those patients receiving antibiotics and those who did not.

Table 1 □ Dental procedures and surgical technique.

Clear	Sterile		Modified sterile		
Restorations	10	Gingivectomy only	2	Restorations and gingivectomy	0
Restorations and extractions	72	Gingivectomy and extractions	3	Restorations, extractions, and gingivectomy	4
		Extractions only	9		
Totals	82		14		4

Table 2 □ Complications.

Nausea and/or vomiting	5
Seizures	3
Temperature elevation	3
Blood loss	1
Tongue swelling	1
Airway swelling	1
Stridor	1
Total	15

DISCUSSION

The data indicate that there was no statistical difference in the incidence of postoperative complications between procedures which were done employing a *clean*, *sterile*, or *modified sterile* technique. A consistent finding of approximately 15 percent of patients with postoperative morbidity was found. General statistics on postoperative complications in a surgical, or pediatric surgical, population have been difficult to pinpoint.¹¹ This was due to the lack of uniform definition for the term *complication*. Since the increased popularity and utilization of ambulatory surgical care units (ASCU), figures are more easily compiled. Natof cites a study that showed almost 45 percent of patients treated in an ASCU manifested some postoperative symptoms, most commonly drowsiness, headache, malaise, dizziness, nausea, and vomiting; these problems were considered, however, to be transient and insignificant.¹¹

In a study on ambulatory pediatric dentistry patients, Smith *et al* found 7.5 percent of patients experienced complications requiring extensive evaluation and therapy.¹² Close examination of their data, however, indicates that their 7.5 percent might have been higher, if the criteria described in this paper had been utilized.

The possible influence of antibiotic therapy on postoperative complications is difficult to determine. It is possible that certain complications, i.e. temperature elevation, may have been prevented by the presence of antibiotics; the morbidity in those patients receiving and not receiving antibiotics, however, remained at approximately 15 percent. It is clear, then, that dental operators who use a *clean* technique, when appropriate, do not expose their patients to any increased risk of morbidity or postoperative complication.

CONCLUSION

Recommendations on the need for *clean* or *sterile* technique during pediatric dentistry procedures in the operating room have, in the past, been based on personal experience. The findings in this retrospective analysis of 100 children and adolescents who received dental treatment in the operating room demonstrate no statistical difference in morbidity or postoperative complications between patients who were treated with a *clean* or *sterile* technique. Based on these data, it appears operators may utilize a *clean* technique for restorative and simple extraction procedures without increased risk to their patients in the operating room.

REFERENCES

1. Stewart, R.E. and Troutman, K.C.: Pediatric dentistry in the hospital, in *Hospital dental practice*, Hooley, J.R., Daun, L.G. eds. St. Louis: C.V. Mosby Co., pp 291-310.
2. Jones, J.E. and Weddell, J.A.: Hospital dental services for children and the use of general anesthesia, in *Dentistry for the child and adolescent*, 4th ed. McDonald, R.E., Avery, D.R., eds. St. Louis: C.V. Mosby Co., 1983, pp 278-296.
3. Matthewson, R.J.; Primosch, R.E.; Sanger, R.G. *et al*: *Fundamentals of dentistry for children*. Chicago: Quintessence Publishing Co., 1982.
4. Loevy, H.T.: *Dental management of the child patient*. Chicago: Quintessence Publishing Co., 1981.
5. Johnson, R.: Hospital treatment of the handicapped dental patient, in textbook of *Dentistry for the handicapped patient*, Wessels, K.E. ed. Massachusetts: PSG Publishing Co., pp 147-183.
6. Biederman, P.: Hospital dentistry, in *Pediatric dental medicine*. Forrester, D.J.; Wagner, M.L.; and Fleming, J. eds. Philadelphia: Lea & Febiger, 1981, pp 617-642.
7. Douglas, B.L.: *Hospital dentistry*, 2nd ed. St. Louis: C.V. Mosby Co., 1970.
8. Roberts, M.: Hospital dental protocol, in *Pediatric dentistry*, Braham, R.L.; Morris, M.E., eds. Baltimore: Williams and Wilkins Co., 1985, pp 464-471.
9. Tocchini, J.J.: Operative dentistry under general anesthesia. J Calif Dent Assoc, 41:15-19, 1965.
10. King, K.J. and Nelson, R.N.: Dental treatment in the hospital utilizing general anesthesia, in *Dentistry for the handicapped patient*, Nowak, A.J. ed. St. Louis: C.V. Mosby Co., 1976, pp 225-249.
11. Enger, D.J. and Mourino, A.P.: A survey of 200 pediatric dental general anesthesia cases. J Dent Child, 52:36-41, January-February, 1985.
12. Libman, R.H.; Coke, J.M.; and Cohen, L.: Complications related to the administration of general anesthesia in 600 developmentally disabled dental patients. JADA, 99:190-193, August, 1979.
13. Nazif, M.M.: Nasal intubation in complete oral rehabilitation: A survey of cases, J Dent Child, 43:25-27, January-February, 1976.
14. Natof, H.E.: Complications, in *Anesthesia for ambulatory surgery*, Wetchler, B.V. ed. Philadelphia: J.B. Lippincott Co., 1985., pp 321-356.
15. Smith, F.K.; Deputy, B.S.; and Berry, F.B.: Outpatient anesthesia for children undergoing extensive dental treatment. J Dent Child, 45:142-145, 1978.

Table 3 □ Complications related to surgical technique.

Complication	Clean	Sterile	Modified sterile
Nausea/vomiting	5	0	0
Seizures	3	0	0
Temperature	1	2	0
Blood loss	0	1	0
Tongue swelling	1	0	0
Airway swelling	1	0	0
Stridor	1	0	0
Totals	12	3	0

Patient and operator attitudes toward rubber dam

Colwyn M. Jones, BDS, FDS
James S. Reid, BDS, FDS, PhD

Rubber dam has been available to the dental profession for over one hundred years.¹ It is the best method of isolating a cavity during preparation and restoration and its use has been advocated for both adults and children.

The exclusion of saliva, blood and gingival fluid ensures the prevention of microbial contamination, allows excellent inspection of the cavity form and improves working conditions, when using restorative materials. The increasing reliance of modern dentistry on adhesive materials, which require dryness to allow the chemical bond with the dental hard tissues to form, has acted as a renewed incentive for the use of rubber dam.⁷⁻⁹

The importance of the safety afforded by rubber dam is highlighted by the list of dental instruments and materials that have been inhaled by patients being treated without rubber dam.^{5,6} This is especially relevant in endodontics where the inhalation of an endodontic instrument leads to an indefensible legal position.^{10,11} Despite this, a survey performed in 1983 showed only 5 percent of the responding general dental practitioners used rubber dam for endodontic procedures.¹² It should also be noted that the oral soft tissues are protected from chemical trauma by rubber dam.¹³

Rubber dam retracts the tongue and cheeks, thus increasing access and visibility. There is no need for the patient to rinse during treatment as the water spray from

the air turbine and any debris from the operative procedure are effectively outside the mouth.

If saliva does collect behind the rubber dam, it can be easily swallowed or a saliva ejector can be used by the patient. During restorative procedures carried out under sedation or general anesthesia the airway is protected, when rubber dam is used.

Nervous and garrulous children often settle once the rubber dam is in place, a phenomenon explained by the child dissociating itself from its isolated teeth.^{14,15} Gagging, which can often be a problem in handicapped patients, may be stopped by a quickly and firmly placed rubber dam.

A safe, dry field in a comfortable patient, with the teeth and colored rubber dam contrasting, are the major advantages to the operator. Although the operating area may not be completely sterile, the aseptic field afforded by rubber dam increases the likelihood of successful endodontic procedures.¹⁶ The risk of the inhalation of contaminated aerosols produced by the air turbine in saliva is reduced. This benefit is more relevant to staff when dealing with high-risk patients. Many articles list the undoubted advantages of rubber dam, but few have assessed the reaction of either the patient or the operator, on a significant level.

METHOD

One hundred consecutive patients who attended the Child Dental Health Unit for treatment were used in the survey. A control group could not be used as endodon-

Dr. Jones is with the Department of Prosthodontics and Dr. Reid is with the Department of Conservative Dentistry, Glasgow Dental Hospital and School, 378 Sauchiehall Street, Glasgow G2 3JZ, Scotland.

tics and bleaching cannot ethically be performed without rubber dam. The policy of the Unit is to use rubber dam, whenever a permanent plastic restorative material is being placed.

The treatment was performed by sixty-seven undergraduate students, all of whom had received instruction in the use of rubber dam as part of their training in operative technique. Clinically the rubber dam was introduced as any new technique would be, according to the age of the patient. If a local anesthetic was used, the rubber dam was fitted after its administration. If any difficulties were encountered, the teaching staff supervising the clinic assisted.

After treatment was finished, the patients were questioned and a short questionnaire was completed by the operator. This included their recall of previous dental treatment, with or without rubber dam; their attitude to rubber dam; and reason for their attitude. Their postoperative anxiety was measured by the use of a 10 cm linear analog scale. This used a 10 cm line marked *very nervous* at the left-hand side and *not nervous* at the right-hand side of the scale. The patients were asked to mark their own score on the line. A number was found by measuring from the left-hand side of the scale to the patients mark and the distance rounded to the nearest centimeter. If the patient was too young to understand the questions or use the linear analog scale, the operating student and the patient's mother reached a consensus on the answers and postoperative anxiety score.

The undergraduate operators also completed a questionnaire on their own attitude, the procedure and the methods used for the retention of the rubber dam. The time taken by the operator to apply the rubber dam was recorded to show the extra time involved when using this technique. This was rounded to the nearest minute.

RESULTS

The survey continued until 100 patients had completed the questionnaire. Thirty-four percent were male and 66 percent were female. The ages ranged from four to twenty-four years of age, mean, 12.9 years (Figure 1).

Sixty-three percent of patients underwent routine restorative treatment. Endodontic therapy was performed on 29 percent of patients and bleaching of vital teeth on 8 percent. Sixty-eight percent of patients had experienced rubber dam previously and 4 percent had always been treated using rubber dam. Forty-two percent had a local anesthetic administered before placement of the rubber dam. Thirty percent of patients preferred treatment with rubber dam *in situ*. Five percent stated treatment

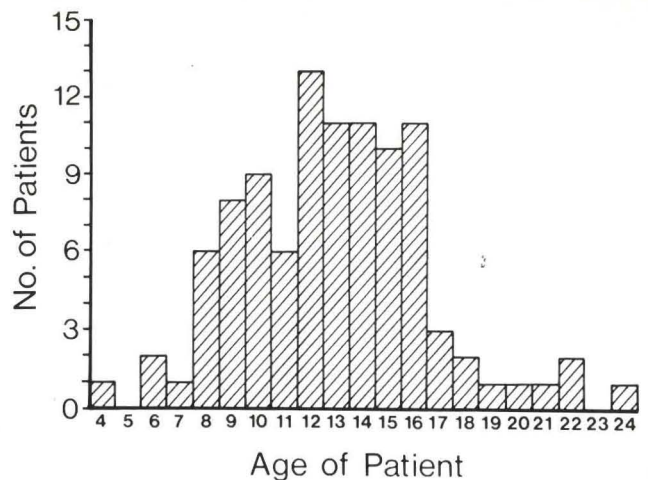


Figure 1. Histogram showing the age ranges of the patients.

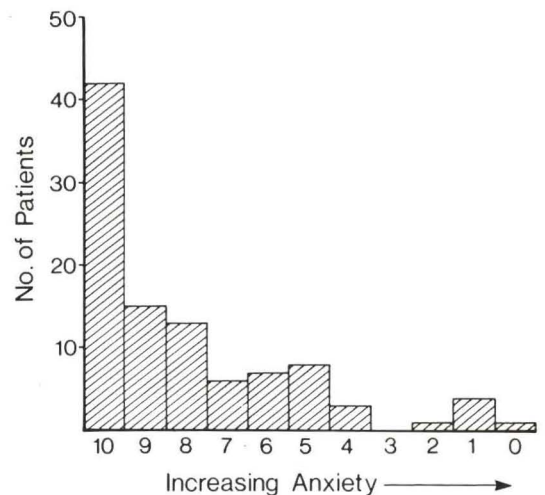


Figure 2. Histogram displaying the distribution of patient anxiety scores.

was less painful, 10 percent preferred having nothing in their mouths, 5 percent said it was more comfortable, 4 percent felt their tongue was better controlled, and 3 percent stated treatment was easier. Three percent gave no reasons for their preference.

Twenty-one percent of the patients preferred treatment without rubber dam. Nine percent stated it was painful and 9 percent stated it was uncomfortable. Three percent of patients disliked its taste.

Forty-nine percent stated that rubber dam made no difference to their treatment or that they did not know.

The average number of teeth isolated at one time was 3.1, range one to eight; and the time taken to apply the rubber dam varied from one to twenty minutes, mean 5.8 minutes. There was no correlation between the time taken to apply the rubber dam and the number of teeth isolated. The patients anxiety score (Figure 2) varied from zero to ten, mean score 8.01.

Fifty-two percent of the patients had the rubber dam secured with floss or elastic ligatures and forty-eight

percent had it retained with a rubber dam clamp with or without a combination of ligatures. The rubber dam was placed successfully in all one hundred patients.

Ninety-four percent of the undergraduates had previous clinical experience in the use of rubber dam, 86 percent in performing endodontic procedures, 71 percent in restorative procedures, and 47 percent in bleaching procedures.

Ninety-eight percent thought the use of rubber dam was worthwhile, 1 percent felt it was not worthwhile, and 1 percent felt it made no difference.

The recorded advantages were moisture control in 57 percent, isolation in 51 percent, patient control in 24 percent, better visibility in 27 percent, safer in 14 percent, and it was felt to be quicker in 8 percent of cases.

The recorded disadvantages were poorer access in 8 percent, discomfort in 4 percent, trauma to the soft tissues in 2 percent, and an inability to communicate with the patient in 1 percent. Three percent stated they had problems applying the rubber dam. The operator was permitted to give more than one advantage or disadvantage in the questionnaire.

Statistical analysis recorded no relationship between the age or sex of the patient and their anxiety score. Similarly the time taken to apply the rubber dam, the number of teeth isolated, the use of a rubber dam clamp, or the use of local anesthesia, had no correlation with their anxiety score.

DISCUSSION

This study attempted to explore the attitudes of patients and operators toward the use of rubber dam.

A previous anecdotal report suggested good patient acceptance and 79 percent of our patients showed this. Of the 21 percent who reported problems, 18 percent experienced pain or discomfort which could have been controlled by adequate local anesthesia. Three percent reported a dislike of the taste of the rubber dam and the placement of a rubber dam napkin may prevent this.³

The time taken to apply the rubber dam varied from between one to twenty minutes. The difference is explained by the undergraduates unfamiliarity with the technique. In 6 percent of cases it was their first clinical use of rubber dam and more experienced students could apply it faster. The average patient anxiety score of 8.01 shows a low level of anxiety. Again, this suggests a high acceptance of dental treatment under rubber dam. The use of rubber dam clamps, ligatures, or a local anesthetic again showed no correlation when compared to the pa-

tient anxiety score, suggesting they made little difference to the patients.

The operators stated access was poorer in 8 percent of their operative procedures and the authors realized this may be a problem, though the use of specialized rubber dam clamps may minimize this problem. The discomfort they reported, presumably from their patients, could have been controlled with adequate local anesthesia. Trauma to the gingival tissues can occur, if the rubber dam clamps are not carefully placed.

One person reported an inability to communicate with the patient and while they may not be able to talk, the use of rubber dam in no way impairs their ability to understand or react to requests.

From the attitudes reported in this study we have shown that rubber dam is well accepted by both patient and operator and we advocate its use routinely.

REFERENCES

1. Barnum, S.C.: Inventor of the rubber dam. *Dent Cosmos*, 12:260, 1870.
2. Barnum, S.C.: Following history of the discovery of the dam. *Can J Dent Sc*, 4:88-89, 1877.
3. Elderton, R.J.: The dental practitioner. A modern approach to the use of rubber dam. *Dent Practitioner Dent Rec*, 21:187-193, February, 1971.
4. Black, G.V.: *Operative dentistry* Vol II. Chicago: Medico-dental Publishing Company, p 115, 1908.
5. Kidd, E.A.M.: Rubber dam - a reappraisal. *Dent Up* 10:233-245, May, 1983.
6. Curzon, M.E. and Barenie, J.T.: A simplified rubber dam technique for children's dentistry. *Br Dent J*, 135:532-536, December, 1973.
7. Van Noort, R. and Northeast, S.E.: The potential clinical consequences of the new dentine bonding resins. *Br Dent J*, 161:437-443, December, 1986.
8. Simonsen, R.J.: Conservation of tooth structure in restorative dentistry. *Quint Int*, 16:15-24, January, 1985.
9. Burke, F.J.T.: Posterior composites: the current status. *Dent Up*, 13:227-239, June, 1986.
10. Medical and Dental Defence Union of Scotland Limited. Annual report. December, 1985.
11. Antrim, D.D.: Rubber dam isolation of fixed prosthesis. *J Endod*, 8:521-522, November, 1982.
12. British Endodontic Society: The practice of endodontics by different groups of dentists in England. *Int Endod J*, 16:185-191, October, 1983.
13. Powell, K.R. and Craig, G.C.: A simple technique for the aesthetic improvement of fluorotic-like lesions. *J Dent Child*, 49:112-117, March-April, 1982.
14. Jinks, G.M.: Rubber dam techniques in pedodontics. *Dent Clin N Am*, 327, July, 1966.
15. Starkey, P.: The application of rubber dam in the pre-school child. *J Dent Child*, 24:230-236, Fourth Quarter, 1957.
16. Fors, U.G.H.; Berg, J.W.; Sandberg, H.: Microbiological investigation of saliva leakage between the rubber dam and tooth during endodontic treatment. *J Endod*, 12:396-399, September, 1986.
17. Reuter, J.E.: The isolation of teeth and the protection of the patient during endodontic treatment. *Int Endod J*, 16:173-181, October, 1983.

Tooth-germ sequestration as a sequela of chronic periapical inflammation of the primary predecessor

Elizabeth D. Goodman-Topper, BDS, LDSRCS
Dan Gazit, DMD
Eliezer Eidelman, D Odont, MSD

LITERATURE REVIEW

The relationship between periapical inflammation of the primary teeth and subsequent injury to the succedaneous permanent teeth has been demonstrated clinically, radiographically, histologically, and experimentally.¹⁻⁷ Turner described enamel hypoplasia in two premolars, which he attributed to apical infection of the primary predecessors.² On the basis of histologic studies of autopsy material, Bauer concluded that periapical inflammation of primary teeth was not contained by the development of a fibrous wall, but spread diffusely through the bone around the buds of the successors, thereby affecting the important protective layer of the young enamel, the "united enamel epithelium" (reduced enamel epithelium).¹ Various changes of the latter were observed, in some cases destroyed, thereby exposing the enamel to inflammatory edema and granulation tissue, which eroded the enamel and deposited on the surface of the deep excavation a "well-calcified metaplastic cementum-like substance".

Andreasen and Riis, on the basis of a histological study in monkeys and on clinical findings in humans, concluded that chronic periapical inflammation needs considerable time (in excess of six weeks) to effect a signifi-

cant influence on odontogenesis in the permanent dentition.⁸ They attributed the lack of influence of short-term inflammation to the demarcating effect of a thin fibrous barrier found between the inflammation zone and the enamel epithelium. Pindborg described arrest of permanent tooth formation subsequent to periapical infection of the primary predecessor.

CASE REPORT

A three-year-old Arab male was referred for dental treatment, to the Department of Pedodontics of the Hadassah Faculty of Dental Medicine in Jerusalem. He suffered from Thalassemia major. This severe progressive hemolytic anemia is caused by a genetic mutation at the gene locus for the production of hemoglobin, and is characterized by profound weakness, failure to thrive, growth retardation due to endocrine abnormalities, poor appetite and jaundice. There may be cardiac complications due to the anemia. Bone abnormalities may be detected radiographically in the form of medullary cavity expansion due to hypertrophy of erythropoietic tissue in medullary and extramedullary locations, in an attempt to increase the manufacture of red blood corpuscles, thus enhancing the level of functional hemoglobin.⁹

Due to the extensive treatment required and the difficulties encountered in behavior management at the

Dr. Goodman-Topper is Instructor, Department of Pedodontics; Dr. Gazit is Lecturer, Division of Oral Pathology; Dr. Eidelman is Professor and Chairman, Department of Pedodontics, Hebrew University, Hadassah Faculty of Dental Medicine, Jerusalem, Israel.

examination session, it was decided to treat this patient under general anesthesia. Routine bitewing radiographs revealed the presence of the mandibular right first premolar while the left homologue could not be determined clearly (Figure 1). The bifurcation area was radiolucent, but contained a faint radiopacity superimposed immediately below the bifurcation. The lamina dura was absent, and there was condensing osteitis in the more apical area of the first primary molar, and in the bifurcation area of the second primary molar. Neither mandibular second premolar was yet visible radiographically, which is not necessarily an aberrant finding at this age.

Treatment

The treatment involved composite restorations on the primary incisors and canines, a formocresol pulpotomy



Figure 1. Bitewing radiographs showing the presence of the mandibular right first premolar tooth-germ, while the left homologue is not apparent. Note the rarefaction in the bifurcation area of the mandibular left primary first molar (arrow), and the condensing osteitis in the more periapical region of this tooth and in the bifurcation area of the adjacent second molar (double arrow).

on the lower right second primary molar and stainless steel crowns on all the maxillary primary molars, as well as the mandibular right primary molars. The clinical and radiographic signs indicated the need to extract the mandibular left primary molars, both abscessed. The first primary molar was "floating" in pus. When it was extracted, a small unattached mass of tissue was removed from the socket, radiographed, preserved in formalin and sent for histological section.

Macroscopic findings

Macroscopic examination revealed a mass of ivory-colored soft tissue measuring 4x4x6 mm covered by mucosa. Within the tissue was a calcified mass.

RESULTS

Histopathologic findings

Low-power micrographs revealed a partially formed molar tooth germ (Figure 2); odontoblasts were found adherent to the dental pulp (Figures 3,4); enamel matrix and a layer of reduced enamel epithelium were found adjacent to the crown of the tooth germ (Figures 5, 6).

On the basis of clinical and radiographic findings, the

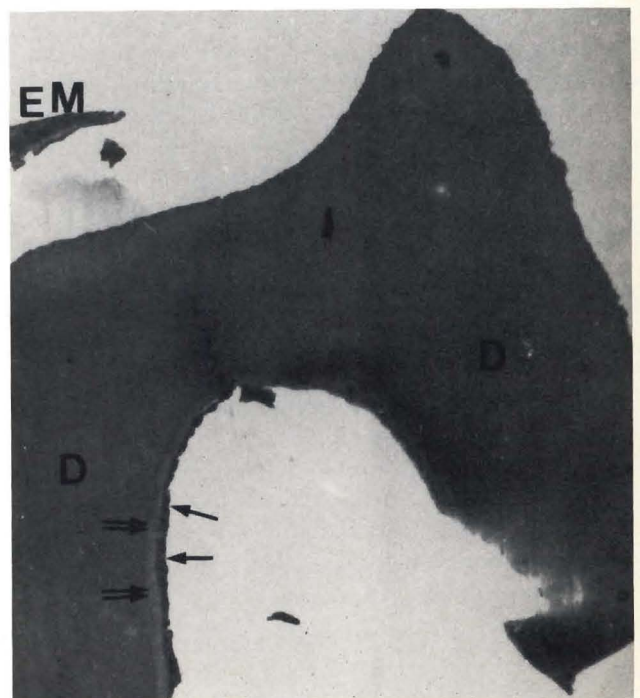


Figure 2. Low-power micrograph of a developing tooth germ. D = dentin; arrow = layer of odontoblasts; double arrow = predentin; EM = enamel matrix. HSE x 58.

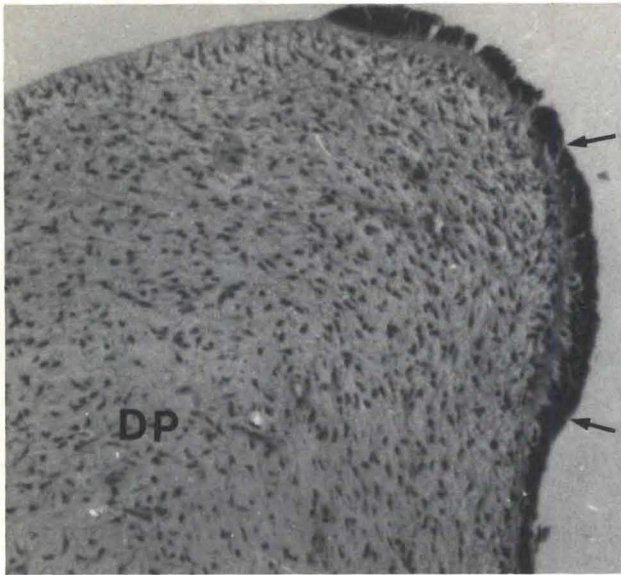


Figure 3. Dental pulp (DP) and odontoblastic layer (arrow). HSE x 173.

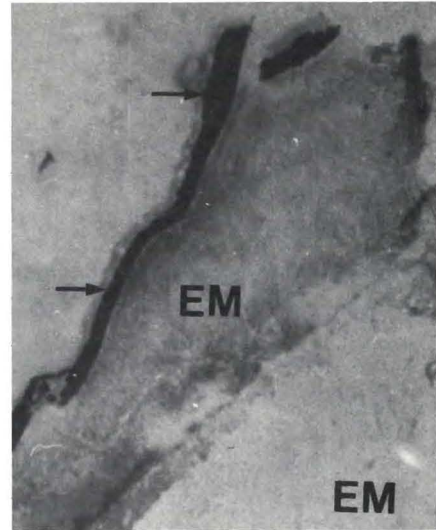


Figure 5. Enamel matrix (EM) and a layer of reduced enamel epithelium (arrow). HSE x 37.

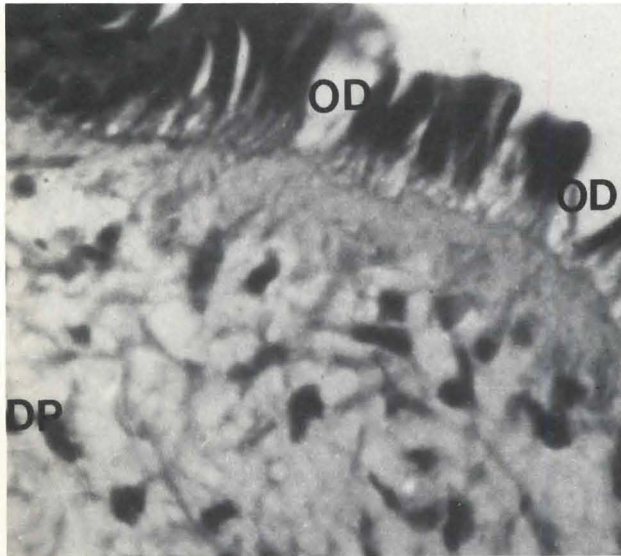


Figure 4. Higher power magnification of dental pulp (DP) and odontoblastic layer (OD). HSE x 460.

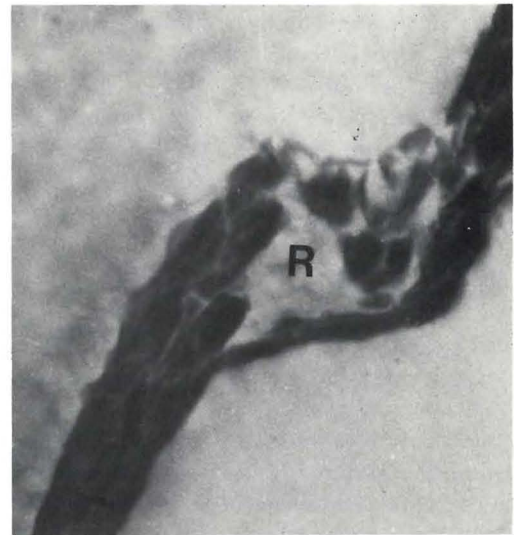


Figure 6. Higher power magnification of reduced enamel epithelium (R). HSE x 460.

mass was identified as a tooth-germ sequestered as a sequela to the chronic inflammation of the primary predecessor. The differential diagnosis of an odontoma could not be excluded, however, definitively.

Radiographic findings

The radiograph revealed a crescent-shaped radiopaque tissue mass, resembling the uncompleted crown of a tooth-germ (Figure 7).

DISCUSSION

The mass of tissue that was removed from the socket was assumed to be the tooth-germ of the mandibular first premolar. The surrounding tissues had been destroyed



Figure 7. Extraoral radiograph of sequestered tissue mass, which was removed at the time of extraction of the mandibular left primary first molar.

by the chronic inflammatory process, and the small amount of crown that had so far developed has been displaced in the socket and rendered radiographically indistinct. A well-recognized sequela of chronic inflammation related to a primary tooth, is hypoplasia or hypomaturation of the succedaneous tooth (Turner tooth). Another well-known complication of extraction of a primary tooth, is the inadvertent removal of the permanent successor when the latter is situated in close proximity, as within the bifurcation of the predecessor.

On histological examination, the differential diagnosis of odontoma was considered. Shafer *et al* define odontoma as a growth in which both the epithelial and the mesenchymal cells exhibit complete differentiation, with the result that functional ameloblasts and odontoblasts form enamel and dentin.¹⁰ The enamel and dentin are usually laid down in an abnormal pattern, because the organization of the odontogenic cells fails to reach a normal state of morphodifferentiation. As these lesions comprise more than one type of tissue, they are termed "composite odontomas". In some of these, the enamel and dentin are laid down in such a fashion that the structures bear considerable resemblance to normal teeth, although they are usually smaller. These have been termed compound composite odontomas.

The etiology of odontomas is unknown although trauma or infection have been implicated. Depending upon the stage of odontogenesis, hypoplasia would be the more likely sequela.

This case was unusual because, compared with the contralateral tooth, the permanent successor was so indistinct radiographically, due to the inflammatory process, that this child might have been classified as having congenital absence of the mandibular left first premolar,

had not the mass been sent for histological section; although this is a much rarer phenomenon than the absence of the second premolar.¹¹ The clinical implications will, indeed, be identical to those of congenital absence. It will be of interest to observe whether the left second premolar will develop normally in an area that was chronically inflamed at a very early stage of tooth formation.

REFERENCES

1. Bauer, W.H.: Effect of periapical processes of deciduous teeth on the buds of permanent teeth. *Am J Orthod Oral Surg*, 32:232-228, 1912.
2. Turner, J.G.: Two cases of hypoplasia of enamel. *Br J Dent Sci*, 55:227-228, 1912.
3. Pindborg, J.J.: *Pathology of the dental hard tissues*. Copenhagen: Munksgaard, 1970, pp 123-128.
4. Shiere, F.R. and Frankl, S.N.: The effect of deciduous tooth infection on permanent teeth. *Dent Prog*, 2:59-64, October, 1961.
5. Morningstar, D.H.: Effect of infection of the deciduous molar on the permanent tooth germ. *J Am Dent Assoc*, 24:786-791, 1937.
6. Valderhaug, J.: Periapical inflammation in primary teeth and its effect on the permanent successors. *Int J Oral Surg*, 3:171-182, 1974.
7. Winter, G.B. and Kramer, I.R.H.: Changes in periodontal membrane, bone and permanent teeth following experimental pulpal injury in deciduous molar teeth of monkeys (*Macaca irus*). *Arch Oral Biol*, 17:1771-1779, December, 1972.
8. Andreasen, J.O. and Riis, I.: Influence of pulp necrosis and periapical inflammation of primary teeth on their permanent successors. Combined macroscopic and histologic study in monkeys. *Int J Oral Surg*, 7:178-187, June, 1978.
9. Stewart, R.E.; Barber, T.K.; Troutman, K.C. *et al*: *Scientific foundations of pediatric dentistry*. St. Louis: C.V. Mosby Company, 1982, p 254.
10. Shafer, W.G.; Hine, M.K.; Levy, B.M.: *A textbook of oral pathology*. Philadelphia: W.B. Saunders Company, 1983, pp 309-310.
11. Rose, J.S.: A survey of congenitally missing teeth, excluding third molars, in 6000 orthodontic patients. *Dent Practit*, 17:3, 107-114, November, 1966.

CERMET-IONOMER CEMENTS

In an attempt to improve the abrasion resistance and strength of glass-ionomer cements, McLean and Gasser (1985) developed the cermet-ionomer cements. These cements, unlike simple mixtures of alloy particles or metal fibres, contain glass-metal powders sintered to high density that can be made to react with polyacids to form a cement. Ion-leachable calcium fluoroaluminosilicate glasses are used in the preparation of the glass powder. The set cement can be burnished or polished to produce a metal finish, but the surface will not be comparable to the typical Beilby veneer of metals.

Wilson, A.D. and McLean, J.W.: *glass-ionomer cement*. Chicago: Quintessence Publishing Co., Inc., 1988, p30.

Comparison of Kodak D-Speed and E-Speed X-Ray film in detection of proximal caries

William F. Waggoner, DDS, MS
James J. Ashton, MS

The scientific community agrees that low-level radiation has potentially adverse biologic effects, particularly in children; the dental profession has worked, therefore, to minimize exposure of patients receiving diagnostic dental radiographs. In 1981, the American Academy of Pediatric Dentistry sponsored a conference on exposure to radiation in pediatric dentistry with general recommendations for minimizing it.¹ Included in the recommendations were: maintaining radiographic equipment at designated standards, regularly assessing quality of film processing or dark-room integrity, use of lead aprons and collars, use of collimated tube heads, individualized radiographic surveys based on clinical findings, and use of the fastest film available.

In 1981, Eastman Kodak introduced a new E-speed intraoral radiographic film, Ektaspeed, which was stated by the manufacturer to be twice as fast as the currently available D-speed (Ultraspeed) film with comparable imaging and contrast characteristics.² Several workers have attempted to evaluate the claims of the manufacturer, with clinical and *in vitro* studies.³⁻⁶ These studies have demonstrated that E-speed film has diagnostic acceptability and imaging comparable to D-speed and exposure reductions from 33 to 50 percent. Okano *et*

al, however, reported D-speed to be a slightly superior film, while White *et al* and Klein *et al* reported the E-speed film to be superior and preferable to D-speed.⁷⁻⁹

Due to the differences in the findings of the earlier studies, it was decided to investigate further and compare the two film types. The purpose of this study was to compare the radiographic images of proximal caries lesions on D-speed radiographic film with those seen on an E-speed radiograph.

METHODS AND MATERIALS

Ninety-nine permanent molars and premolars that had been extracted for orthodontic or periodontal reasons were used for this study. All teeth had a caries lesion on the mesial or distal surface or on both. The lesions ranged from small "white spot" areas of demineralization to areas of frank cavitation. A macroscopic examination was completed of each proximal surface noting the presence of lesions. The teeth were numbered from one to ninety-nine and photographs (1.5 x) were taken of each proximal surface.

Teeth were prepared for *in vitro* radiographic examination by first grouping the teeth into groups of three and then positioning a group into a block of modelling clay such that buccal cusps were facing the radiographic tube head and the teeth were in proximal contact. A pilot study was carried out to ascertain the optimum exposure times for both the D-speed and the E-speed films for the x-ray machine utilized. Results indicated

Dr. Waggoner is Assistant Professor, Department of Pediatric Dentistry, Ohio State University, College of Dentistry; and Dr. Ashton is with the Department of Preventive Medicine, Ohio State University, College of Medicine.

that diagnostic imaging was best for the D-speed film, when taken at 70 kvp, 10 mA, 21 impulses (0.35 seconds). An intraoral dental radiographic machine (General Electric Model 1000) was used for the exposures. Its sixteen-inch collimated tube was placed at a two-inch standard distance from the teeth.

For each group of three teeth, one D-speed and one E-speed radiograph were exposed. Small letters made of lead were placed in the upper left hand corner of each film to identify the groups of teeth. All films were processed simultaneously in an automatic film processor (Phillips Model 810) at 29.4°C for 4.3 minutes.

A transmission densitometer (Model TBX, Tobias Associates, Inc.) was used to compare radiographic density of each set of films. Using a random distribution, all sixty-six radiographs were then mounted into several multiple hole radiographic mounts.

The radiographic evaluation was completed independently by fourteen faculty members of the University of Iowa and the University of Oklahoma College of Dentistry. Each of the fourteen was given all sixty-six films and asked to evaluate each proximal surface in terms of caries detectability. Table 1 illustrates the ranking system utilized. A viewbox masked to allow light to illuminate only one radiograph at a time was supplied. Evaluators were instructed not to return to a film once its evaluation was complete. They were told that they would be viewing two types of film and also that some proximal surfaces exhibited clinical caries but others did not.

To gain an assessment of the actual extent of the penetration of caries, a histologic examination was done after the completion of the radiography. Specimens for polarized light microscopy were obtained by sectioning each tooth longitudinally through the central region of the lesion using a hard-tissue microtome. Undemineralized, unembedded sections 100-150 μm thick were produced. Each specimen was imbibed in water and quinoline and evaluated with the polarizing light microscope for evidence of the deepest penetrating changes of the enamel or dentin. A histologic ranking similar to that used for the radiographic evaluation was used (Table 2).

The statistical analysis was carried out in two parts: First, a Friedman's two-way-layout-test was used to assess any differences that might have occurred because of a rater effect. This test was chosen because of the discreet nature of the scores. Friedman's method tested the null hypothesis that no rater effect existed, meaning that all fourteen raters would have scored each tooth surface similarly.

In order to assess the effect of film-type, the four best

Table 1 \square Ranking system used to record penetration of caries, radiographically.

0 - No radiolucency evident
1 - Radiolucency limited to outer half of enamel
2 - Radiolucency evident in inner half of enamel
3 - Radiolucency evident in outer half of dentin
4 - Radiolucency evident in inner half of dentin

Table 2 \square Ranking system used to record penetration of caries, histologically.

0 - No histologic changes seen
1 - Histologic changes confined to outer half of enamel
2 - Histologic changes evident in inner half of enamel
3 - Histologic changes evident in outer half of dentin
4 - Histologic changes evident in inner half of dentin

raters were selected for further analysis. These four were determined by use of a Spearman Rank Correlation test, which correlated the histologic and radiographic scores. Using these four selected raters, a Wilcoxon Signed Rank Test was performed for each rater separately to determine whether a film effect was present.

RESULTS

A Wilcoxon Signed Rank Test on the densitometric readings indicated that the radiographic densities of the pairs of films were similar.

The Friedman's tests indicated that there was a significant difference between radiographic raters ($p \leq .0001$), regardless of film type (Table 3). As shown in Table 3, there were statistically significant differences among the fourteen raters for both the E-speed and the D-speed film. When the differences in radiographic scores on the two film types were compared, however, it was found that there were no rater differences ($p = .9936$). This indicates that the raters were consistent within themselves from film to film. In other words, some raters, number 6 for example, tended to assign very low values to all tooth surfaces, while other raters, like number 10, assigned higher values, but it did not make any difference whether they were rating surfaces on the E-speed or the D-speed. They were consistently low or consistently high regardless of film type.

As the histologic depth of a caries lesion almost always exceeds the radiographic depth, often by several micrometers, it can be easily seen that the raters who consistently rated surfaces higher were also those with the highest Spearman rank correlation.¹⁰ The Wilcoxon Signed Rank Test was completed for each of the four best raters and no statistically significant differences were

Table 3 □ Rater differences for E-speed and D-speed films, using a Freidman's test.

Rater differences - E Speed Film (P≤.0001)														
Rater	6	12	8	5	1	11	3	4	14	7	2	9	13	10
Mean radiographic score	.31	.39	.43	.45	.47	.47	.51	.52	.54	.56	.59	.60	.61	.77

Rater differences = D Speed Film (p≤.0001)														
Rater	6	12	8	3	5	1	11	7	4	13	14	2	9	10
Mean radiographic score	.32	.40	.41	.52	.52	.54	.54	.57	.58	.61	.62	.62	.67	.83

Raters connected by an underline are not statistically different.

found based on film type. Statistical significance is usually defined to have been observed when $p < 0.05$. Table 4 gives the p values for each of the four raters. The third column of Table 4 illustrates the number of times the radiographic ratings were equal for both films. The fourth column represents the number of times that surfaces on the D-speed film were not equal to the E-speed. There was a very slight tendency to rate lesions slightly greater on the D-speed than the E-speed, but it does not approach a significant level.

DISCUSSION

The variability between raters, independent of film-type, found in the present study has similarly been reported by others. White *et al* in a study comparing E-speed and D-speed radiographs and xeroradiography found the variance between individual observers to be greater than the differences between image receptors (films).⁸ Okana *et al* reported that the largest source of variation in comparing the diagnostic accuracies of the two film types was the variation between dentist observers; more so than differences in film type or film density.⁷ The present study was not designed to investigate possible causes of rater differences but some may be postulated. The eyesight of raters would obviously affect their diagnostic capability. It was assumed that all raters used in this study had normal or corrected vision but no

evaluation of visual acuity was made to validate the assumption. Mental fatigue or eye fatigue might also have affected some raters. Those who did the rankings early in the morning may have been different in their diagnoses than those who did the rankings at the end of the day following clinical activities. Clinical experience might be another variable. A study to evaluate some of these possible variables would be of value.

The comparable ability to diagnose interproximal decay from D-speed or E-speed film as evidenced from this study is in agreement with the findings of several others.³⁻⁶ In addition to being comparable for detection of interproximal caries, D-speed and E-speed films have shown comparable images for the detection of periodontal bone lesions, calculus, and periapical disease.¹¹⁻¹³ For use in clinical endodontic views, Kleier, *et al* found D-speed to be judged superior in terms of contrast, image quality, and rater satisfaction.¹⁴ In carrying out their study, however, Kleier *et al* followed exposure guidelines provided by the manufacturer for exposing the clinical radiographs.¹⁴ Preece and Jensen reported that the exposure required to produce a specific density on a radiograph depends largely on the individual characteristics of the x-ray unit used.¹⁵ In the various studies previously mentioned, exposure times for the E-speed were 33-50 percent of those used for D-speed, based on densitometric measurements. In the present study, the E-speed was taken at an exposure time 42 percent less than the D-speed, again based on comparable densities. The findings of Kleier, *et al* might have been affected, therefore, by an inappropriate exposure time for that particular x-ray machine.¹⁴ Girsch, *et al* also compared the use of the two films with endodontic techniques, specifically measuring endodontic files within a root canal and overextended beyond the apex.¹⁶ Measurements of instruments of E-speed film were not significantly different from measurements on D-speed film, and E-speed was considered by the authors to be reliable for applications to endodontics.

Table 4 □ P values for four selected raters.

Rater	Mean radiographic score D Speed	Mean radiographic score E speed	Number of surfaces rated alike on both film types D = E (n = 198)	Number of surfaces when ratings D ≠ E		Wilcoxon Signed Rank p value
				p value		
				D > E	E > D	
#2	0.616	0.556	151 (76%)	27 (14%)	20 (10%)	0.2318
#4	0.581	0.520	154 (78%)	25 (12.5%)	19 (9.5%)	0.1667
#9	0.667	0.596	151 (76%)	28 (14.5%)	19 (9.5%)	0.2403
#10	0.833	0.773	133 (67%)	37 (19%)	28 (14%)	0.3222

LIMITATIONS

The decrease in radiation found with the E-speed film is related to large silver bromide crystals on the film, which are more sensitive than smaller crystals. While allowing for a reduction in exposure, the increased sensitivity places some handling constraints on the E-speed film. Kogon *et al*, reported finding a decrease in the contrast with E-speed films which were manually processed at temperatures greater than 22 C, when compared to D-speed films processed under the same conditions or either film type automatically processed.⁵ Diehl *et al*, reported similar findings.¹⁷ Manually processed D-speed films had greater contrast than manually processed E-speed. But characteristics were similar when automatic processing was done. They also stated that, based on their study, they felt that E-speed film was more sensitive to varying conditions such as changes in temperature, developing solution concentration, and operator error.

Frykholm found film contrast and resolution to be similar between D-and E-speed films, but reported that as E-speed film neared its expiration date, the amount of fog on the film increased, more so than the D-speed.¹⁸ He recommended that E-speed be used while four to six months of storage time remains.

It is recommended that E-speed film be used with a long cone technique.^{2,19} The long cone calls for longer exposure times than the short cone, but due to the inverse square law, in a properly exposed radiograph, the same amount of radiation has reached the film with either the short or the long cone. The long-cone technique with longer exposure times allows more flexibility to obtain a preferable radiographic density.

CONCLUSIONS

The following conclusions can be made based on the results of this study.

- No difference was found between E-speed and D-speed radiographic film in the ability of dentists to diagnose interproximal decay.
- There is wide variability in the diagnosis of interproximal radiographic decay by dentists, regardless of film type used.

In light of the comparable diagnostic imaging of E-speed radiographic film at a 40-50 percent reduction of radiation necessary for the D-speed film, the use of E-speed film is recommended to minimize further the

exposure of patients to radiation during dental radiographic procedures. Close attention must be paid, however, to handling and developing characteristics of the film.

REFERENCES

1. Nowak, A.J.; Creedon, R.L.; Musselman, R.J. *et al*: Summary of the conference on radiation exposure in pediatric dentistry. J Am Dent Asso, 103:426-428, September, 1981.
2. Silha, R.E.: Methods for reducing patient exposure combined with Kodak Ektaspeed dental x-ray film. Dent Radiol Photo, 54:80-87, 1981.
3. Reynolds, R.L.: A clinical evaluation of Kodak Ektaspeed dental x-ray film. J Okla Dent Assoc, 73: 13-14, Summer, 1982.
4. Kaugers, G.E.; Harmon, J.F.; Kaugers, C.C.: A comparison of D- and E-speed intraoral film. Gen Dent, 32: 317-319, July/August, 1984.
5. Kogon, S.L.; Stephens, R.G.; Reid, J. *et al*: The effects of processing variables on the contrast of type D and type E dental film. Dentomaxillofac Radiol, 14:65-68, 1985.
6. Svenson, B.; Grondahl, H.G.; Peterson, A. *et al*: Accuracy of radiographic caries diagnosis at different kilovoltages and two film speeds. Swed Dent J, 9:37-43, January, 1985.
7. Okano, T.; Huang, H.J.; Nakamura, T.: Diagnostic accuracy on detection of proximal enamel lesions in non-screen radiographic performance. Oral Surg, 59:543-547, May, 1985.
8. White, S.C.; Hollender, L.; Gratt, B.M.: Comparison of xeroradiographs and film for detection of proximal surface caries. J Am Dent Assoc, 108:755-759, May, 1984.
9. Klein, A.I.; Yim, P.; Campbell, E. *et al*: Dental radiographic diagnostic resolution with minimal exposure. Pediatr Dent, 7:47-52, March, 1985.
10. Waggoner, W.F.: A study of the carious lesion utilizing radiography polarized light microscopy and scanning electron microscopy. Quint Int, 11:1163-1174, November, 1984.
11. Grondahl, K.; Grondahl, H.G.; Olving, A.: A comparison of Kodak Ektaspeed and Ultraspeed films for detection of periodontal bone lesions. Dentomaxillofac Radiol, 12:43-46, 1983.
12. White, S.C.; Gratt, B.M.; Hollender, L.: Comparison of xeroradiographs and film for detection of calculus. Dentomaxillofac Radiol, 13:39-43, 1984.
13. White, S.C.; Hollender, L.; Gratt, B.M.: Comparison of xeroradiographs and film for detection of periapical lesions. J Dent Res, 63:910-913, June, 1984.
14. Kleier, D.J.; Benner, S.J.; Averback, R.E.: Two dental x-ray films compared for rater preference using endodontic views. Oral Surg, 59:201-205, February, 1985.
15. Preece, J.W. and Jensen, C.W.: Variations in film exposure, effective Kvp and HVL among 35 dental x-ray units. Oral Surg, 56:654-661, December, 1983.
16. Girsch, W.J.; Matteson, S.R.; McKee, M.N.: An evaluation of Kodak Ektaspeed periapical film for use in endodontics. J Endo, 9:282-288, July, 1983.
17. Diehl, R.; Gratt, B.M.; Gould, R.D.: Radiographic quality control measurements comparing D-speed film, E-speed film and xeroradiography. Oral Surg, 61:635-640, June, 1986.
18. Frykholm, A.: Kodak Ektaspeed - a new dental x-ray film. Dentomaxillofac Radiol, 12:47-49, 1983.
19. Horton, P.S.; Sippy, F.; Kohout, F.J. *et al*: A clinical comparison of speed group D and E dental x-ray film. Oral Surg, 58:104-108, July, 1984.

Conservative technique for restoring primary molars after pulpotomy treatment

Joel H. Berg, DDS, MS
Kevin J. Donly, DDS, MS

The restoration of choice for a primary molar following pulpotomy has traditionally been the stainless steel crown. This extracoronal restoration invariably requires the removal of tooth structure not involved in the decay process, or not removed as a result of access to the coronal pulp.¹ Even so, the stainless steel crown has been the treatment of choice because the crown of the tooth becomes "brittle" by loss of vitality.

Recently, through the development of glass ionomer materials, several new restorative options following pulp therapy have been attempted.² A conservative technique utilizing a combination glass ionomer and composite "sandwich" is described.^{3,4}

CLINICAL TECHNIQUE

Primary molars without extensive tooth destruction, but in need of pulpotomy should be selected for this technique. Interproximal cavities are acceptable for this technique, if cusps are not involved. The pulpotomy should be performed using a standard technique with conservative access.¹ After completion of the formocresol pulpotomy, a thin layer (1 to 2 mm) of zinc oxide eugenol (ZOE) paste is placed over the entire floor of the pulp chamber. After allowing the ZOE paste to set, a matrix band and wedge are placed. Glass ionomer

silver material[†] is used to overfill the cavity so that contact is achieved at the proximal surface, and so that the material extends occlusally to the dentinoenamel junction. After a period of three minutes, during which the glass ionomer/silver obtains its initial set, the glass ionomer/silver material should be reduced so that its occlusal extent is about 0.5 mm apical to the previously existing dentinoenamel junction. All exterior surfaces of the enamel should be beveled. The enamel margins of the preparation should be acid-etched for sixty seconds. Thirty seconds after commencing the acid-etching, the glass ionomer material should be etched.⁵ An unfilled resin material or a partially filled white sealant material should be used as an intermediate bonding agent between the glass ionomer and the composite (Figure). We have found that a partially filled white sealant material acts nicely as an intermediate bonding agent while simultaneously masking the color of the silver glass ionomer material. The bonding material should be polymerized, and a posterior composite resin material placed in two buccolingual increments to achieve the final result (Figure).⁶ The restoration should be adjusted and polished as required.

DISCUSSION

This conservative technique provides a more esthetically pleasing result in patients where significant

Dr. Berg and Dr. Donly are assistant professors, Department of Pediatric Dentistry, The University of Texas Dental Branch, P.O. Box 20068, Houston, TX 77225.

[†]Ketac Silver, ESPE-Premier Sales Corp., Norristown, PA.

tooth structure remains after the completion of a pulpotomy. Additionally, if it is anticipated that a pulpotomy is needed, and this technique is to be considered, a conservative access during pulpotomy should be obtained, thus conserving tooth structure and increasing the extent of available bonding surface for retention of the restoration.

Case selection is crucial to achieve acceptable results. Preferably, a primary molar with at least two complete walls of tooth structure should be selected. For example, if both the mesial and distal surfaces of a primary molar were decayed, resulting in a pulpotomy, but where the buccal and lingual surfaces remained completely intact, this technique may be employed. It is also essential that enamel margins be achievable throughout the completed restoration. This technique is particularly beneficial for situations where the access for the pulpotomy was made through only the occlusal surface, leaving all proximal surfaces intact. It is also a favorable technique where only one proximal surface has been lost as a result of decay. The benefits of this technique can be easily observed, particularly in the case of a maxillary first primary molar, where a stainless steel crown is not considered esthetically pleasing. This restoration is esthetically pleasing, at the same time allowing the retention of the remaining tooth structure by means of a bonded restoration. Although this technique has not been tested in a controlled clinical trial, in selective cases, it can be a useful alternative to the traditional stainless steel crown, following pulpotomies in primary molars.

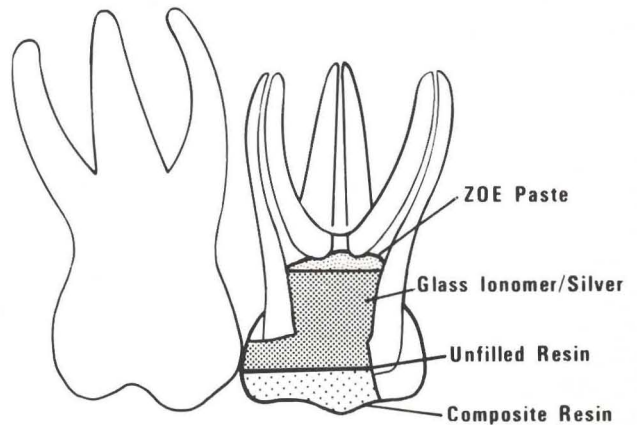


Figure. Completed restoration.

REFERENCES

1. McDonald, R.E.; Avery, D.R.: *Dentistry for the child and adolescent*. 5th Ed. St. Louis: C.V. Mosby Co., 1987.
2. Aurelio, James A.: Chamber retained restorations with glass ionomer cements. *Florida Dent J*, Spring, 1987.
3. McLean, J.W.; Proesser, H.J.; Wilson, A.D.: The use of glass-ionomer cements in bonding composite resins to dentin. *Br Dent J*, 158: 410-414, November, 1985.
4. McLean, J.W.: Limitations of posterior composite resins and extending their use with glass ionomer cements. *Quint Int*, 18: 517-529, August, 1987.
5. Garcia-Godoy, F. and Malone, W.F.P.: Effect of various etching times on two glass ionomer lining cements. *Texas Dent J*, April, 1987.
6. Donly, K.J.; Jensen, M.W.; Reinhardt, J. et al: Posterior composite polymerization shrinkage in primary teeth: an *in vivo* comparison of three restorative techniques. *Pediat Dent*, 9: 22-25, January-February, 1987.

A CHILD'S FIRST VISIT

Therefore, a child's first visit to the dentist should occur no later than 12 months of age so that the dentist can evaluate the infant's oral health, intercept potential problems such as nursing caries, and educate parents in the prevention of dental disease in their child (Goepferd, 1986). An ever-increasing demand by parents for an early dental evaluation of their infants and toddlers and for the acquisition of preventive knowledge requires the modern dental practitioner to be proficient in the examination of the infant and toddler (Goepferd, 1986).

Pinkham, J.R. et al: *Pediatric dentistry*. Philadelphia: W.B. Saunders Company, 1987, p 149.

Vitamin D-dependent rickets type II: report of three cases

Case reports

Kenji Kikuchi, DDS
Tae Okamoto, DDS
Mizuho Nishino, DDS, PhD
Eiji Takeda, MD, PhD
Yasuhiro Kuroda, MD, PhD
Masuhide Miyao, MD, PhD

Patients with vitamin D-dependent rickets (DDR) type II are afflicted by rickets in early childhood, with typical lateral bowing deformities of the legs, defective bone mineralization, hypocalcemia due to impaired intestinal calcium absorption, hypophosphatemia, elevated serum alkaline phosphatase activity, secondary hyperparathyroidism, and an increased plasma level of $1\alpha,25$ -dihydroxyvitamin D_3 ($1\alpha,25$ - $(OH)_2D_3$).^{1,2} A majority of patients with this disease have alopecia. It differs from DDR type I (caused by reduction of renal enzyme activity, and which shows clinical, radiological and biochemical findings similar to those in the type II disease), in that the plasma $1\alpha,25$ - $(OH)_2D_3$ concentration is high and alopecia often appears.

$1\alpha,25$ - $(OH)_2D_3$ is the most potent hormonal form of vitamin D_3 , the major biological function of which is to induce intestinal calcium transport and bone mineral mobilization by binding to a specific cytosol receptor in those organs. The specific receptor for $1\alpha,25$ - $(OH)_2D_3$ is found in various cells, such as lymphocytes, alveolar macrophages, skin fibroblasts and cells of the small intestine, bone, kidney, pituitary gland, parathyroid

Dr. Kikuchi, Dr. Okamoto and Dr. Nishino are with the Department of Pedodontics, School of Dentistry and Dr. Takeda and Dr. Miyao are with the Department of Pedodontics, School of Medicine, University of Tokushima, Kuramoto-cho 3, Tokushima 770, Japan.

gland, pancreas, brain, nerve, and others.³⁻⁵ Recently these cells have been used for quick diagnosis of the disease. Lymphocytes of the three patients mentioned in this paper were used for diagnosis.⁶

Patients with DDR type II are thought to have abnormal receptors for $1\alpha,25\text{-(OH)}_2\text{D}_3$. Abnormal receptors cause disturbances of mineral homeostasis in target organs. The disorder appears to be transmitted as an autosomal recessive trait; but the pathogenesis is still obscure. Only fifteen pedigrees of twenty cases with DDR type II were reported and no dental manifestation was described.

In this study, we describe three patients, two four-year-old girls and a three-year-old boy, who suffer from DDR type II with alopecia. These patients were treated with large doses of 1α -hydroxyvitamin D₃ ($1\alpha\text{-(OH)D}_3$) and showed an alteration of the phenotypic expression of the disease. Dental manifestations are reported and treatment options are discussed.

CASE REPORT

The Case 1 and Case 2 patients are four-year-old Japanese girls and Case 3 is a three-year-old Japanese boy. Their alopecia became evident in the first few months after birth. The patients were admitted to the Department of Pediatrics in the University of Tokushima at age 3y 0m, at 2y 9m and at 2y 2m, respectively. Clinical examinations revealed alopecia and typical lateral bowing deformities of the legs, which were their chief complaint. Skeletal radiograms of these children showed metaphyseal lesions of rickets, fraying, flaring in epiphyseal regions of knees of all three patients and in the radius and ulna of the boy only (Case 3). The data from the biochemical analyses of the serum of the three patients are shown in the Table. Low concentrations of serum calcium and phosphate, increased activity of alkaline phosphatase (ALP), and higher levels of parathyroid hormone (PTH) and $1\alpha,25\text{-(OH)}_2\text{D}_3$ in the serum are shown.⁷ Based on these findings, the three children were diagnosed as DDR type II patients. Treatment was begun with 0.1 $\mu\text{g/kg/day}$ of $1\alpha\text{-(OH)D}_3$ by oral supplement. Treatment with $1\alpha\text{-(OH)D}_3$ was progressively increased to 1.0 $\mu\text{g/kg/day}$, and then to 3.0 $\mu\text{g/kg/day}$ $1\alpha\text{-(OH)D}_3$. Case 1 and Case 2 showed improvement in phenotypic and biochemical findings, twenty-five weeks and nine weeks, respectively, after treatment was begun. Case 3 did not respond well, however, to this treatment and the rickets was not brought under control.

Case 1 was referred to our clinic, Tokushima University Dental Hospital, at age 3y 1m; Case 2 at 4y 1m; and

Table 1 Biochemical data of three patients with vitamin D-dependent rickets type II.

Subject	Case 1 (3y 0m)	Case 2 (2y 9m)	Case 3 (2y 2m)	Normal
Serum				
Ca (mg/dl)	8.6	8.2	8.4	8.8-10.8
P (mg/dl)	3.6	2.5	2.2	4.5-6.5
ALP ^a (K.A.U.)	86	130	287	10-45
PTH ^b (ng/ml)	0.9	0.8	1.2	0.0-0.5
$1,25\text{(OH)}_2\text{D}_3$ (pg/ml)	176	265	196	41.6 ± 3.8

^a Alkaline phosphatase

^b Parathyroid hormone

Case 3 at 2y 3m. Figure 1 shows the physical characteristics of three patients, when Case 1 was at age 4y 6m and after medication for a year and six months; Case 2 at 4y 2m and after medication for a year and five months; and Case 3 at 3y 0m, after eleven months medication. Their alopecia was not improved by treatment. Growth retardation in height and body weight was not found. All have achieved normal mental development. Lateral bowing deformities of the legs were improved in Case 1 and Case 2 and slightly improved in Case 3.

On the first visit to the clinic, examinations of Case 1 and Case 2 showed that all primary teeth had erupted and a few were carious. Hypoplasia of dental enamel was not found. In Case 3, however, gingival swellings and periapical abscesses in the regions of the upper right primary canine and primary first molar were observed. These teeth were extracted. A ground section of the extracted upper right primary molar was obtained and examined under the microscope (Figure 2). It showed abundant interglobular dentin and lack of predentinal layer. In all probability dentinogenesis was disturbed by the DDR type II. This suggests a relationship between hormonal function of vitamin D₃ and dentinogenesis.

Radiographic findings of the upper left primary molars of DDR type II patients before and after $1\alpha\text{-(OH)D}_3$ treatment are shown in Figure 3. This indicated that large pulp chambers and thin dentin were seen in radiographs of Case 1 before treatment (Figure 3 A) and Case 3 before and after treatment (Figures 3 D,E). These characteristics, however, in Case 1 and Case 2 after treatment (Figures 3 B,C). These findings suggested that large pulp chambers and thin dentin, which were thought to be caused by DDR type II, could be corrected by effective medication. Case 3 patient did not respond well to the treatment, and large pulp chambers and thin dentin remain, along with a retarded formation of the apical portions of the teeth.

Because of the possibility of correcting large pulp

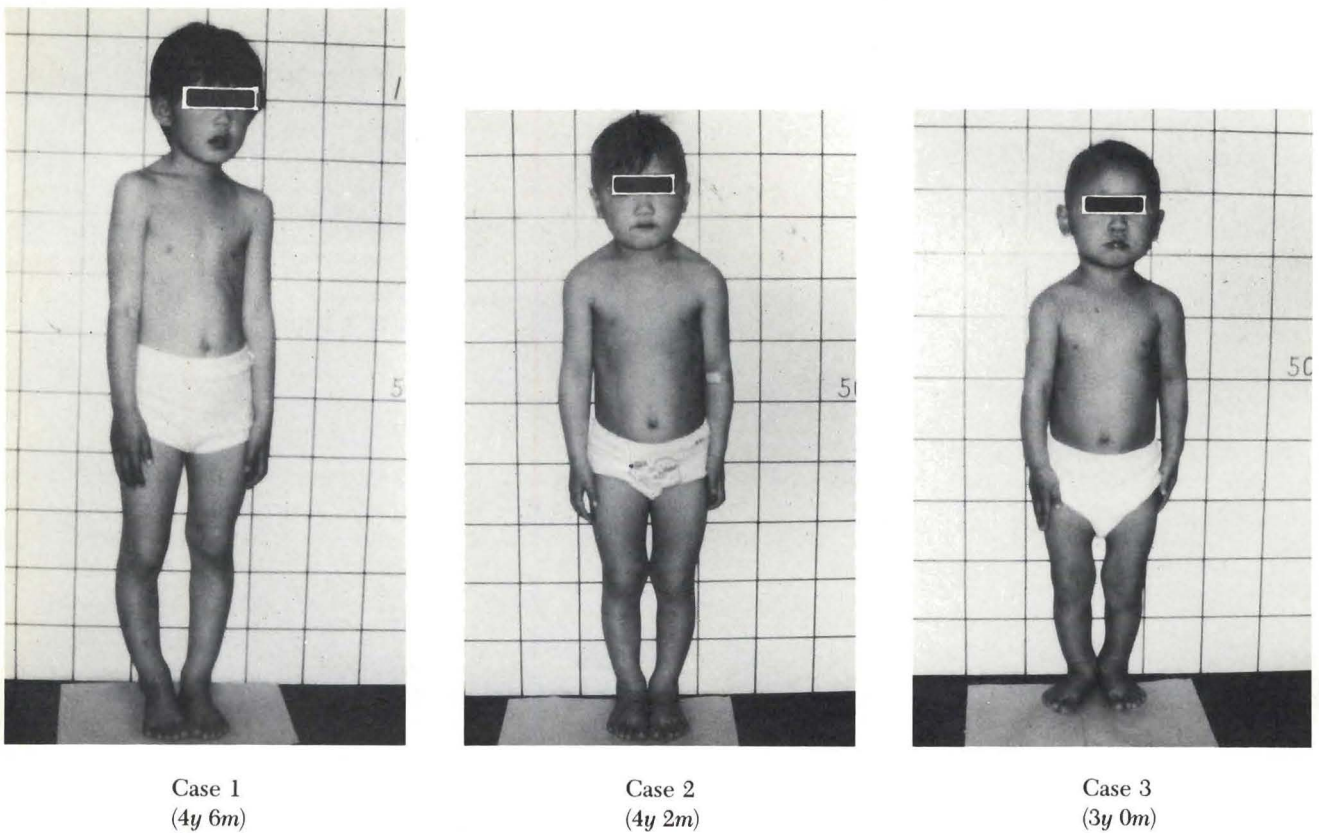


Figure 1. Physical features of three patients.



Figure 2. Micrographic findings of a ground section of extracted primary first molar of Case 3 shows abundant interglobular dentin in a deep dentinal area and lack of predentinal layer.

chambers, carious teeth were treated conservatively, using a caries-arresting agent, $\text{Ag}(\text{NH}_3)_2\text{F}$ and zincphosphate cement. Instruction on tooth brushing and consultation on eating habits were used to encourage a reduction in caries activity. The patients are recalled every one or two months. Simple composite resin fillings are now possible for Case 1.

DISCUSSION

Brooks *et al* in 1978 identified a form of rickets, in which certain target organs show a lesser response to $1\alpha,25\text{-(OH)}_2\text{D}_3$, a most potent hormonal form of vitamin D_3 .⁸ They called it vitamin D-dependent rickets type II (DDR type II). There are a number of reports on the dental findings in cases of familial hypophosphatemic vitamin D-resistant rickets (VDRR).⁹⁻¹¹ Several cases of DDR type II, however, have been reported without reference to dental manifestations.

In the present study, the dental findings of three patients with DDR type II with alopecia, and who were treated with large doses of vitamin D_3 derivatives ($1\alpha\text{-(OH)D}_3$), are described. Case 1 and Case 3, before treatment, had large root canals and large pulp chambers. Especially Case 3, a three-year-old boy, had a severe affliction of the disease. When admitted to our clinic, he suffered from gingival abscesses in the upper right primary canine and first primary molar regions, thought to be caused by bacterial infection associated with dental caries. The extracted primary first molar was prepared for ground section and microscopic examination. The examination showed an abundance of interglobular dentin in the deep dentinal areas and a deficient predentinal layer. These findings suggested that

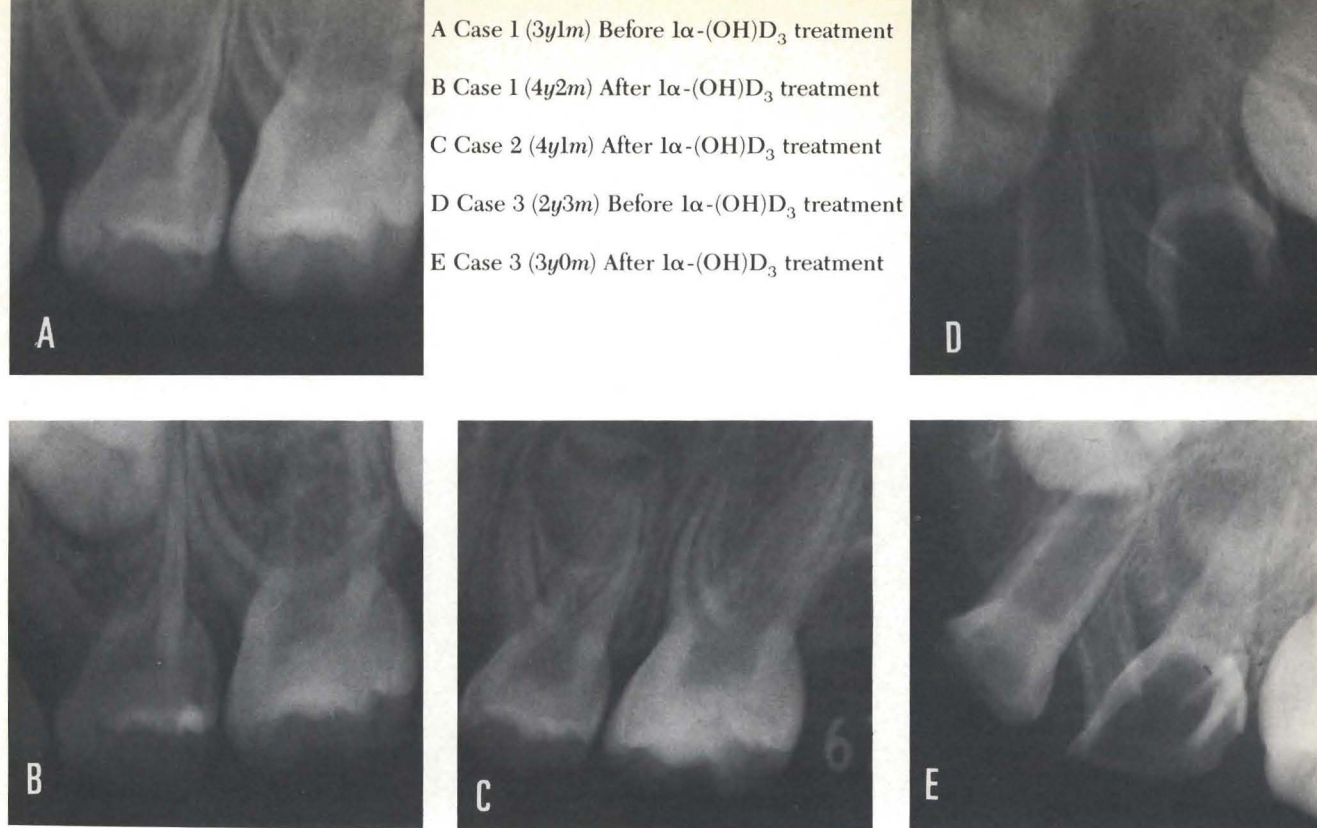


Figure 3. Radiographic findings of upper left primary molars.

normal dentinogenesis had been disturbed by the disease; perhaps it occurred postnatally about the time when alopecia occurred for the first time. The condition of Case 3 was not controlled with medication; but the formation of the root of the erupted primary teeth did occur. In Case 1 and Case 2 after medical treatment, normal development of root canals and pulp chambers was achieved. Pulpal horns extending nearly to the dentinoenamel junction, reported in the patients with VDRR, were not found in the radiographs of erupted primary teeth of these patients.⁹⁻¹¹ Furthermore, hypoplasia of the dental enamel or delayed eruption of the primary teeth did not occur. A reduction of caries activity was achieved through instruction in oral hygiene and diet control. When closure of abnormally large pulp chambers occurred, routine treatment of caries lesions was given. At the present time, treatment appears to have been successful. In the case of VDRR, because of the characteristic occurrence of gingival abscesses, prophylactic treatment using stainless steel or polycarbonate crowns is occasionally used.¹¹ Prophylactic treatment is not necessary, however, in the DDR type II case.

The permanent teeth can be expected to develop normally in number and size, and rate of crown formation; this can be determined by orthopantomographic examination. It is possible, however, that the postnatal calcification of the enamel and dentin may be affected. Thus, the permanent teeth of these patients should be radiographically examined soon after their eruption. The size of the root canals and pulp chamber should be

ascertained, and as occasion requires, prophylactic treatment should be provided.

It is evident that normal or nearly normal dental development can be achieved in controlled rickets patients, thus permitting routine treatment of carious teeth.

REFERENCES

1. Bell, N.H.: Vitamin D-dependent rickets type II. *Calcif Tissue Int*, 31:89-91, 1980.
2. Sockalosky, J.J.; Ulstrom, R.A.; Deluca, H.F. *et al*: Vitamin D-resistant rickets: end organ unresponsiveness to 1,25(OH)₂D₃. *J Pediatr*, 96:701-703, 1980.
3. Provvedini, D.M.; Tsoukas, C.D.; Deftos, L.J.: 1α,25-dihydroxyvitamin D₃ receptors in human leukocytes. *Science*, 221:1181-1183, 1983.
4. Abe, E.; Shiina, Y.; Miyaura, C.: Activation and fusion induced by 1α,25-dihydroxyvitamin D₃ and their relation in alveolar macrophages. *Proc Natl Acad Sci USA*, 81:7112-7116, 1984.
5. Balsan, S.; Garabedian, M.; Liberman, U.A.: Rickets and alopecia with resistance to 1,25-dihydroxyvitamin D: two different clinical courses with two different cellular defects. *J Clin Endocrinol Metab*, 55:803-811, 1983.
6. Takeda, E.; Kuroda, Y.; Saijo, T.: Rapid diagnosis of vitamin D-dependent rickets type II by use of phytohemagglutinin-stimulated lymphocytes. *Clinica Chimica Acta*, 155:245-250, 1986.
7. Takeda, E.; Kuroda, Y.; Saijo, T.: 1α-hydroxyvitamin D₃ treatment of three patients with 1,25-dihydroxyvitamin D-receptor-defect rickets and alopecia. *Pediatrics*, 80: 97-101, 1987.
8. Brooks, M.H.; Bell, N.H.; Love, L.: Vitamin D dependent rickets type II, resistance of target organs to 1,25-dihydroxyvitamin D. *N Engl J Med*, 298:996-999, 1978.
9. Tracy, W.E.; Campbell, R.A.; Ore, P.: Dentofacial development in children with Vitamin D resistant rickets. *JADA*, 76:1026-1031, 1968.
10. Harris, R. and Sullivan, H.R.: Dental sequela in deciduous dentition in vitamin D resistant rickets. *Australian Dent J*, 200-203, August, 1960.
11. Yasufuku, Y.; Kohno, N.; Tsutsumi, N.: Dental management of familial hypophosphatemic vitamin D resistant rickets. *J Dent Child*, 50:300-304, July-August, 1983.

ABSTRACTS

Waldman, H. Barry: Medicaid and Medicaid dentistry in the Reagan years. J Dent Child, 55:409-417, November-December, 1988.

A general review of the Medicaid program is provided. Particular emphasis is placed on how the Medicaid program fared during the Reagan years. The continuing difficulties faced by dentistry under Medicaid are considered, along with a newly established climate that both allows and encourages reductions of dental services for the poor, especially for its 12.3 million children.

Dental services; Medicaid; Trends, economic

Waldman, H. Barry: And what of the children? J Dent Child, 55:418-421, November-December, 1988.

Major federal legislation has been enacted to aid the elderly, but what of the needs of children? An updated review of existing health and social needs of children is provided. General concerns for children also include the following areas: changing home environment, child abuse and neglect, high school dropout problem, teenage unemployment, teenage pregnancy and abortions, drug use, and automobile accidents.

Child and adolescent health; Economics; Social issues; Pediatric dentistry

Duncan, William K.; Silberman, Stephen L.; Trubman, Aaron: Labial hypoplasia of primary canines in black Head Start children. J Dent Child, 55:423-426, November-December, 1988.

Hypoplastic defects of the labial surface of primary canines, although quite common, are not well documented in the literature. The relationship of this lesion with dental caries and the effects of fluoridated water on this relationship is unclear. This study was undertaken to provide additional documentation to the literature, determining the prevalence of hypoplasia on the labial surface of mandibular primary canines in a black Head Start population, and to report the number of hypoplastic lesions that are carious in both fluoridated and

non-fluoridated communities. Results showed that hypoplasia of the labial surface of the mandibular primary canines in this sample has a prevalence of 37 percent; 26 percent of these lesions became carious, with a nearly identical prevalence in both fluoridated and non-fluoridated communities. The labial surface hypoplasia of mandibular primary canines in a black Head Start sample was common; more potentially carious than normal enamel; and does not appear to be affected by water fluoridation. Additional studies are needed to determine causality and effective means of prevention and/or treatment.

Enamel hypoplasia; Caries; Fluoridation; Pediatric dentistry

Gonzalez, Cesar D.; Frazier, P. Jean; Messer, Louise B.: Sealant knowledge and use by pediatric dentists: 1987 Minnesota survey. J Dent Child, 55:434-440, November-December, 1988.

Results of a 1987 survey on the use of sealants by pediatric dentists in Minnesota are reported to update the reports published by others between 1978 and 1984 in this state. The mailed questionnaire we used also measured the respondents' knowledge and opinions

about caries-preventive methods. In general, respondents were knowledgeable regarding caries-preventive procedures, and had positive attitudes toward sealants. All respondents reported using sealants; only 46 percent reported applying sealants more than ten times per week. Use of sealants was highest for patients aged 6-14 years. In offices employing dental hygienists, 59 percent reported delegating the application of sealants to the hygienist. Continuing efforts are needed to promote sealant usage for age-groups older than 14 years, in addition to continuing sealant usage in the 6- to 14-year-old age-group.

Sealants; Attitudes, practitioner; Hygienists; Prevention; Demographics

Vanderas, Apostole 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.

A central question related to the multifactorial etiology of the dysfunction of the masticatory system is how much each of the etiologic factors contributes to the development of cranioman-

Continued on page 406

INDEX TO ADVERTISERS

Alberta Children's Hospital.....	405
Block Drug Company.....	Cover 4
Colgate-Palmolive Company.....	393, 407
John P. Pearl & Associates.....	Cover 3
Johnson & Johnson.....	398
National Dairy Board.....	403
Procter & Gamble/Crest.....	401
RMO Diagnostic Services.....	400
Vivadent.....	Cover 2
Wm. Wrigley Jr. Company.....	399

Anthony J. Jannetti, Inc., Advertising Agency
P.O. Box 56, North Woodbury Road, Pitman, NJ 08071

ABSTRACTS

Continued from page 402

dibular dysfunction. An approach to this program is to study the frequency of craniomandibular dysfunction separately for patients subject to different etiologic factors. The purpose of this study was to determine the prevalence of craniomandibular dysfunction in white children classified by the parents as *calm*. The results showed low prevalence of TMJ tenderness (7.2 percent), TMJ sounds (14.4 percent), limited maximal opening (0.8 percent), deflection on maximal opening (5.6 percent), and headaches (10.8 percent). The only symptom with high prevalence was muscle tenderness (46.8 percent). Malocclusion and oral parafunctions are the known causative factors of the mild symptoms seen in this group; the relationship needs more investigation.

Dysfunction, oral; Temporomandibular joint; Headache; Malocclusion; Parafunction, oral

Jones, Colwyn M. and Reid, James S.: Patient and operator attitudes toward rubber dam. J Dent Child, 55:452-454, November-December, 1988.

This study was undertaken to assess the acceptability of rubber dam to practitioners (67 undergraduate students) and to patients (100 young persons, aged 4-24 years). The patients had undergone a variety of restorative procedures in the undergraduate clinic of the Child Dental Health Unit, then had completed a post-treatment questionnaire. The undergraduates also completed a questionnaire on the use of rubber dam. Seventy-nine percent of the patients preferred the use of rubber dam or stated that it made no difference to their treatment, whereas the other 21 percent preferred treatment without rubber dam; 98 percent of the operators felt the use of rubber dam was worthwhile, and one percent either felt it made no difference or that its use was not worthwhile. Nearly all of the operators and more than three fourths of the patients had no objection to the use of rubber

dam. The authors believe that the benefits derived from the use of rubber dam far outweigh any disadvantages and advocate its routine use.

Rubber dam; Dental procedures; Attitudes, patient and practitioner

Berg, Joel H. and Donly, Kevin J.: Conservative technique for restoring primary molars after pulpotomy treatment. J Dent Child, 55:463-464, November-December, 1988.

Primary molars have traditionally been restored with a stainless steel crown subsequent to performing a pulpotomy, even if minimal tooth structure was removed during the pulpotomy access. This report describes a conservative technique for restoring primary molars after pulpotomy, using glass ionomer/silver cermet and composite resin. After the pulpotomy is completed and a thin layer of ZOE paste is placed over the root-canal orifices, glass ionomer/silver cermet is placed into the pulp chamber, and is built up to near the dentinoenamel junction. Using an unfilled or partially-filled resin intermediary bonding agent, composite resin is polymerized above the glass ionomer to achieve the final restoration. In appropriately selected situations, this technique allows for minimal additional tooth reduction after completion of the pulpotomy, and provides an esthetically pleasing result.

Restorations; Molars, primary; Pulpotomy; Technique, conservative

Kikuchi, Kenji; Okamoto, Tae; Nishino, Mizuko; Takeda, Eiji; Miyao, Masuhide: Vitamin D-dependent rickets type II: report of three cases. J Dent Child, 55:465-469, November-December, 1988.

Three cases of Vitamin D-dependent rickets (DDR) type II were reported, with dental findings and management of these cases summarized as follows. Large pulp chambers were found in two patients by x-ray examinations; ground sections of primary maxillary first molar from one of these two cases showed an abundance of interglobular dentin. The

second of these two cases showed improvement in size of pulp chamber after receiving medication for a year. One of three cases did not show large pulp chambers. This indicates the possibility to perform the ordinary dental management by suppression of caries activity and having a careful recall system.

Rickets, type II (DDR)

Waggoner, William F. and Ashton, James J.: Comparison of Kodak D-speed and E-speed x-ray film in detection of proximal caries. J Dent Child, 55:459-462, November-December, 1988.

One method of minimizing radiation exposure is the use of the fastest radiographic film which provides a diagnostic image. The purpose of this study was to determine the diagnostic quality of the new higher-speed Ektaspeed (E) x-ray film and compare that to the quality of the slower speed Ultraspeed (D) x-ray films, specifically in the diagnosis of interproximal caries. Ninety-nine extracted permanent molars and premolars having at least one proximal surface with a carious lesion were selected. Lesions ranged from small "white spots" to areas of frank cavitation. The teeth were mounted in modeling clay with proximal surfaces in contact in groups of three and radiographed at standard settings for both film types. The films were then processed simultaneously in an automatic film processor. Each film was randomly assigned a number between 1 and 66 and mounted in an x-ray mount in consecutive order. Fourteen dentists were asked independently to rate each proximal surface for presence and extent of caries. Evaluators were unaware of film types. A Friedman's two-way layout test was performed to examine rater differences and a Wilcoxon signed rank test to evaluate film differences. A rater effect was found ($p < .0001$), but no difference was found between film types. Under optimal conditions, the two film types were comparable in their capability to record interproximal caries. **X-ray film; Kodak Ektaspeed and Ultraspeed; Proximal caries**