ASDC AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN

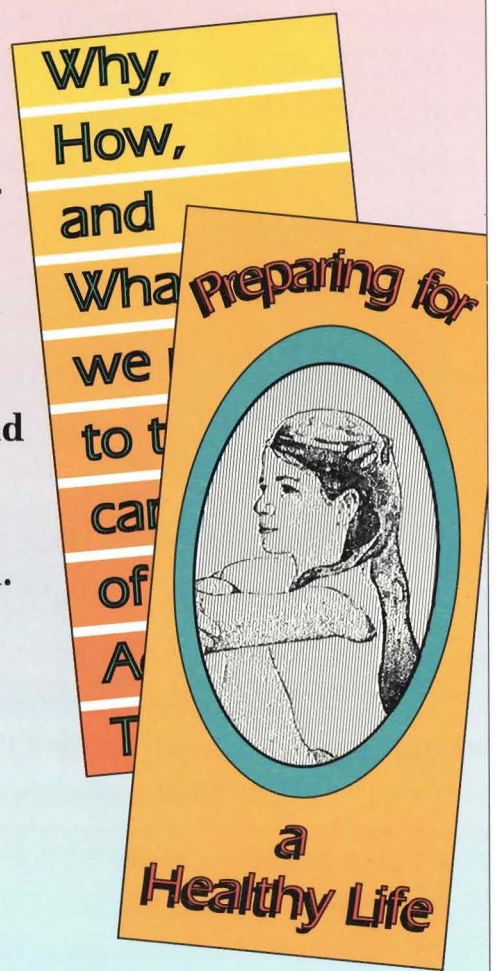
JANUARY– FEBRUARY 1991

JOURNAL OF DENTISTRY FOR CHILDREN

A CHALLENGE TO OUR TEENAGERS

One of the most important transitions that characterizes normal human growth is the acceptance of responsibility for one's own health. Evidence of this occurring is observable in the years immediately preceding adolescence.

As health care professionals, we should encourage children to accept this responsibility. For the goal to be accomplished satisfactorily requires that we provide children and their parents with sufficient information and emphasize the importance of strength of character in leading a healthy life. Children should be taught that a strong, personal commitment to good health is needed, if a high-quality lifestyle is to be enjoyed.



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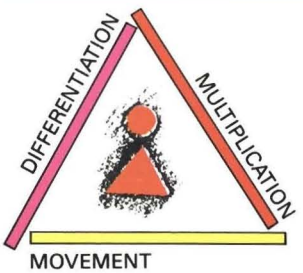
IT IS BETTER TO BIND YOUR CHILDREN
TO YOU BY A FEELING OF RESPECT,
AND BY GENTLENESS, THAN BY FEAR.

—Terence Adelphi
185-159 B.C.



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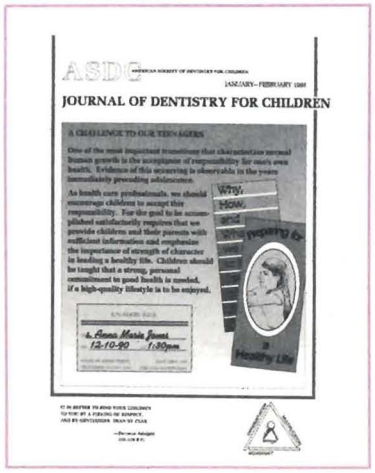

Even though knowledge, practice, and encouragement are important ingredients of a personal program for good health, will power and self discipline spell the difference between success and failure.

For the busy reader

Secondary retention in the primary dentition—page 17

In this study the clinical, radiographic and histological characteristics of secondarily retained primary molars were investigated and the results of different treatments were evaluated. Occurrence in the primary dentition may predispose the patient to a similar disorder in the permanent dentition.

Requests for reprints should be directed to Dr. G.M. Raghoebar, University Hospital Groningen, Dept. of Oral and Maxillofacial Surgery, P.O. Box 30.001, 9700 RB Groningen, The Netherlands.

The status of water fluoride assay programs and implications for prescribing of dietary fluoride supplements—page 23

During 1987-89, a survey of dental directors in the U.S. was conducted by mail and followed-up by telephone. Questions asked about the presence of state-affiliated water fluoride assay programs, fees charged, number and proportion of the population with naturally occurring fluoride in the water, and the number and proportion with optimally fluoridated water. The assay is indicated whenever the specific water fluoride content is not available.

Requests for reprints should be directed to Dr. Stephen Levy, Department of Preventive and Community Dentistry, College of Dentistry, The University of Iowa, Iowa City, Iowa 52242.

Dental general anesthesia: clinical characteristics of 933 patients—page 27

This study describes the clinical features of 933 patients who received dental treatment using general anesthesia at the University Hospital of Leuven, Belgium. The majority of patients had more than one reason for admission. Three fourths had rampant caries; one third had excessive dental fear. These main indications remained constant during the six-year study, as the number of patients who received general anesthesia increased.

Requests for reprints should be directed to Dr. M. Vermeulen, Department of Pediatric Dentistry, School of Dentistry, Oral Pathology and Oral Surgery, University Hospital St. Rafaël, Capucijnenvoer 7, B-3000 Leuven, Belgium.

Training dentally anxious children to cope—page 31

Previous research had shown that training in coping skills, when combined with film modeling, was more effective in relieving anxiety during stressful medical procedures than either treatment alone. This study of dentally anxious children was conducted to show differences among treatment groups. It showed significant, predicted differences on self-report measures of anxiety, but not on behavioral or physiological (pulse) measures.

Requests for reprints should be directed to Dr. Jeffrey S. Nevid, Department of Psychology, St. John's University, Jamaica, New York 11439.

Sealant use by general practitioners: a Minnesota survey—page 38

Recent national studies show an increase in sealant use, but not the widespread acceptance and use of this preventive procedure in dental practice that is warranted, given the need for them that exists and their favorable potential impact. This study was a one-time, random sample survey of Minnesota general practitioners; a 37-item mail questionnaire was designed to measure level and frequency of sealant use, knowledge and opinions about methods to prevent dental caries, characteristics of office structure, length of practice experience, demographics, dental school experience and other sources of information about sealants.

Requests for reprints should be directed to Dr. Cesar D. Gonzalez, Assistant Professor, Department of Pe-

diatric Dentistry, Marquette University, School of Dentistry, 604 N. 16th Street, Milwaukee, WI 53233.

Managing sealant utilization among insured populations: report from Vermont's "Tooth Fairy" program—page 46

This report assesses the use of sealants among one insured population in Vermont. Provider behavior with sealants has changed, with nearly 70 percent of U.S. dentists reporting regular use. Insurance program management is described.

Requests for reprints should be directed to Dr. Robert W. Gerlach, Division of Dental Health, Vermont Department of Health, 60 Main Street, P.O. Box 70, Burlington, Vermont 05402.

'I know you've heard it before, but...' (A litany for change— Part II)—page 50

The need to heighten the public's awareness of the economic, social and health needs of the children is a continuing problem—one that competes for resources and attention with the concern engendered by elders' organizations.

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.

Directors of pediatric dentistry programs—page 55

Only minimal information is available about the directors of specialty programs. The need is to increase dramatically the overall availability of information on advanced dental-education programs.

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.

Williams (Elfin Facies) syndrome: review of the literature and report of a rare case—page 57

This disorder is characterized by multiple anomalies. Etiology is unknown; about one hundred cases have been reported.

Requests for reprints should be directed to Dr. Robert A. Boraz, Associate Professor of Surgery and Pediatrics, Director, Dental Service, University of Kansas Medical Center, 39th and Rainbow Blvd., Kansas City, Kansas 66103.

The management of self-inflicted oral trauma secondary to encephalitis: a clinical report—page 60

Requests for reprints should be directed to Dr. D.F. Duperon, UCLA School of Dentistry, Section of Pediatric Dentistry, Room 23-020, Center for the Health Sciences, Los Angeles, CA 90024.

Mandibular and dental development subsequent to thyroid therapy in a boy with Down syndrome: report of case—page 64

Requests for reprints should be directed to Dr. J.M.H. Dibbets, School of Dentistry, Antonius Deusinglaan 1, 9713 AV, Groningen, The Netherlands.

Treatment costs for carious primary teeth related to fluoride exposure—page 69

Requests for reprints should be directed to Dr. Aaron Trubman, Department of Diagnostic Sciences, School of Dentistry, University of Mississippi, 2500 North State Street, Jackson, MS 39216-4505.

Secondary retention in the primary dentition

Clinic

Gerry M. Raghoebar, DDS
Geert Boering, DDS, PhD
Boudewijn Stegenga, DDS
Arjan Vissink, DDS, PhD

Secondary retention refers to the cessation of eruption of a tooth after emergence. This disturbance of eruption cannot be attributed to a physical barrier in the path of eruption or an abnormal position.[1] Other terms used in the literature are submerging, ankylosis and infraclusion.[2-4] As the neighboring teeth continue to erupt simultaneously with the growth of the alveolar bone, the affected tooth becomes secondarily in infraclusion. The extent of infraclusion is related to the rate of facial growth.[2] Secondary retention is observed in first and second molars. Primary molars are affected more frequently than permanent molars.[5] Several hypotheses regarding the etiology have been proposed, including deficient eruptive force, disturbed metabolism of the periodontal ligament, squeezing, trauma, deficient local vertical bone growth, local inflammation, and disturbance in interaction between normal resorption and hard tissue repair.[2,5-9] A hereditary component has also been suggested, based on the observation of secondary retention in several members of the same family.[4,10,11] The exact biological mechanism of secondary retention is still unknown. It is often suggested that limited areas of ankylosis play an important

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role in the development of secondary retention.

Consequences of secondary retention of primary molars are delayed exfoliation, malocclusion, increased susceptibility to dental caries and periodontal disease of both the neighboring teeth and retained molar, and dislocation of the successor.[5,12-15] Early recognition of secondary retention, proper treatment and a thorough follow-up are important to prevent or minimize these consequences. In this study the clinical, radiographic, and histological characteristics of secondarily retained primary molars were investigated and the results of different treatment methods were evaluated.

MATERIAL AND METHODS

Material

A molar was considered secondarily retained when its occlusal surface was at least 1 mm below the level of the occlusal plane of the relevant dental arch, at an age when this tooth would normally be in occlusion. Based on this definition, fifteen female and nineteen male patients (mean age: 13.9 ± 5.2 years, median 13 years, range four to thirty-two years) with seventy-seven secondarily retained primary molars were selected. The patients all had been referred to the Department of Oral and Maxillofacial Surgery of the University Hospital Groningen by their dentist, orthodontist or oral surgeon. Two patients were brothers and five patients belonged to one family.

Clinical examination

The following variables were recorded:

- ☐ The number and location of the secondarily retained molars.
- ☐ The extent of infraclusion: the distance (mm) between the occlusal surface of the retained molar and the occlusal plane of the relevant dental arch.
- ☐ The percussion sound of the retained molar: dull, cushioned sound (normal tooth) or a sharp, solid sound (ankylosis).
- ☐ The degree of tilting of the adjacent teeth: no tilting; moderate tilting (less than half of the surface of the retained molar covered); and severe tilting (more than half of the retained molar surface covered).

Radiographic examination

Orthopantomograms and intraoral periapical radiographs were taken of all patients. The following variables were recorded:

- ☐ The relationship between the retained molar and its successor.
- ☐ The presence or absence of root resorption.
- ☐ The presence or absence of a periodontal ligament space.
- ☐ The vertical development of the alveolar process in the area of the secondarily retained tooth.

Treatment

Secondarily retained molars were treated in three different ways, namely:

- ☐ Extraction of the retained molar (N = 25).
- ☐ Extraction of the retained molar in combination with orthodontic treatment to create or hold space for the successor (N = 16).
- ☐ No treatment (N = 36).

Histologic examination

All removed molars (N = 41) were examined by light microscopy. After removal, the molars were fixed in a 10 percent buffered formalin solution for two weeks, washed with tap water and demineralized in a solution of 25 percent formic acid and 10 percent sodium citrate

Table 1 ☐ Distribution of secondarily retained primary molars.

	m1	m2	N
Mandible	11	35	46
Maxilla	5	26	31
N	16	61	77

Table 2 ☐ Distribution of secondarily retained permanent molars.

	M1	M2	N
Mandible	5	-	5
Maxilla	5	1	6
N	10	1	11

Table 3 ☐ Treatment results of secondarily retained primary molars in relation to eruption of the successor.

	N	Normal eruption	Impaction	Agenetic
Extraction	25*	10	6	5
Extraction and orthodontic posttreatment	16**	14	–	–
No therapy	36***	30	1	2

* Four premolars were removed, because of abnormal positions.
** Two premolars can yet erupt and have enough space.
*** Three premolars can yet erupt and have enough space.

in water. After embedding in paraffin, sections (7 μm)were cut in a mesiodistal direction, parallel to the vertical axis of the molar and stained with hematoxylin and eosin. The examination was especially focused on the detection of ankylotic areas. Ankylosis was defined as direct contact of the alveolar bone with root cement or dentin.

Follow-up

New cases of secondary retention in the same group were recorded. The effect of the different treatment methods on the eruption of the successor (if present), on the height of the alveolar process, and on the occlusion were evaluated. The extent of infraclusion was measured in cases in which no treatment was carried out.

RESULTS

Unless otherwise stated, the data given below all concern primary molars.

Clinical features

The distribution of the secondarily retained molars is given in Table 1. There is a prevalent occurrence of second molars in the mandible and maxilla. In one patient all molars were retained (Figure 1). Secondary retention of permanent molars (N = 11; Table 2; Figure 2) was observed in nine patients (mean age: 13.5 years, range eleven to seventeen).

The mean infraclusion was 4.1 ± 1.9 mm (median 4 mm, range 2-10 mm). In three cases the extent of infraclusion was so severe that the retained molar was covered almost totally by the surrounding tissues (Figure 3). In these cases, a narrow transepithelial connection between the occlusal surface of the retained tooth and oral cavity could be detected.

On percussion in twenty-one molars, a sharp, solid sound suggesting ankylosis was recorded, while in forty-eight molars a dull, cushioned sound was heard. In eight cases, it was not possible to perform a reliable percussion test, because the retained molar was too obscured by surrounding structures (severely tilted neighboring teeth).

No tilting of the neighboring teeth was observed in forty-eight secondarily retained molars, moderate tilting in twenty-one cases and severe tilting in eight cases. In most cases, tilting was limited to the distal tooth and mainly observed, if infraclusion was 4 mm or more and apparently insufficient space was available for the potential successor.

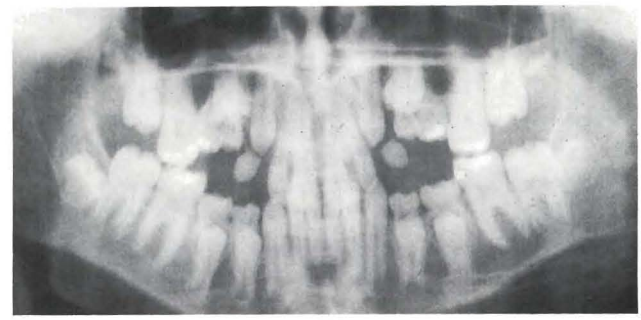

Figure 1A. Orthopantomogram of a ten-year-old boy with secondary retention of all primary molars.

Figure 1B. Clinical view of the right side.

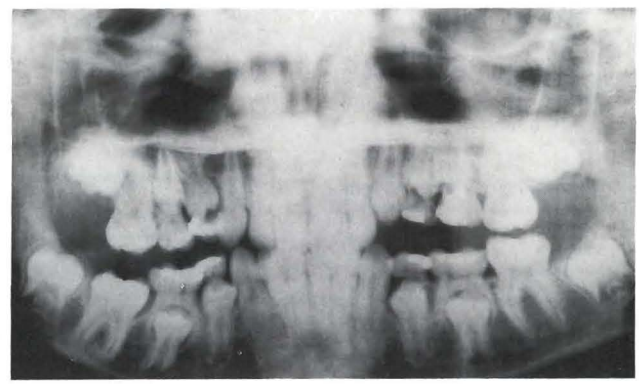

Figure 2. Orthopantomogram of a twelve-year-old girl with secondary retention of the left first and second primary molars and right first permanent molar in the mandible.

Radiographic features

The successor of seven secondarily retained molars was agenetic. In all cases in which the premolar was present, a delay of root resorption of the retained molar in comparison with the normal primary molars was ob-

served. Four successors had an abnormal position in the jaw.

Partial absence of the periodontal ligament space, suggestive for the presence of ankylosis, was seen in six cases. In five of these cases, a sharp percussion sound was recorded.

In all cases a decrease in vertical dimension of the alveolar bone was noted in the region of the retained molar.

Histologic features

In thirty-two molars (78 percent) local areas of ankylosis were observed in the interradicular root area (Figure 4). In two cases, ankylosis was also observed at the outer root surface. From the seventeen removed molars with a sharp percussion sound, fifteen showed histological ankylosis. The radiographic diagnosis of ankylosis (N = 6) was supported by histological data.

Follow-up

During the follow-up period (six months to six years), four new cases of secondarily retained molars were diagnosed, namely two primary and two permanent molars. The latter was observed in two patients. The treatment results are given in Table 3 and illustrated in Figures 5, 6, and 7. The extent of infraclusion was progressive in most cases. All primary molars with successors that were left in place exfoliated, although with some delay. No reeruption of the molars was observed.

The percussion test is not a reliable diagnostic tool.

Eruption of a premolar after shedding of the retained molar always was associated with a recovery of the height of the alveolar process (Figure 5). Impaction of a successor (N = 7) was observed in case of lack of sufficient space for this tooth to erupt. Five secondarily retained molars without a successor were removed (Figure 6), because of the severe infraclusion, tilting of the neighboring teeth, or the extreme or progressive root resorption. The two remaining molars without a successor did not show any of these characteristics and were, therefore, left in place (Figure 7). A prosthetic build-up was made in both cases.

The authors wish to thank Dr. H.W.B. Janssen and Dr. C.J.F. Schoots for their participation in the histological part of the study.

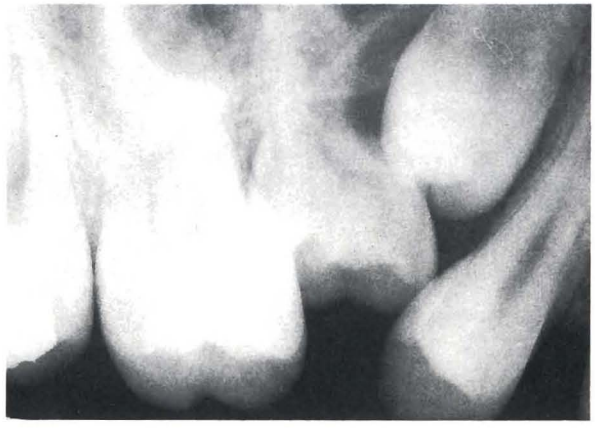

Figure 3A. Intraoral periapical radiograph of a thirteen-year-old girl with secondary retention of the left second primary molar in the maxilla.

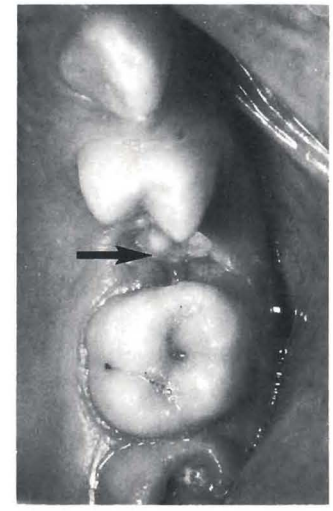

Figure 3B. Clinical view of the same patient, the retained molar being covered by the surrounding tissues (arrow).

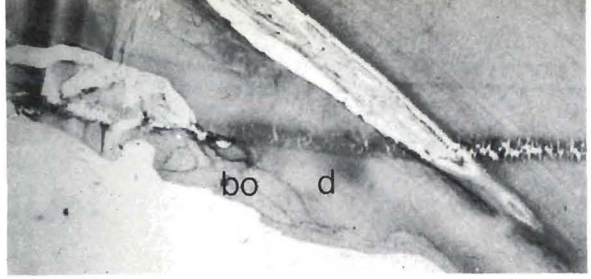

Figure 4A. Histological section of a secondarily retained primary second molar in the maxilla. Bifurcation area. Dentin (D) in contact with bone (BO). H-E, x20.

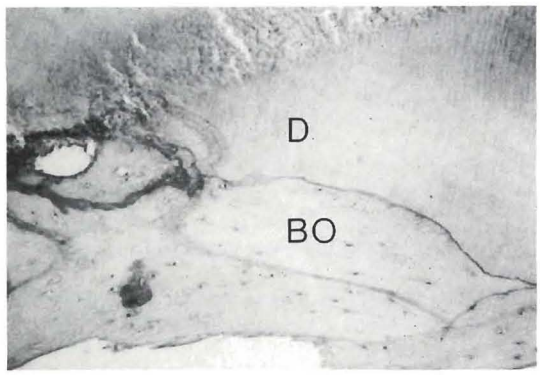

Figure 4B. Detail of bifurcation area. H-E, x80.

Figure 5A. Orthopantomogram of a twelve-year-old girl with secondary retention of the second primary molar in the left mandible and maxilla.

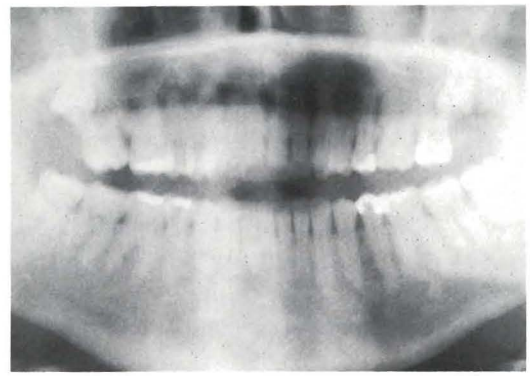

Figure 5B. Orthopantomogram of the same patient after five years without any active treatment. The premolars have erupted normally and the alveolar process has recovered its height.

DISCUSSION

From the results of the present study, proper treatment of the disorder in the primary dentition and a careful follow-up usually ensure a normal development of the permanent dentition. Furthermore, it appears that the occurrence of secondary retention in the primary dentition may predispose to a similar disorder in the permanent dentition.

Several nominations are used for the eruption disorder studied. We prefer the term 'secondary retention' because of its neutrality with respect to its still unknown cause. Submerging is a misnomer, because the involved molar does not sink into the alveolar process, but remains static while the other teeth continue to erupt.[5] Ankylosis only reflects one common exponent of the cessation of eruption. This is stressed by the fact that both clinically and histologically, ankylosis cannot be detected in all cases.[9,13] Infraclusion is only a description of the clinical situation, and is easily confused, therefore, with other abnormalities of the dentition causing infraclusion.[4]

We call the disorder 'secondary' retention to distinguish it from 'primary' retention. In contrast to secondary retention, a primarily retained tooth has never shown enough tendency to erupt into the mouth. The tooth remains unerupted in the jaw beyond the time at which it should have been erupted. Secondary retention usually occurs in the primary molars in the mandible.[2,4,5,12,13] In this study, the mandibular second primary molar was most frequently affected, which is in accordance with the literature.[5,16-18] Some authors reported that the mandibular first primary molar, however, was the most frequently retained.[13,14] In a study, it was shown that after the age of nine years, the mandibular second primary molar was more frequently affected.[4] This molar may not exfoliate on time and still be evident in older children.[13]

The prevalence of secondary retention has been found to be age-related, with a maximum in eight- and nine-year-old children.[4] Patients participating in our study were predominantly between ten and twenty years of age. A possible explanation for this relative old age-group might be that the oral surgeon is usually confronted with the more severe and longer existing cases of secondary retention.

The most reliable clinical and radiographical characteristic of secondary retention seems to be infraclusion. In addition, the percussion test is used to assess ankylosis in relation to secondary retention.[3,14,19] A percussion test may easily result in false negative findings, because of its subjectivity and because of the fact that minor areas of ankylosis may fail to give a change in resonance.[13,20] It is, therefore, not a reliable diagnostic tool. In this study, two molars with a sharp percussion sound histologically showed no ankylosis.

Radiographically, ankylosis was observed in a minority of cases, while according to the literature and to the results of our study, areas of ankylosis were observed histologically in 78-100 percent of the cases.[9,16,18,19] The low number of cases in which ankylosis was detected radiographically may be the result of the projection of the pictured molar in a flat plane and the preferential location of ankylosis in the interradicular area of the roots.[9,19,21-23] Both circumstances make that small areas of ankylosis are usually not diagnosed on radiographs.[16] Spontaneous reeruption of

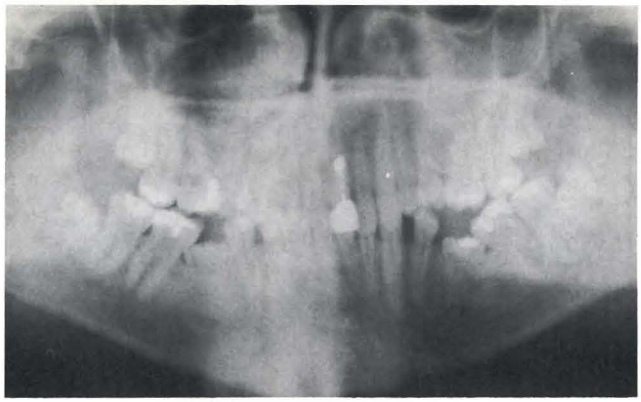

Figure 6. Orthopantomogram of a fourteen-year-old girl with secondary retention of both second primary mandibular molars without a successor. These molars were removed, because of tilting of the neighboring teeth and root resorption of the retained molar.

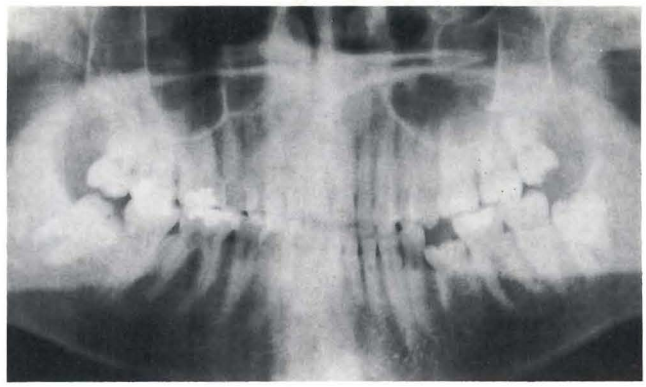

Figure 7. Orthopantomogram of a twenty-five-year-old man with secondary retention of the left second primary mandibular molar without a successor. No treatment was performed.

the secondarily retained molar occasionally occurs due to resorption of the area of ankylosis.[18,23] This was not observed, however, in our study.

In the management of secondary retention, early recognition and diagnosis as well as proper treatment and careful follow-up are very important. The indication for treatment depends on the age of the patient, the extent of infraclusion, the extent of tilting of the neighboring teeth, and the presence and location of the successor. Usually the recommended treatment is to wait for normal shedding under the condition of an adequate follow-up.[24] Extraction of the retained molar and the use of a space maintainer are indicated in cases of severe infraclusion, severe occlusal disturbances, and dislocation of the crypt of the successor. Whenever possible, extraction should be deferred until the first permanent molar erupts. In case of an agenetic successor, the retained molar can be left in place if infraclusion is slight, the adjacent teeth show no tilting, and the progression of root resorption is slow. In such a case, the occlusal, labial and lingual surfaces can be built up with composite resin in order to prevent tilting of the neighboring teeth and supra-eruption of the antagonist.[25] As the eruption of the neighboring teeth continues, however, a new build-up or removal of the retained molar may be necessary. Particularly in the mandible, it is advisable to treat the resulting space orthodontically or prosthodontically in order to prevent tilting of the neighboring teeth.

The presence of secondary retention in the primary and in the permanent dentition may be due to the same etiology, and is probably the result of degenerative changes in the periodontal ligament of a multirooted tooth. Further investigation is necessary to detect the precise cause.

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The status of water fluoride assay programs and implications for prescribing of dietary fluoride supplements

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In recent years, the prevalence of dental caries in children has decreased dramatically in the United States and other developed countries.[1-3] The widespread use of fluoride is generally believed to be the most important reason for this decline[3,4] Community water fluoridation long has been recognized as the most efficient and cost-effective method of providing the recommended levels of systemic fluoride for the prevention of dental caries.[5,6] Approximately 46 percent of the U.S. population, however, does not have access to optimally fluoridated water.[7]

For children who do not drink optimally fluoridated water, the use of dietary fluoride supplements (tablets and drops) is recommended.[8-11] Before prescribing fluoride supplements, it is important that determination of the fluoride content of the major sources of drinking water be obtained for each patient, to determine the proper dose and to avoid unnecessary risks of dental fluorosis.[8] Concerns have been expressed recently over an increase in the prevalence of mild dental fluorosis in the United States.[12]

Although several studies have reported that the majority of physicians and dentists prescribed dietary fluoride supplements for some of their child patients, studies have also shown that many health professionals did not assay water for fluoride content.[13-24] Thus, dietary fluoride supplements are sometimes prescribed without specific knowledge of the fluoride content of the patient's water supply, thereby increasing the risk of dental fluorosis.

Although health professionals are encouraged to have the water supplies of their individual patients assayed for fluoride content, and although a number of states have school programs providing dietary fluoride supplements, little is known about the states' programs for providing assays of individual patients' water supplies.*[25] The purpose of this paper is to describe the status of state-affiliated water fluoride assay programs of individual water supplies in the United States.

METHODS

Data for this report were collected in the process of developing a series of articles about dietary fluoride supplements for various state medical and dental journals. The articles were endorsed by the Association of State and Territorial Dental Directors (ASTDD). During 1987 and 1988, a survey was conducted by mail of the fifty state dental directors and the dental director for the District of Columbia. Nonrespondents were contacted by telephone in 1988-89. Questions asked about the presence of state-affiliated water fluoride assay programs, fees charged, number and proportion of the population with naturally occurring fluoride in the

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water, and number and proportion of the population with optimally fluoridated water. In looking for patterns among the states in their offering of and charging for state-affiliated assay services, information about population size, number and proportion of population receiving fluoridated water, and number and proportion of population with naturally occurring fluoride in the water supplies was considered. Similar observations were made for the geographical regions of the Department of Health and Human Services (HHS).

RESULTS

Responses were obtained from each of the fifty-one targeted state dental programs. All dental programs, in conjunction with their state laboratories, were able to provide dentists and physicians with lists of communities (and schools, in some cases), that had optimally fluoridated water and those with suboptimal levels. Thirty-nine programs (76 percent) reported that water-fluoride assay services for individual water supplies were available at the state level, whereas twelve (24 percent) reported that such assay services were available only at commercial laboratories. The majority of assay services were provided by state laboratories while four dental schools also were reported to provide the services.

The fees assessed by the public programs for assay services varied greatly. The median charge to the individual was $3.00 and the mean was $3.82. Eighteen of the thirty-nine states with programs provided assay services free of charge. The highest fee was $15.20. Seventeen programs charged $5.00 or more; eight of the seventeen charged $8.00 or more. Three programs waived fees, if certain requirements were met by the patient and provider.

Table 1 shows the availability of assay services by HHS region. Table 2 shows results for assay programs and costs by state population size. Table 3 shows results on assay services by proportion of the population served by fluoridated water.

DISCUSSION

Reports that dentists and physicians do not uniformly assay patients' private drinking water supplies for fluoride content have implicitly assumed that necessary assay services for water fluoride were readily available. According to state dental public health personnel surveyed in this study, such services were not available, however, from the state governments of twelve states with a total population of approximately eighty-two million people and with approximately fifty-three million people without optimally fluoridated water.[7] In these twelve states, only commercial laboratories could provide these services. However, commercial laboratories generally charge substantially higher fees for such analyses that they perform less frequently than their other "standard" analyses.

Among the thirty-nine states offering fluoride assay of patient water supplies, eighteen states provided the services without charge to the patient, while the remaining states charged patients a fee. Even though this fee was lower than those typically charged by commercial laboratories, the fee may be a barrier for many patients, especially in the eight states that had relatively higher fees of $8.00 or more. Title XIX (Medicaid) does not generally provide coverage for them.

There were less likely to be assay programs in the group of nine states with the largest populations. Among those states with assay programs, however, the costs were generally lower in large population states than in states with small populations.

In general, states in which fluoridated water was not available to large proportions of their respective populations were less likely to have this service available. These differences in state programs may reflect in part the comprehensive nature of some state dental programs versus the very limited scope and resources of others.

With current concerns about dental fluorosis, the assay is indicated whenever specific knowledge of water

Table 1 ☐ Status of water fluoride assay programs: by HHS region.

	Region										
	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
Number of states	6	2	6	8	6	5	4	6	4	4	51
States	CT,ME, MA,NH, RI,VT	NJ,NY	DE,DC, MD,PA, VA,WV	AL,FL, GA,KY, MS,NC, SC,TN	IL,IN, MI,MN, OH,WI	AR,LA, NM,OK, TX	IA,KS, MO,NE	CO,MT, ND,SD, UT,WY	AZ,CA, HI,NV	AK,ID OR,WA	
Proportion with Programs	1.0	0.50	0.67	0.88	1.0	0.40	1.0	1.0	0.25	0.50	0.76

fluoride content is not available.[26] In view of the following observations, it would be appropriate for public health officials to consider the relative costs and benefits of assays and dietary, fluoride-supplement programs in balancing caries prevention and risks of dental fluorosis:

- ☐ Recent appreciation of the substantial benefits of the use of topical fluorides.[26,27]
- ☐ Substantial costs of water-fluoride assay (whether charged to the patient or subsidized by the state government).
- ☐ Substantial evidence of deficiencies in provider compliance with recommended assay and dietary fluoride-supplement protocol.[14-24]
- ☐ Repeated difficulties with patient compliance with dietary fluoride supplements.[28]

If efficient and affordable water-fluoride-assay programs cannot be made available in a given state, then emphasis on the use of topical fluorides may be preferred. The use of topical fluoride mouthrinses and gels generally are contraindicated, however, in preschool children, due to difficulties in rinsing and expectorating, resulting in inadvertent swallowing of substantial quantities of fluoride.[29,30] The use of fluoridated dentifrice provides the topical benefits of fluoride and, when ingested, also provides systemic benefits. The ingestion of fluoride dentifrice by young children, however, also is believed to be a contributing factor in the increased prevalence of dental fluorosis.[29,31]

Table 2 ☐ Status of water fluoride assay programs: by state population size.

Population size (Millions)	6.3–26.7	4.4–6.3	2.5–4.4	1–2.5	0–1
Number of states	9	11	11	10	10
Proportion with programs	0.56	0.91	0.73	0.80	0.80
Cost (Among those with state program–in dollars)					
Range	0–7.00	0–8.00	0–10.00	0–12.00	0–15.20
Mean	1.75	2.78	4.38	3.88	5.40
Standard deviation	3.50	2.95	4.73	4.61	5.45
Median	0	3.00	3.75	2.50	5.50

Table 3 ☐ Status of water fluoride assay programs: by proportion of population served with fluoridated water.

Proportion of population with fluoridated water	.80–1.0	.63–.80	.50–.63	.25–.50	0–.25
Number of states	3	17	9	11	11
Proportion with programs	1.0	0.88	0.78	0.73	0.55

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RISKS IN DISTANCE RUNNING

Although studies have not been performed in prepubertal children, iron depletion, manifested by low serum ferritin concentration, even with a normal hemoglobin concentration, is not uncommon among adolescent runners of both sexes. An iron-poor diet is probably a main contributor to this disorder. Hemolysis is an often-cited cause of iron loss in runners and is manifested by low serum haptoglobin levels. One possible mechanism is repetitious foot strike (previously known as "march hemoglobinuria"). Hematuria and mild occult gastrointestinal bleeding have been observed and may contribute to iron depletion.

A child's ability to maintain thermal homeostasis during prolonged running is less efficient than that of an adult, particularly when the climate is very hot or very cold. This deficiency may result in heat-or cold-related disorders, including heatstroke or hypothermia. Of particular concern is the dehydration that accompanies prolonged running, even if the child is given fluid *ad libitum*. In addition, children take longer than adults to acclimatize to hot, humid climates, which further increases their risk for heat-related disorders.

Committee on Sports Medicine, American Academy of Pediatrics:
Risks in distance running for children.
Pediatrics, 86:799-800, November 1990.

Dental general anesthesia: clinical characteristics of 933 patients

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Although most patients can receive dental care under routine conditions in a conventional office environment, there are exceptions that make an alternative method of treatment necessary. One way of helping these patients is to offer dental treatment using general anesthesia. The indications for treatment under general anesthesia are shown in Table 1 (*next page*).

Epidemiological reports—describing larger groups of patients, their referral, and dental state—are lacking. This study describes the clinical features of 933 patients and precedes a follow-up study to evaluate the long-term results of total oral rehabilitation using general anesthesia for different patient groups.

MATERIAL AND METHODS

In a six-year period, from January 1983 until December 1988, 1872 patients received dental treatment using general anesthesia at the Department of Restorative and Pediatric Dentistry of the University Hospital of Leuven, Belgium. Before admission, all patients received an oral examination at the outpatient clinic. The treatment was performed during a one-day hospitalization. Most of the patients were permitted to leave the hospital the same evening; but some (mostly adults) handicapped patients and patients with medical problems, remained overnight. Endotracheal intubation was used. The required preventive, restorative and surgical treatment was completed in one session.

The patients were listed according to the date of treatment and numbered consecutively in each year. To reduce the work of abstracting the files, the patients with odd serial numbers were studied. Four files were not found. The following data were abstracted from 933 files: age, sex, indications for treatment using general anesthesia, person who referred the patient for treatment under general anesthesia and the DMF-T (*D*ecayed, *M*issing and *F*illed permanent teeth) or dmf-t (*d*ecayed, *m*issing and *f*illed primary teeth) score before treatment.

All data were recorded in dBase-III plus. Data analyses were performed with use of the SPSS/PC+ statistical package on a personal computer. In each separate analysis, missing data were left out, which accounts for the variability in the number of cases in the different tables.

RESULTS

The demand for complete oral rehabilitation using general anesthesia increased during the last six years from 271 patients in 1983 to 360 patients in 1988.

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Age and sex

The age distribution is shown in the Figure. There was a wide range of ages, the youngest patient being one year old and the oldest seventy-nine; the median age was ten. The five-year-old children made up the largest group (10.9 percent of all patients). The median age of the male patients (nine years) was lower than that of the female patients (eleven years). In the group of patients younger than fifteen years there were more male than female patients who received dental treatment using general anesthesia (56.5 percent male, 43.5 percent female). In the group of patients older than fifteen years, the sex distribution was reversed (46.6 percent male, 53.4 percent female). Because the younger patient group was larger, the overall sex distribution showed a male predominance (52.6 percent male, 47.4 percent female).

Indications

The majority of the patients had more than one reason for admission. Three quarters had rampant caries (more than seven decayed teeth) (Table 1). In a third of the patients, excessive fear was the reason for using a general anesthetic. Children (≤ thirteen years) were more frequently treated using general anesthesia because of fear than adolescents and adults (> thirteen years) (respectively 43.2 percent and 25.0 percent).

The median age of the mentally or physically handicapped patients was fourteen years (range 2-67). Only 8.1 percent of these handicapped patients were younger than six years. Eleven percent of the patients had a severe local infection. Some of them presented with systemic symptoms such as fever and malaise. Ten percent of the patients were referred because of a medical problem (5.1 percent of the children and 17.1 percent of the adolescents and adults). Cancer (31.9 percent), psychiatric disease (22.3 percent), hemophilia (19.1 percent) and cardiac disease (18.1 percent) were the main medical indications for treatment using general anesthesia. Adolescents and adults were often treated using general anesthesia on their own demand (17.0 percent). Of the patients with nursing caries 84.2 percent had more than seven decayed teeth; 40.0 percent were younger than three years of age. Six patients were six years old and four were seven years old. Because of the specific caries pattern and the retrospective confirmation of the prolonged use of a pacifier dipped in honey, these patients also were coded for nursing caries as an indication for treatment using general anesthesia. The indication "too young" is generally accepted in preschool children to mean between two to five years of age. Three six-year-old children who had to undergo extensive treatment and a nine-year-old boy with a deeply retained tooth to be extracted, were also judged as being too young for treatment using local anesthesia.

The main indications, namely rampant caries and fear, remained constant over the years 1983-1988. As shown in Table 2, the prevalence of some indications has changed. The number of patients treated using general anesthesia because of an allergy to local anesthetics, a severe infection, or a mental or physical handicap decreased, and because of dental surgery (extraction of retained teeth) increased.

Table 1 ☐ Indications for treatment under general anesthesia (904 patients).

Indication	Percentage
Extensive amount of treatment required	
Rampant caries	75.3
Nursing caries[1-3,6,7]	7.7
Dental surgery[2,3,6,7]	4.6
Fear[1,2,4,6]	35.6
Handicap[1-8]	23.3
Infection[1,2,6]	11.3
Medical problem[1-3,6,7]	10.5
Patient's demand	8.0
Too young[2,3,5,7]	4.4
Pain	2.7
Allergy to local anesthetic[1-6]	1.9
Others**[1-3,5,7]	1.8

* Extraction of retained teeth.
** Trauma, social situation, hyperpharyngeal reflex, in combination with other surgical procedures.

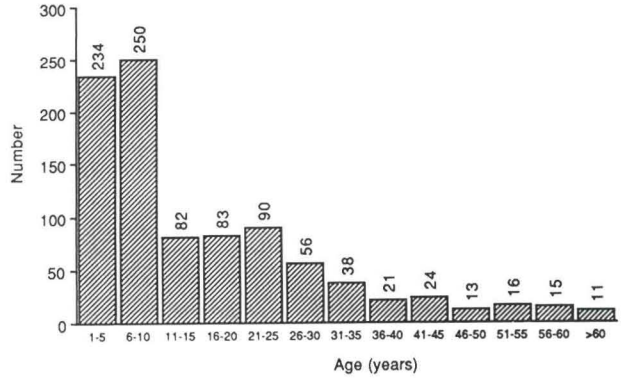

Figure. Age distribution of 933 patients treated under general anesthesia.

Referral

Table 3 shows that the largest group of patients was referred by a local dental practitioner. The second most important group was composed of those patients who presented themselves directly to our out-patient clinic

Table 2 ☐ Changing prevalence of indications (%) for treatment under general anesthesia over a six-year period.

	'83 (n = 132)	'84 (n = 144)	'85 (n = 142)	'86 (n = 149)	'87 (n = 161)	'88 (n = 176)
Allergy local	5.3	4.2	0.0	1.3	0.0	1.1
Infection	15.2	15.3	8.5	9.4	9.9	9.1
Handicap	29.5	26.4	30.3	16.1	19.3	20.5
Dental surgery	0.8	1.4	0.7	4.7	10.6	8.0

Table 3 ☐ Referral of patients for treatment under general anesthesia.

Referral	(%) (n = 889)
Dentist	45.2
General practitioner	12.3
Pediatrician	15.6
Specialist	7.9
No referral	18.2
School	0.8

and were accepted for treatment using general anesthesia, subsequently. Children were mainly sent by the dentist (49.6 percent) or the pediatrician (24.1 percent) or came on their parents' own initiative (15.3 percent). Adults and adolescents were referred by the dentist (39.0 percent), came on their own initiative (22.3 percent) or were sent by the general practitioner (20.4 percent).

From 1983 until 1988 the group of patients sent by a private dental practitioner became more numerous. Their number increased from 36.7 percent of the patients treated using general anesthesia in 1983 to 53.2 percent in 1988. The number of patients referred by a general practitioner decreased from 18.8 percent in 1983 to 7.6 percent in 1988.

Dental condition

The median number of carious teeth was ten, with a range from zero to twenty-eight. Eight patients had no decayed teeth. Three of them needed a total extraction because of the their periodontal condition, two received a general anesthetic for removal of the wisdom teeth and three were mentally retarded and needed extractions for orthodontic reasons or prosthetic rehabilitation.

Half of the children with a primary dentition had more than nine carious teeth, 84 percent had no teeth missing and 92 percent had had no teeth filled, before.

In the mixed dentition, the median number of decayed permanent teeth was four (range 0-12) and of primary teeth seven (range 0-17). Of the children with a mixed dentition 84 percent had no teeth filled, but in 54 percent of these patients one or more permanent teeth were missing because of caries.

In the permanent dentition, the median number of decayed teeth was eleven (range 0-28). Only 20 percent of these patients had no missing teeth. The median number of missing teeth was four (range 0-28). Of these patients 57 percent had no teeth filled before our intervention.

Rampant caries, fear and a mental or physical handicap were the main indications.

DISCUSSION

The purpose of this paper was to describe patients treated using general anesthesia with regard to age, sex, indications for treatment using general anesthesia, source of referral and dental condition. This study begins an investigation into the long-term effect of total oral rehabilitation using general anesthesia. Because of the retrospective nature of the study, some data could not be recovered. On the other hand, clinical characteristics of a great number of patients were collected in a relatively short period of time. In this way, there also was no interference with routine dental practice during the period registered.

The aim of dental treatment using general anesthesia at the Department of Restorative and Pediatric Dentistry is total oral rehabilitation in one session. This study showed that most patients treated using general anesthesia were children. We often treated very young children, one in four patients was younger than five years. As reported before, more boys than girls are treated using general anesthesia.[9,10] Rampant caries, fear, and a mental or physical handicap were the main indications. Most patients were referred by their local dentist.

The indications reported by Enger and Mourino in a group of pediatric patients were comparable with those of the children aged one to thirteen years treated in our department. An extensive treatment plan because of rampant caries or nursing caries and fear for treatment using local anesthesia were the main reasons for admission.[9]

More than a third of the patients received dental treatment using general anesthesia because of fear. Lack of cooperation, regressive behavior or extreme verbal or physical fight-or-flight reactions often interfere with good dental treatment using local anesthesia. Odontophobia can also be expressed by a radical avoidance of all dental treatment.[11,12] The results of this study showed that fear is more frequently an indication for treatment using general anesthesia in children than in adolescents and adults. On the other hand, the older patients were more often treated using general anesthesia on their own demand. The subjective motives mentioned by these patients were lack of time or discipline to attend frequent dental appointments. This demand for treatment using general anesthesia, combined with the bad dental condition strongly suggested odontophobia. We assumed that adults expressed their fear more ambiguously than children, but that this indication was of equal importance in all ages.

Despite the bad dental condition and the apparent lack of previous dental care, many patients had visited a local dental practitioner before referral to our clinic. After treatment using general anesthesia these patients were referred back to their dentists; the others received an appointment at our outpatient clinic. There, we emphasize the repeated instruction of dental hygiene. The dental condition is carefully examined. A good patient-dentist relationship should prepare the patient to cope with future treatment using local anesthesia.

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BODY BUILDING IN ADOLESCENTS

The American Academy of Pediatrics recommends:

1. Strength training programs for prepubescent, pubescent, and postpubescent athletes should be permitted only if conducted by well-trained adults. The adults should be qualified to plan programs appropriate to the athlete's stage of maturation, which should be assessed objectively by medical personnel.

2. Unless good data become available that demonstrate safety, children and adolescents should avoid the practice of weight lifting, power lifting, and body building, as well as the repetitive use of maximal amounts of weight in strength training programs, until they have reached Tanner stage 5 level of developmental maturity.

Committee on Sports Medicine, American Academy of Pediatrics: Strength training, weight and power lifting, and body building by children and adolescents. Pediatrics, 86:801-803, November 1990.

Training dentally anxious children to cope Behavior

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Dental phobia has been cited as a primary factor associated with the avoidance of dental treatment and as a significant problem challenging practicing dentists.[1-5] The fearful dental patient often does not adhere to recommended dental hygiene techniques, may resist scheduling regular appointments, and may require valuable professional time in efforts to ease his anxiety.[6]

Most behavioral techniques for treatment of dental phobia in children of grammar-school age focus on the use of modeling techniques in which fearful children are shown filmed or live models successfully undergoing dental treatment.[7-9] Graded exposure to the dental situation is also combined with modeling.[10,11] In contrast, techniques that focus on dentally phobic adults employ training in more active coping skills, such as meditation-based relaxation or self-hypnosis techniques.[12-15] Learning to cope may be especially helpful since it provides individuals with skills they can use in coping with anxiety associated with dental treatment.[16]

The purpose of the present study was to incorporate training in coping skills within a multicomponent behavioral program for dentally anxious grammar-school children in a school-based program. Previous research shows that such training, when combined with filmed modeling, was more effective in relieving anxiety during stressful medical procedures than either treatment

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alone or an information only control.[17] The specific coping skills that were taught in this previous study involved the use of comforting self-talk as a form of self-statement modification. In another study, a combination treatment consisting of training in the use of calming self-talk, muscle relaxation, and pleasant imagery was shown to be more effective in reducing anxiety among preschool children during their initial dental visit than was an attention control condition, but was not significantly different from a sensory information treatment.[18] But there remains an absence of research exploring training in coping skills with dentally anxious children.

A secondary purpose of the present study was to examine differences in effectiveness between exposure-based (dental operatory setting) and nonexposure based (classroom setting) coping skills training. It was predicted that a multicomponent treatment, consisting of exposure-based, coping skills training and videotape modeling would be more effective in reducing dental anxiety than a waiting list control. It was also predicted that exposure-based coping skills training would be more effective than the same treatment condition conducted in a classroom-based (nonexposure) setting.

METHOD

Subjects

Four hundred and forty students in the fourth through six grades from six public elementary schools located in middle class and lower middle class neighborhoods in Brooklyn and Queens were administered the Dental Anxiety Scale as part of a screening procedure that also included a personal interview.[19] Parental consent was obtained from all treatment participants. Sixty-eight students (33 females and 35 males) scoring in the upper quartile (total scores of 12 or greater) who also reported fear of dental treatment upon interview completed treatment. Ten children failed to complete treatment for various reasons, including absence from more than one training session, lack of compliance with procedures, or requests to discontinue participation. Treatment completers (47 whites and 21 nonwhites) ranged in age from nine to thirteen years (Mean = 11.2 years).

The Dental Anxiety Scale is a self-report measure of dental anxiety that contains four questions related to specific aspects of dentistry:

- ☐ Anticipating a dental visit the following day.
- ☐ Sitting in the dentist's office awaiting treatment.
- ☐ Sitting in the dentist's chair while the dentist prepares to use the dental drill.
- ☐ Sitting in the dental chair while the dentist prepares the instruments to scrape the teeth around the gums during a cleaning.

Respondents indicate how they would feel in each situation by choosing one of five response options that are scaled according to the level of subjective anxiety. Total scores may range from 4 (no anxiety) to 20 (high anxiety). Kuder-Richardson reliability coefficients of .86 (internal consistency) and .82 (temporal stability) were reported in the original standardization.

Apparatus

MODELING VIDEOTAPE

A thirty-two-minute videotape recording was prepared showing two child models, a nine-year-old female and a twelve-year-old male, undergoing prophylactic dental treatment. The models were shown entering the dental office, waiting in the reception area, and then undergoing dental procedures (radiography and prophylactic treatment). Both models were shown enacting a coping style of modeling by demonstrating behavioral compliance with the dentist's instructions despite a mild degree of anxiety and discomfort. Dental apparati presented in the film consisted of a reclining dental chair, overhead high intensity lamp, equipment console containing a dental drill, and handpieces for water and air delivery.

INFORMATION AUDIOTAPE

A ten-minute audiotape was prepared by a female dental assistant who stressed the importance of preventive dental care and described the benefits of regular dental treatment and the procedure of radiography and prophylaxis.

DENTAL OPERATORIES

Exposure-based treatment was conducted in dental operatories located in public school medical suites. The dental operatories contained similar basic equipment, consisting of an adjustable dental chair, storage cabinets for holding dental tools, a dental drill, and a bracket tray containing mouth mirror, explorer and periodontal probe.

This research was based on the doctoral dissertation of the first author completed under the direction of the second author.
Portions of this work were presented at the annual meeting of the American Psychological Association, New Orleans, LA, August 1989.

Measures

STATE-TRAIT ANXIETY INVENTORY FOR CHILDREN (STAIC)[20]

A downward extension of the State-Trait Anxiety Inventory, the STAIC consists of self-report scales that provide separate measures of state and trait anxiety. The state anxiety measure was used in the present study since it related more closely to the experience of subjective anxiety in the dental situation. The state scale consists of twenty items that require subjects to respond on a three-point scale of subjective anxiety. Reliability coefficients for the A-state scale are reportedly .82 for males and .87 for females (internal consistency), and .31 for males and .47 for females (temporal stability). The construct validity of the STAIC appears sound, evidence indicating that the A-state score is higher under conditions of stress (e.g., before a final examination) than it is under normal conditions.[21]

PULSE

Pulse was taken by manual palpation of the right wrist for a period of fifteen seconds while the subject was seated in the dental chair during an oral examination.

BEHAVIOR RATING SCALE

A behavior rating scale, adapted from Machen and Johnson, was used to assess subjects' behavior in the dental operatory.[22] Ratings were obtained from two independent observers who were blind to subject assignment and initial dental anxiety score. The scale was arranged in a four point response format (1 = definitely negative; 2 = slightly negative; 3 = slightly positive; and 4 = definitely positive) with regard to five target areas:

- ☐ Reaction to separation from peers.
- ☐ Initial reaction to the dental environment.
- ☐ Behavior toward dentist/assistant.
- ☐ Reaction during procedures.
- ☐ Reaction following dental treatment.

A summated score across target areas was computed for purposes of analysis of treatment group differences.

Treatment conditions

Subjects were randomly assigned to one of six treatment conditions from stratified blocks formed on the basis of age, race, sex, and socioeconomic status. All subjects, with the exception of waiting-list controls, were exposed to the ten-minute dental information audiotape. The six treatment conditions consisted of the following:

Exposure-based multicomponent treatment. Coping skills training consisted of a mediative relaxation technique combined with the use of a coping self-statement. Treatment was conducted in the dental environment in small groups of five or fewer subjects for three, one-hour-long sessions. The first session which was held in the reception area outside the dental operatory, consisted of training in Benson's relaxation technique with diaphragmatic breathing as the attentional focus.[23] Subjects also received training in self-statement modification, which centered on the use of a specific coping self-statement, "I can relax, the force is with me." This self-statement, which was adapted from the movie *Star Wars*, was chosen because of its popular recognition within the target group and its association with a sense of personal power and self-control. Subjects were directed to discuss the self-statement in the context of the meaning it had to them and its relevance to the hero of the film series, Luke Skywalker. They were then directed to practice using the coping self-statement during the diaphragmatic breathing exercise, while sitting in the reception area. In subsequent sessions, subjects repeated the diaphragmatic breathing/self-statement modification exercise while seated in the dental chair, but without any prophylactic equipment present (Session 2), and while seated in the dental chair with an explorer, mouth mirror, and periodontal probe prominently displayed in front of them (Session 3). During the third session, subjects were also exposed to the modeling videotape portraying the two child models undergoing prophylactic treatment. In each treatment session, subjects received ten minutes of individual training, while the remaining subjects observed the procedures.

Exposure-based coping skills training condition. Subjects in this condition received coping skills training identical to that described above, but did not receive exposure to the modeling videotape. This condition was intended to examine the efficacy of coping skills training apart from modeling.

Videotape modeling condition. Subjects assigned to this condition were exposed to the modeling videotape in a classroom setting, but did not receive coping skills training. To equate length of treatment across conditions, subjects received three hour-long sessions, the first two involving discussion of experiences and feelings about dentistry, and the final session including exposure to the modeling videotape.

Nonexposure-based coping skills training condition. Subjects received coping skills training in a classroom

setting, rather than in the dental situation during three hour-long treatment sessions. Subjects were trained in the coping skills technique incorporating both diaphragmatic breathing and the coping self-statement and were instructed that they could utilize these coping skills whenever they confronted the dental situation. Subjects in this condition did not receive imaginal or vicarious (videotape modeling) exposure to the dental situation.

Information dissemination/discussion group control condition. Subjects in this condition received exposure to the information audiotape and met with the therapist in small groups for three hour-long group discussion sessions. This condition provided no training in coping skills techniques nor exposure to videotaped models.

Waiting-list control condition. Subjects were informed that they were placed on a waiting list and would receive treatment for dental anxiety at a future date.

Assessment procedure

Assessments were conducted approximately two weeks following treatment (or control periods). Subjects were told to come to the medical suite dental operatory to receive dental treatment, but were not informed about the specific nature of the treatment in order to induce generalized expectancies. Subjects were met in small groups in the waiting area and were called into the dental operatory individually, where they were met by the dental assistant. The dental assistant, a thirty-seven-year-old female, was attired in a white nurse's gown. She addressed each of the subjects by name and explained that she would make an oral examination of each. Subjects were instructed to recline comfortably in the dental chair and to open their mouths wide. To prevent confounding subjective anxiety with experiences of pain of physical discomfort, dental procedures were limited to noninvasive prophylactic treatment designed to prevent exposing subjects to any actual physical pain or discomfort. Subjects were asked by the dental assistant to bite down on radiographic paper, but were not actually exposed to radiation. They were then given simulated prophylactic treatment during which a mirror and explorer were inserted into their mouths and a short oral examination was completed by the dental assistant, but no scraping of teeth was performed. Nor was an anesthetic of any type administered. Immediately following the oral examination, subjects completed the State Anxiety Scale of the STAIC, while still seated in the dental chair.

Behavioral ratings were obtained from two raters who were blind to subject assignment and positioned unobtrusively in the periphery of the subject's field of view. Raters were previously trained in the use of the behavioral rating scale, in ten practice cases.

RESULTS

Preliminary analysis

Pretreatment analysis of variance on Dental Anxiety Scale (DAS) scores revealed no significant differences across treatment conditions. A Pearson correlation of .82 ($p < .05$) was obtained as a measure of interrater reliability based on summated behavioral rating scale

The results showed significant, predicted differences among treatment groups on self-report measures of anxiety, but not on behavioral or physiological measures.

scores. Preliminary analyses failed to reveal any gender differences across dependent measures. Hence sex of subject was not included as a factor in the analysis of treatment differences.

Treatment differences

While the measures were selected to provide a comprehensive assessment of anxiety, they proved to be nonsignificantly correlated with one another ($ps > .05$), and so each measure was analyzed separately by analysis of variance.

Group means and standard deviations, and analyses of variance results, are reported in the Table 1. While there were no significant treatment differences for summated behavioral ratings, or for pulse rates, a significant treatment effect for state anxiety was obtained which was further analyzed by Newman-Keuls comparisons. As predicted, the post-hoc analysis showed significantly lower (ps < 0.5) state anxiety in exposure-based multicomponent treatment (Group 1) compared to the waiting-list control (Group 6). Significantly lower state anxiety ratings were also obtained in the coping skills training conducted under exposure conditions (Group 2) than under nonexposure (classroom) conditions (Group 4). Additionally, significantly lower state anxiety scores were obtained for exposure-based multicomponent treatment (Group 1) in comparison to videotape modeling (Group 3), coping skills training under nonexposure (classroom) conditions (Group 4) and information/discussion group (Group 5) conditions. Finally, coping skills training under exposure conditions (Group 2) produced lower state anxiety ratings than did the information dissemination/discussion group condition (Group 5).

Cohen's *f* statistic was used to compute size of effects on the state anxiety measures for treatment differences overall and for significant effects in the Newman-Keuls post-hoc analysis.[24] The overall effect size was .59, which is indicative of a large experimental effect consistent with meaningful differences among treatment groups. Analyses of significant intergroup comparisons by the Newman-Keuls procedure showed effect sizes (d) ranging from 1.09 for the comparison of exposure-based multicomponent treatment with the waiting list control condition to 1.52 for the comparison between the exposure-based multicomponent condition and the nonexposure-based coping skills training condition.

Supplementary analysis

A supplementary analysis was conducted to explore relationships between dependent measures and subject variables. Separate multiple regression analyses were computed in order to determine whether state anxiety, pulse, and behavioral rating could be predicted on the basis of subject sex, DAS score, grade level, age, and race. No significant prediction equations were obtained.

DISCUSSION

The results showed significant, predicted differences among treatment groups on self-report measures of anxiety, but not on behavioral or physiological measures. Dentally phobic children who received an exposure-based multicomponent treatment program (Group 1) which combined coping skills training in the dental operatory and videotape modeling, reported significantly less state anxiety in the phobic situation than did all other treatment and control conditions except exposure-based coping skills training without videotape modeling (Group 2). While it would be tempting to conclude that the incorporation of videotape modeling in multicomponent treatment did not incrementally contribute to the effects of *in vivo* coping skills training alone, we note that only multicomponent treatment was significantly different from the waiting-list control condition. Hence we suggest that the multicomponent treatment was the more robust treatment in the present study.

We had hypothesized that coping skills training conducted under exposure conditions would be more effective than the same treatment administered in a classroom (nonexposure-based) setting. While the re-

Table □ Means, standard deviations, and ANOVA results on dependent measures.

	Variables		
	State anxiety	Pulse	Behavior ratings
Treatments	M (SD)	M (SD)	M (SD)
1. Exposure-based multicomponent treatment	30.75 (5.53)	20.75 (2.26)	15.58 (0.93)
2. Exposure-based coping skills training	33.17 (4.67)	21.00 (2.59)	14.71 (0.86)
3. Videotape modeling	37.00[a] (4.65)	21.50 (2.97)	14.75 (1.10)
4. Nonexposure-based coping skills training	40.90[ab] (6.64)	21.20 (2.62)	15.00 (0.67)
5. Information dissemination/ group discussion	40.09[ab] (8.23)	20.64 (1.63)	14.73 (2.46)
6. Waiting-list control	39.36[a] (7.84)	21.55 (3.05)	15.00 (1.86)

Note. [a]$p < .05$ compared with Group 1 (exposure-based, multicomponent treatment).
[b]$p < .05$ compared with Group 2 (exposure-based coping skills training only). No other significant effects were revealed.

sults for self-reports of state anxiety supported this prediction, the significance of this finding is attenuated by the failure to demonstrate significant differences between the exposure-based coping skills training and the waiting-list control. Since limited sample sizes in the present study may have reduced power, further research would be appropriate to investigate differences between exposure-based and nonexposure-based treatments.

More limited treatment approaches, consisting of either information dissemination combined with group discussion, or videotape modeling alone, failed to show superior effects across measures when compared to the waiting-list control condition. This suggests that there may be a therapeutic advantage in a more comprehensive treatment approach that incorporates coping skills training as a treatment component.

The present study failed to show treatment group differences in behavioral and physiological (pulse) measures. The lack of concordance among response domains, however, is not an uncommon finding in the dental anxiety literature.[25,26] Previous research has failed to show a relationship between self-reported dental anxiety and behavioral manifestations of anxiety within the dental operatory.[27] One reason that behavioral measures failed to reveal significant differences may be a lack of behavioral variability in the dental setting. The task requirements in dental settings are rather delimited. Dentally phobic children may be compliant with instructions to sit quietly in the dental chair and open their mouths widely, while harboring significant levels of subjective anxiety. In the present study, children were generally behaviorally compliant and manageable, and failed to evidence overt behavioral manifestations of anxiety despite differences among groups in reported anxiety. It is possible, however, that the noninvasive nature of the dental treatment attenuated disruptive behavior.

Behavioral compliance may also be an artifact of subject selection, since subjects agreed to treatment with the understanding that they would be observed within a dental operatory, while undergoing a dental treatment. Studies that have reported significant variability in subjects' behavioral responses in the dental setting have involved either preschool children as subjects or children known to have undergone a prior traumatic dental experience.[28,29] Subjects in the present study were all grammar-school-aged children with histories of complying with school demands for evidence of regular dental examinations, despite subjectively reported fear on dental anxiety measures and interview.

Another possible explanation of the lack of concordance among measures from different response domains may relate to response specificity. Multicomponent treatment incorporated meditation-type relaxation and cognitive coping skills techniques that may have more specific effects in reducing cognitive measures of anxiety. Research has shown that meditators reported less cognitive anxiety but more somatic anxiety than did individuals who practiced physical exercise.[30]

Lack of differences in pulse rates across treatment conditions has also been reported in investigations of treatment for dental anxiety and children's anxiety related to surgical procedures.[17,31] Some investigators, however, have reported significant reductions in pulse rate for dentally phobic children exposed to coping skills training or sensory information conditions, so the sensitivity of pulse rate as a measure of treatment effects in research on anxiety related to dental or medical procedures remains an open question.[18]

The present study was limited by several factors. Treatment was presented in only three sessions across a two-week period, in order to minimize the time spent away from class and maintain subject attention. It is conceivable that increasing the number of treatment sessions may afford subjects greater opportunity to practice and integrate the coping skills techniques, producing more robust treatment effects. While subjects were given instructions to practice the newly learned skills at home, and to keep daily records of their time spent practicing, which were to be countersigned by their parents, few subjects complied with this request, which made it impossible to validate subject adherence to treatment manipulations. Children's expressed dislike to such "homework", and competing time demands on parents, may have attenuated compliance with practice suggestions and completion of diaries.

The scope of the present study was also limited to a school-based program, which did not permit assessment of dental phobia during actual dental visits outside school. Hence the ecological validity of the present results would be strengthened by studies that explore the generalizability of effects of school-based programs to the natural environment. Future studies should also investigate the effects of multicomponent treatment with more severely dentally phobic children who show prior evidence of noncompliance or behavioral disruption during dental treatment.

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FLUOROSIS AND DENTAL CARIES IN CHILDREN

Fluorosis levels and caries prevalence were evaluated in 152 children aged 6–8 yr residing from birth in an area with 5 ppm fluoride in the drinking water. Sixty-two of the subjects had mild fluorosis in both primary and permanent dentitions, 31 were defined as moderate, and 4 cases had no signs of fluorosis; 14 cases had a more severe fluorosis level in the primary dentition as compared to 41 cases in which fluorosis was more severe in the permanent dentition. More primary dentitions were free of fluorosis in females than in males ($P<0.05$). No differences between males and females were found in the permanent dentition fluorosis. The decay rate in the permanent dentition gradually increased with increasing fluorosis severity, a finding not observed in the primary dentition. Reasons are discussed for the lower fluorosis level in the primary dentition and the more severe fluorosis in older age-groups as well as the fluorosis severity difference by gender.

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Sealants

Sealant use by general practitioners: a Minnesota survey

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Today in the United States, over half of new caries lesions occur on occlusal tooth surfaces.[1,2] Pit and fissure sealing has been demonstrated to be a safe and effective procedure for the primary prevention of occlusal caries.[3-9] Since 1983, sealants have been recommended for widespread use by the National Institutes of Health and by professional dental organizations.[10] Studies in the 1970s and early 1980s found sealants to be underutilized and dentists both uninformed and reluctant to use the new technique.[11-13] While more recent studies show an increase in sealant use, the figures are not high considering the need for, and favorable potential impact of, this primary preventive procedure.[2,14-21]

Several factors have been reported to be associated with sealant use in dental practice. For example, in a 1982 national study, positive attitudes about the effectiveness of sealants were held particularly among recent dental graduates, pediatric dentists, dentists who employed hygienists, and those who treated large

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numbers of children.[12] In the most recent national study (1984-85), Cohen and others reported sealant use to be associated with patient acceptance, based on dental experience and exposure to sealant information; the dentist's year of graduation, and attendance at continuing education courses; and the availability of insurance reimbursement.[15] Practitioner knowledge and attitude are also important predictors of sealant use.[22]

Several state studies of sealant use by dentists have been reported. Faine and Dennen, for example, found that in Washington, the organizational structure of the practice, the number of hygienists employed, and the year of the dentist's graduation were all positively associated with higher sealant use.[16] In Virginia, Rubenstein and Dinius reported higher sealant use to be associated with a more recent year of graduation from dental school.[17]

Three previous studies were reported in Minnesota. Simonsen, in 1978, found only 38 percent of general practitioners to be sealant users, with only 7 percent considering themselves to be "routine users" of the procedure.[13] Duffy and others, in a 1983 survey of dental hygienists in Minnesota, reported that sealants were in use in 62 percent of the general dental practices in which these respondents were employed, but that only 36 percent of the respondent hygienists were applying sealants themselves.[23] Martens and others, in 1987, reported a relatively large increase in sealant use by Minnesota general practitioners during the period 1980-84.[24]

The objectives of the present study were two-fold: first, to describe the level and frequency of sealant use among general dental practitioners in Minnesota; and second, to describe factors associated with the frequency of sealant use.

MATERIALS AND METHODS

Data collection and analyses procedures

The study was a one-time random sample survey of Minnesota general practitioners, using a mail questionnaire. A 20-percent, random sample (555 dentists) was selected from the listed population of 2,742 licensed, resident general practitioners in Minnesota, using a random-number, generator computer program.

The 37-item mail questionnaire* was designed to measure level and frequency of sealant use, knowledge and opinions about methods to prevent dental caries, characteristics of office structure, length of practice experience, demographic characteristics, dental school experience with sealants, and sources of information about sealants.

The questionnaire was pretested with fifteen general dentists selected as a random subsample from the sample list. An additional ten dentists were deleted because they were specialists in pediatric dentistry. After revisions based on the pretest, the questionnaire was mailed in May 1987 to 530 dentists, accompanied by a cover letter and self-addressed, stamped return envelope. A follow-up postcard reminder was sent to all dentists one week later. A third mailing, including a duplicate questionnaire, revised cover letter, and a self-addressed, stamped envelope, went to nonrespondents three weeks after the original mailing; 375 responses (71 percent of total) were obtained.[25] A total of 293 usable responses from currently practicing general dentists was analyzed.

In practices where sealants were in use, three dependent variables were analyzed: the number of times per week sealant was applied by the dentist, the number of times per week sealant was applied by a dental hygienist (if employed), and the percent of patients in the 6-14-year-old age-group who received sealants.

The independent variables used to analyze the dependent variables were as follows: number of years since graduation of dentist, number of dental hygienists employed, the percent of patients who were eighteen years of age or younger, and three summary scores: sealant information exposure (SIE), sealant knowledge (SK), and sealant opinion/favorability (SOF). The SIE was a weighted score across five items describing exposure to various sealant information sources. The SK was a summation of the number of agree/disagree responses that were favorable to sealants across nine opinion statements.

Stepwise multiple regression was used to analyze factors associated with the extent of sealant use among all sealant users. This procedure was used to estimate the predictive power of several sets of independent variables for each of the three dependent variables.

RESULTS

Response and characteristics

Of the 293 usable questionnaires, 94 percent of the respondent dentists were male. Sixty-four percent were in solo private practice. Half of the respondents graduated from dental school before 1973 and half graduated between 1973 and 1987. Almost half (47 percent) reported that they had received information on sealants in their undergraduate dental education. Over a third

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

(39 percent) reported that they had attended a continuing dental education course about sealants within the past five years. The sample was representative of Minnesota dentists with regard to sex (94 percent of Minnesota dentists are male). The sample was approximately three years younger than Minnesota dentists in general; in 1987, the median year of graduation for all Minnesota dentists was 1970.

Knowledge and opinion: percent responses

Nearly all respondents (89 percent) rated community water fluoridation as "very effective", whereas only 35 percent rated sealants as "very effective" (Table 1). Half the respondents rated toothbrushing, flossing and restorations as "very effective" for preventing dental caries in children.

Responses shown in Figure 1 were recorded to reflect correct and incorrect answers in accordance with current textbooks and information on preventive and pediatric dentistry.[26-28] Almost all respondents know the importance of sealants regardless of the fluoridation status of the community (item "a"); that sealants are effective in preventing occlusal caries (item "b"); and that newly-erupted permanent molars are the most important candidates for sealants (item "e"). Fewer re-

Table 1 ☐ Distribution of ratings of effectiveness of methods to prevent dental caries in children as perceived by general dentists in Minnesota (N = 293 responses).

Item statement	Very effective	Effective	Somewhat effective	Not effective
a. School water fluoridation	35	42(a)	22	1
b. Dietary fluoride supplements (drops or tablets)	26(a)	48	25	1
c. Fluoride dentifrices	15	49(a)	35	1
d. Community water fluoridation	89(a)	10	1	0
e. Topical fluoride (operator-applied)	20	54(a)	25	1
f. Fluoride rinses	10	51(a)	37	2
g. Infrequent sugar consumption	37	41(a)	20	2
h. Pit and fissure sealants	35(a)	54	11	0
i. Professional oral prophylaxis	19	42	33	6(a)
j. Restoration of carious teeth	48	34	14	4(a)
k. Toothbrushing	57	35	7	1(a)
l. Flossing	52	37	8(a)	3

(a) Ideal responses in accordance with current information on preventive dentistry.[26-28]

Table 2 ☐ Distribution of patients reported to receive sealants in practices of Minnesota general dentists by age-group of patients (N = 278 Respondents).

Age-group (years)	Percent of patients			
	Mean(a)	Standard deviation	Range	Mode
2-5	5.3	13	0-100	0
6-14	59.0	29	0-100	50
15-18	13.0	16	0-80	0
>18	2.5	5.5	0-60	0

(a) Mean of percentage estimates provided by 278 respondents.

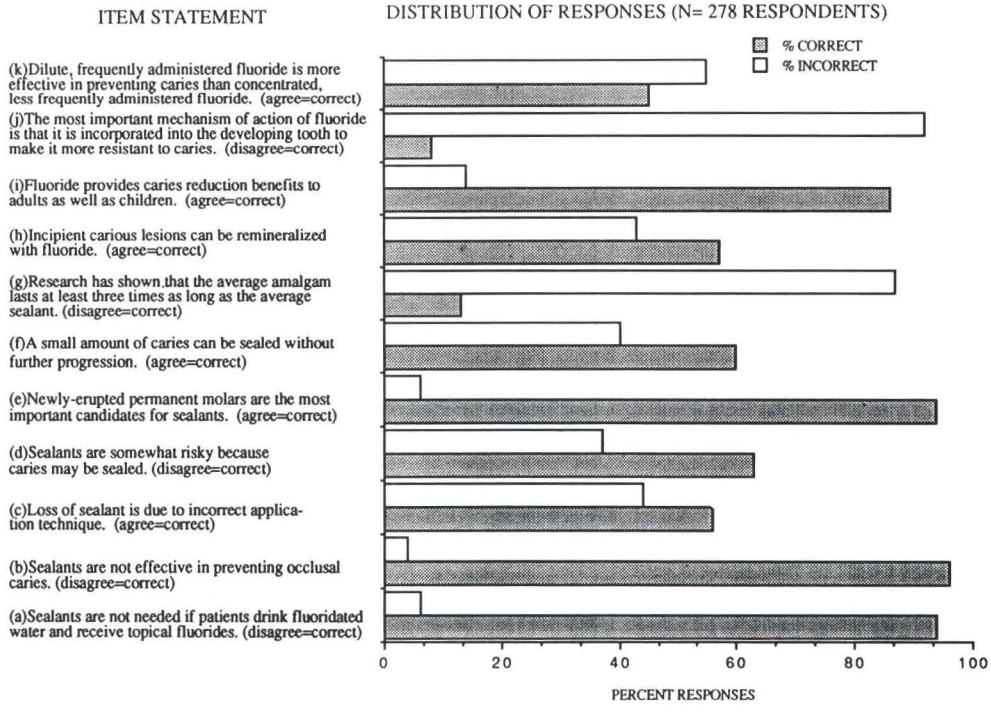

Figure 1. Distribution of correct and incorrect responses to eleven knowledge statements regarding caries prevention made by general dentists in Minnesota (N=278).

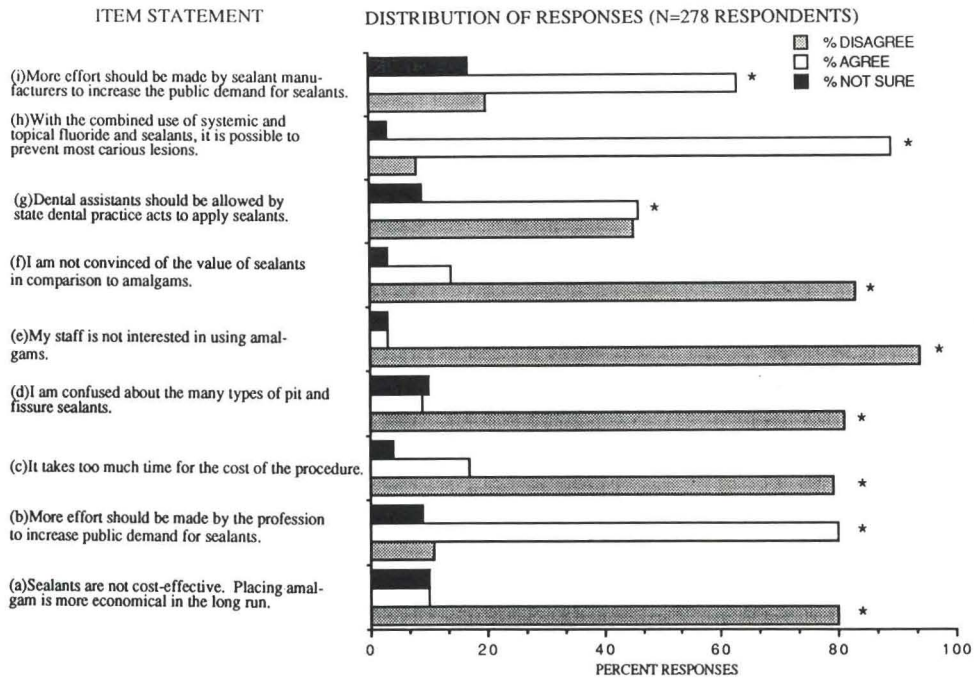

Figure 2. Distribution of agree/disagree responses to nine opinion items by general dentists in Minnesota (N=278). An asterisk indicates the response considered favorable toward sealants in constructing the sealant opinion/favorability score used in analyses.

spondents answered correctly to items "c", "d", and "f", and only 13 percent answered item "g" correctly. The sum of correct answers to these seven sealant items was used in later analyses as the SK score.

Nearly all respondents (86 percent) were aware of the benefits of fluoride to adults as well as children (item "i"); but only approximately half answered correctly to items "h" and "k" regarding remineralization of incipient caries and the importance of dilute, frequently administered fluoride in caries prevention. Nearly all respondents answered item "j" incorrectly.

Figure 2 summarizes respondents' opinions about sealants and sealant use. More than three-quarters answered favorably to almost all of the items, except items "g" and "i". Based on current research, favorable responses to these nine opinion items were summed to form the SOF score.[26-28]

Frequency of sealant use

Almost all respondents (95 percent) reported using sealants. Subsequent analysis focused on the sealant users (N=278), and the level of frequency with which they used sealants. Frequency of use of sealants per week varied considerably, with respondents reporting a range of 1-25 times per week (mean ± S.D. = 3.3 ± 3.6) for themselves, and a range of 0-50 times per week (3.2 ± 5.3) for their employed hygienist (in those practices employing dental hygienists). Sixty-two percent of the respondents who employed dental hygienists (N = 205), delegated sealant application to the hygienist. Sealants were used almost exclusively for patients in the range of six to fourteen years of age, and were placed infrequently in the younger and older age-groups (Table 2). The brands of sealant used most frequently were: Helio-seal† (43 percent), Concise white sealant● (26 percent), and Delton★ (23 percent). Nearly all respondents (87 percent) reported following currently recommended procedures for sealant application (perform prophylaxis, etch, wash, dry, apply sealant).[29] Similarly, the majority (79 percent) reported using the recommended brush or cup with pumice slurry as the prophylaxis procedure prior to sealant application.[29]

The values achieved (expressed as mean ± S.D.) for the three summary scores were: SIE: 11.13 ± 3.80 (range: 0-20; mode: 9); SK: 4.72 ± 1.29 (range: 0-7; mode: 5); SOF: 6.91 ± 1.74 (range: 0-9; mode: 8).

Factors associated with frequency of sealant use

Table 3 shows the standardized beta weights (regression coefficients) for all variables making statistically significant contributions to the three regression equations. Each column shows the multiple correlation (Multiple R) of the independent variables in the regression equation with the dependent variables, and the regression weights for each of the independent variables that added significantly to the equation. Also shown for each dependent variable is the R-squared value, or

†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.

the proportion of the variance in the dependent variable explained by the independent variables as a group. Each row in the Table shows the standardized regression coefficients for the contribution of the independent variables to each of the three dependent variables.

FREQUENCY OF SEALANT USE PER WEEK BY THE DENTIST

Among all respondent-dentists who were sealant users, the frequency of sealant use per week by the dentist was associated positively with:

- ☐ Employing more hygienists in the practice.
- ☐ Treating a high percentage of patients under eighteen years of age.
- ☐ Achieving high values on the SIE, SK and SOF scores.

The number of years since graduation from dental school was not statistically significant and, therefore, did not enter the equation to predict frequency of sealant use per week by the dentist.

FREQUENCY OF SEALANT USE PER WEEK BY THE DENTAL HYGIENIST

The frequency of the hygienists' use of sealants per week, as estimated by the respondent-dentist, was associated positively with:

- ☐ Employing more hygienists in the practice.
- ☐ Treating a high percentage of patients under eighteen years of age.
- ☐ A high value on the SK score achieved by the respondent-dentist.

Unique to this analysis for the hygienists neither the SIE or SOF scores achieved by the respondent-dentist entered the equation. As in analyses for frequency of sealant use per week by the dentist, the number of years since graduation from dental school by the dentist was not associated with frequency of sealant use per week by the hygienist.

PERCENT OF SIX- TO FOURTEEN-YEAR-OLD PATIENTS RECEIVING SEALANTS

The third column in Table 3 shows the regression weights for variables that were statistically significant contributors to the equation for the percent of six- to fourteen-year-old patients receiving sealants. Having higher percentages of patients in this age-group was associated positively with more recent graduation and

This study was supported in part by a grant from the Johnson and Johnson Dental Care Company.

Table 3 ☐ Standardized beta weights for regression equations explaining contribution of independent variables to sealant usage by general dentists in Minnesota.

Independent variables	Dependent variables		
	DDS use times/week	RDH use times/week	Percent 6-14-year-olds receiving sealants
Multiple R (R square)	0.40(0.16)	0.34(0.12)	0.38(0.15)
No. yrs. since graduation (DDS)	n.s.(a)	n.s.	−0.23
No. hygienists employed	0.15(b)	0.26	n.s.
Percent of patients age 18 yrs. or under	0.27	0.14	−0.11
Sealant information exposure score (SIE)(c)	0.13	n.s.	0.16
Sealant knowledge score (SK)(d)	0.16	0.14	0.12
Sealant opinion/ favorability score (SOF)(e)	0.13	n.s.	0.23

(a) n.s. = Standardized beta weight for regression equation indicated this variable was a statistically non-significant ($p > 0.05$) contributor to the equation.
(b) Standardized beta weight for the regression equation, indicating this variable was a statistically significant ($p > 0.05$) contributor to the equation.
(c) SIE Score = A weighted summary score constructed from responses to five items on exposure to sealant information.
(d) SK Score = A summary score summing the number of correct responses to seven knowledge items about sealants.
(e) SOF Score = A summary score of the number of agree/disagree responses that were favorable to sealants across nine opinion statements.

the achievement of high values on the SIE< SK and SOF scores. A low, negative association was observed between this dependent variable and the percentage of child patients in the practice.

Overall, the independent variables most consistently associated with the three dependent measures of sealant use were the two measures of practice structure (the number of hygienists employed and the percent of patients aged eighteen years or younger), and the SK score. The SIE and SOF scores were significant contributors to two of the three dependent variables. Years since graduation from dental school was a significant contributor to only one of the three dependent variables.

Non-users of sealants

The fifteen respondents who reported not using sealants were generally older than the sealant-users. They were, however, similar to those using sealants in that they treated a similar proportion of child patients. Twelve respondents reported that they had not learned about sealants in dental school. The two major reasons selected for non-use of sealants were a belief that sealants "do not last long in the mouth", and an insufficiency of pediatric patients. The factor most frequently selected was "an increase in patient requests". As shown in Figure 3, lack of knowledge about sealants was a consideration in this small group, as demonstrated by the number responding incorrectly to six of the seven knowledge items. In addition, a high proportion of these respondents believed that sealants "are not cost effective" (73 percent) and that "I am not convinced of the value of sealants in comparison to amalgams" (86 percent).

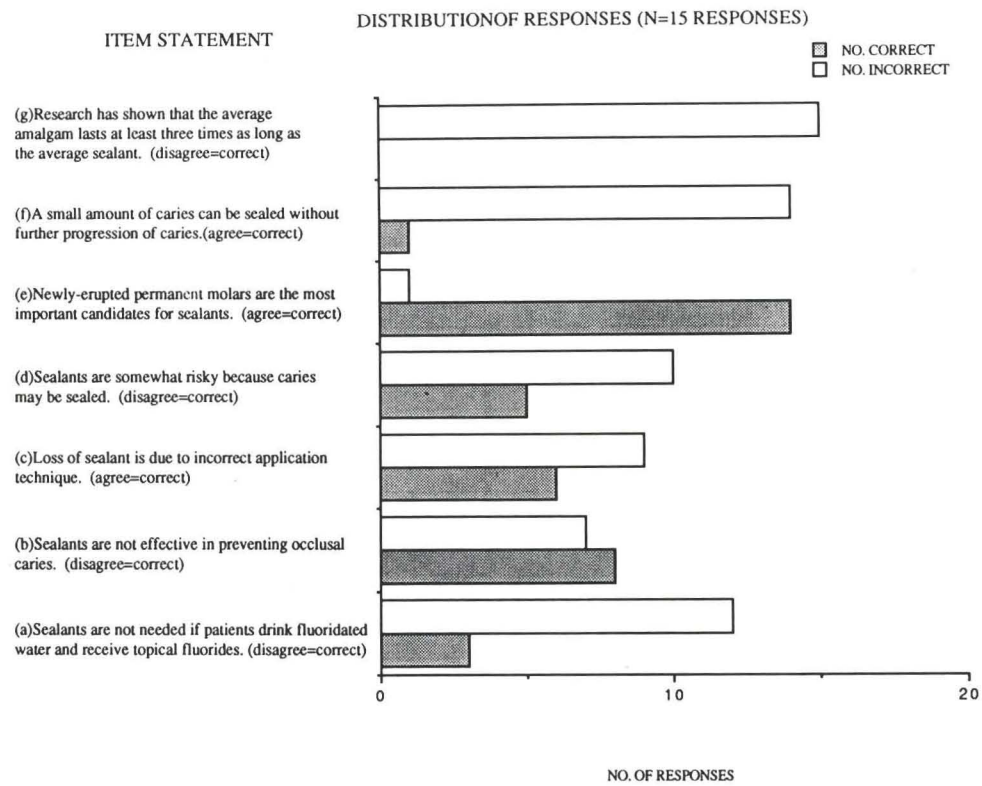

Figure 3. Distribution of correct and incorrect responses to seven statements about sealants, made by sealant non-users, among general dentists in Minnesota (N = 15).

DISCUSSION

Consistent with recent studies in other states and in Minnesota, the proportion of general dentists who reported using sealants, in this study, is considerably higher than that described in earlier studies.[11-13,16-20,24] In addition, delegation of the sealant procedure to dental hygienists (62 percent) was higher than in a 1983 Minnesota study (36 percent), and a 1985 national survey (45 percent).[15,23] The increase was consistent with the extent of delegation to hygienists reported more recently in a 1985 Virginia study (69 percent).[17] Despite this reportedly wide utilization of sealants, the frequency of use and proportion of child patients receiving sealants in the present study were both relatively low, also in agreement with recent surveys.[16-20] This interpretation is also consistent with findings of the 1986-87 national survey of U.S. schoolchildren in which sealants were present in only 7.6 percent of five to seventeen-year-olds and 11 percent of eight to ten-year-olds.[30] Research is required on the extent to which the need for sealants in various age-groups is actually being met, such as could be obtained by conducting epidemiological surveys.

Because sealants have received high levels of favorable attention in professional journals and public media over the past several years, it is possible that some practitioners may be giving a "socially desirable" response, thus artificially inflating the measures of sealant use. In the future, additional valid measures of sealant use could include analyses of records of billings and insurance claims, as well as clinical examinations of population groups.

Sealant use was reported to be almost exclusively in the six- to fourteen-year age-group of patients. This finding is perhaps based on earlier recommendations that erupted teeth that have been caries-free for four years do not need to be sealed.[31] Recent work by Ripa, Leske and Varma, however, shows a relatively constant rate of caries attack in occlusal surfaces of first permanent molars for up to ten years after eruption. Such a pattern also was evident in the NIDR 1979-80 na-

Sealant use was almost exclusively in the six- to fourteen-year age-group of patients.

tional survey of five- to seventeen-year-olds.[1] New initiatives to increase sealant use should continue, therefore, for the six- to fourteen-year-olds, but should also focus on age-groups older than fourteen years in order to provide benefit for premolars, and second and third molars.

The values for multiple R's and R-squareds in the regressions were relatively low, ranging from 0.34 to 0.40 (for perfect prediction, the R-squared value would be 1.0). Clearly, other factors not measured here are involved in predicting the level of sealant use by general practitioners and the limited associations observed here provide a basis for further research. Year of graduation was associated with only one of the three dependent variables. Two factors may operate to decrease the effect of this variable in this state. First, as use of this new technology diffuses throughout the practicing community, the contribution of this particular variable will likely decrease over time as sealants become the standard of care to protect pits and fissures of susceptible tooth surfaces. Second, numerous continuing education courses on sealants have been offered in Minnesota over the past five years, and widespread and positive mass media coverage of sealants has occurred since 1983, increasing public awareness.

The nature of the relationship observed in this study between age distribution of patients attending the practice and the use of sealants needs further investigation. The low, but significant negative association (−0.11) between the percent of young patients in the practice and the proportion of the young patients receiving sealants is perplexing. One interpretation could be that the association is negligible, meaning no relationship really exists. If so, further investigation is needed, because a positive association would be expected. A second interpretation is that in practices where the proportion of child patients does not represent a major contribution to practice revenues, dentists may be more inclined to provide the inexpensive, but effective sealant procedure, as compared with practices in which practice livelihoods are dependent on children receiving restorations. A third interpretation could be that there is a "novelty effect" or "curiosity factor" operating in practices with a lower proportion of child patients, whereby these practitioners may choose to use a newly developed clinical procedure. A final interpretation could be that practitioners with a low proportion of child patients place a stronger emphasis on prevention for these individuals and promote sealant usage.

A relatively large proportion of the respondents did not appear to be well informed concerning current scientific information on sealants and fluoride. A large proportion of respondents tended to overrate the effectiveness of toothbrushing, flossing and restorations as caries-preventive methods in children, while underrating the effectiveness of sealants and all fluoride delivery methods, with the exception of community water fluoridation. The percentages of responses observed for perceived effectiveness of toothbrushing, flossing, and restorations in this study are almost identical with those found in the 1982 national study of dentists.[12] Almost all respondents agreed (incorrectly) with the statement: "The most important mechanism of action of fluoride is that it is incorporated into the developing tooth to make it more resistant to caries." While this mechanism of action is important, the remineralization process, a topical effect of fluoride, now is also considered one of the main mechanisms of action of fluoride.[33,34] Nearly half responded incorrectly to the statement that "incipient carious lesions can be remineralized with fluoride," and more than half were not aware that "dilute, frequently administered fluoride is more effective in preventing caries than concentrated, less frequently administered fluoride."

General practitioners in this state continue to be concerned about the possibility of sealing over caries. Such concerns appear unfounded, based on the work of several investigators who have reported that the number of bacteria in sealed initial carious lesions decreases dramatically with time.[35-38] The reasons selected for not using sealants by non-user respondents were similar to those reported five to fifteen years ago in prior research during the early phases of the diffusion of adoption of sealant products. These findings regarding knowledge about both sealants and fluoride suggest a need for continuing educational efforts that focus on the two procedures in combination.

CONCLUSIONS

Reported use of sealants is widespread among general dentists in Minnesota, even though measures of frequency of use suggest that this preventive technique is not being used as often as it should be in order to meet need. The most consistent predictors of higher frequency of sealant use were the number of hygienists employed, the percent of patients eighteen years of age or younger, and the sealant knowledge score. Most sealants are reportedly used with patients aged six to fourteen years, although current evidence points to the need for sealants in older age-groups as well. A relatively large proportion of respondents were not well informed concerning current scientific information on sealants and fluoride.

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The study was conducted in the Department of Preventive Sciences, Divisions of Pediatric Dentistry and Health Ecology, School of Dentistry, University of Minnesota.

Managing sealant utilization among insured populations: report from Vermont's "Tooth Fairy" program

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John H. Senning, BS

Provider behavior relating to sealants has changed in recent years, with nearly 70 percent of dentists in the United States reporting regular sealant use.[1] Increased professional acceptance has apparently not resulted in optimal access to care, since cross-sectional surveys report that only 6–8 percent of children in the United States have sealants.[2,3] Despite recognized effectiveness and high levels of unmet need, sealants remain under-utilized for preventing dental caries.[4,5] Product marketing, perceived effectiveness, manpower, and cost all contribute to low sealant usage.[6]

Third-party coverage for sealants is reported to be a significant determinant of utilization, since it affects both provider and patient behavior.[4,7] Although third-party reimbursement for sealants has become generally more available, most dental insurance programs either do not routinely cover sealants or carefully manage utilization through application of various eligibility criteria.[8] Among state Medicaid programs, the largest single source for publicly funded dental care, only twenty-one states and the District of Columbia reported covering sealants for Medicaid-eligible persons under age twenty-one years.[9] These states employed five basic models for controlling utilization, ranging from open, unrestricted coverage to prior authorization for all requested services (Table). Nearly three-quarters of those state Medicaid programs with sealant benefits managed utilization through restrictive age or authorization requirements. The mean upper age limit for those state programs with age-related criteria was 15.1 years, which is similar to that reported in a survey of private dental plans.[7]

The need for management of sealant utilization in public or private dental insurance programs has not been documented. Nonetheless, these practices prevail, and their potential effects on access to care are unknown. This paper assesses the use of sealants among one insured population in Vermont, with reference to the appropriateness of the criteria for managing provider behavior regarding both treatment and eligibility.

METHODS

The history of dental utilization from Vermont's "Tooth Fairy" program, a dental insurance program for chil-

Table □ Sealant eligibility criteria for persons 0-21 years, State Medicaid Programs, US 1988.

Level	Eligibility criteria	States (n)
Least restrictive	None (open access)	5
	Tooth number	4
	Age/Post-Eruption limits	2
	Tooth number and age	6
	Prior authorization or other	4
	Subtotal, states with coverage	21
Most restrictive	No sealant coverage	29

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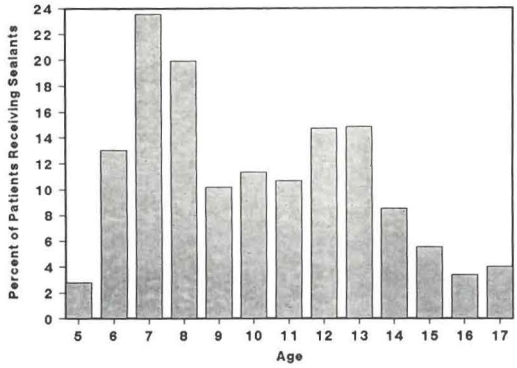

Figure 1. Percent distribution of patients with sealants by patient age; "Tooth Fairy", Vermont, October 1988-September 1989.

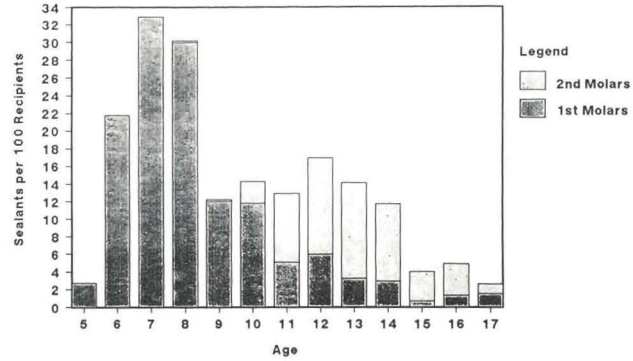

Figure 2. Number of sealants per 100 recipients by age and tooth number; "Tooth Fairy", Vermont, October 1988-September 1989.

dren from working poor families, was analyzed for data relating to the placement of sealants. The data set consisted of twelve months of claims (October 1988 - September 1989), and included all non-orthodontic services billed during the study period. Claims data were sorted by American Dental Association procedure code, then sorted by patient, provider and tooth number for analysis.

RESULTS

The "Tooth Fairy" program first covered sealants in 1987, with benefits limited to the occlusal surfaces of permanent first or second molar teeth. There are no other age or authorization requirements limiting care for eligible clients. In this regard, the "Tooth Fairy" program is comparable to four state Medicaid programs (including Vermont's), which manage utilization by tooth number only. The "Tooth Fairy" program, which requires patient cost-sharing, reimburses dentists according to schedule at up to $10.00 per sealed tooth. Sealant reimbursement averages 68.7 percent of the mean charge made by the dentist, which is comparable to overall "Tooth Fairy" reimbursement levels (68.8 percent of charge).

A total of 7,010 children were eligible for "Tooth Fairy" benefits during the sample period, 37.8 percent of whom received at least one covered dental service. Eligibility for "Tooth Fairy" is limited to children through age nineteen years, with patients (children receiving care) averaging 8.1 years of age. All eligible families reported annual incomes below 150 percent of poverty, with mean annual family income totalling $9,891.

"Tooth Fairy" patients receive virtually all dental care in private dental practices in Vermont. Nearly three-quarters of Vermont's 285 dentists voluntarily participate in the "Tooth Fairy" program. During the twelve-month study period, 39.1 percent of participating dentists submitted at least one invoice for sealant care for enrolled children.

Over 92 percent of reported services consisted of either diagnostic, preventive or restorative dentistry (ADA codes 00000-02999), with sealants representing the third most frequently rendered type of service (following prophylaxis and periodic examination). Sealants accounted for 6.2 percent for all procedures submitted to "Tooth Fairy", outnumbering occlusal restorations by 1.55:1. The sealant-to-occlusal restoration ratio for first molars was 1.85:1, while for second molars, the ratio was 1.01:1 ($X^2 = 23.89$, $p < 0.0001$).

Sealants were placed on 10.5 percent of children with dental treatment history. Figure 1 shows that treatment varied by patient age. Age distribution at time of placement of sealant was bimodal (ages seven and twelve to thirteen), with 23.5 percent of seven-year-old patients receiving sealants. Multiple tooth treatment was common, and patients with sealant history had on average 3.0 sealed teeth during the study period. Treatment rates varied by patient age, as reported in Figure 2. Children age seven years received 1.4 times as many sealants as children age thirteen years.

DISCUSSION

Insurers cite concerns regarding excessive utilization as one rationale for excluding sealants from dental benefit plans.[5] The Council on Dental Research offered the following characterization of insurer attitudes toward sealants: "carriers see these items a bottomless pit, provided indiscriminately to patients".[8] While including sealants as part of benefit plans does contribute to increased care, this study of "Tooth Fairy" clients reports that sealant usage is both low and appropriately targeted by patient age.[7]

In this sample, 92.8 percent of sealants were placed within four years of probable eruption of the target

teeth. This is comparable to utilization data reported among a sample of general dentists, and suggests that voluntary provider behavior is relatively consistent with professional guidelines for sealant usage.[10,11] Similarly, findings from this study in Vermont approximate the one reported by Medicaid-eligible populations with sealant benefits.[12,13]

Given prevailing usage patterns, rational management controls may be indicated. Management of use that relies on age or eruption cohorts, or uses other restrictive criteria such as authorization, are inconsistent with common dental office billing protocol. Difficulties associated with claims processing and delayed reimbursement are probable where management criteria are not "user friendly". Since dissatisfaction with program management practices is a significant determinant of provider nonparticipation in Medicaid-type programs, inappropriate utilization-management practices may particularly affect access to preventive care among low-income populations.[14,15]

The 1986 National Health Interview Survey reported that 49.4 percent of low-income children age two to sixteen received dental care during a twelve-month period.[3] The low-income, insured Vermonters included in this survey demonstrate lower overall utilization, with only 37.8 percent of children reporting any dental care. Comparing "Tooth Fairy" incidence data with NHIS prevalence data, however, demonstrates that "Tooth Fairy" children were far more likely to receive dental sealants than their United States counterparts. Among "Tooth Fairy" recipients, 4.5 percent received sealants during the twelve-month study period, while only 2.2 percent of low-income United States children reported any history of sealant care. Consequently, implementation of sealant benefits and elimination of age and other restrictive criteria for governing sealant placement may be one method for expanding access to preventive services among low-income populations.

Finally, the sample demonstrated significant variation in treatment practices based on tooth number and age. Younger children were more likely to receive sealants, and permanent first molar teeth accounted for 77.0 percent of all sealant claims submitted on "Tooth Fairy" patients. This variation in practice, sealing newly erupted first molars but not second molars, may be inappropriate given reports of caries development in unsealed first and second molar teeth of older adolescents.[16,17] Limiting sealant usage to newly erupted teeth, while consistent with age-related criteria found in most public and private dental insurance programs, may place older adolescent children at unnecessary risk for new caries development.

CONCLUSIONS

Including sealant coverage as part of publicly-funded dental programs may be one method for expanding access to necessary preventive care. Such programs may not require excessive management to control utilization, since provider behavior is typically consistent with professional treatment guidelines, and overall utilization is likely to be low. Practices that encourage usage, such as unrestricted coverage of sealants as a routine insurance benefit for children, may be preferred.

Among "Tooth Fairy" recipients, 4.5 percent received sealants during the study period, whereas only 2.2 percent of low-income children in the U.S. had any history of sealant care.

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PREVENTIVE DENTISTRY IN TEXAS, USA

The results of a 1985 survey of 1000 Texas dentists regarding three major types of preventive measures—educational services, preventive procedures, and diagnostic services—are presented. The results show that among several given educational services, respondents tended most to instruct on correct brushing or flossing and tended least to counsel on diet. Among preventive procedures, most dentists removed plaque or calculus. A very small portion applied occlusal sealants on patients under the age of 15. As for diagnostic services, most performed oral cancer screening exams. Most performed dental X-rays, but many did not use leaded protection on their patients while taking X-rays. A large number did not check their patients' blood pressure. Income, attendance at continuing education programs, and number of dental hygienists were strong, positive predictors of provision of all three types of preventive measures. Dentists who practiced in more populous areas, or had practiced for fewer years, more likely provided patients with educational services and preventive procedures. Dentists delivered more preventive procedures, if they attended more professional dental meetings. Dentists who worked more hours were more likely to provide educational services and preventive procedures. Patient load correlated negatively with dentists' delivery of preventive procedures.

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Demography

'I know you've heard it before, but...' (A litany for change — Part II)

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

"Our goal is to place children at the top of the national agenda. Children must become our number one national priority. Children are our economy, our national defense, our future."[1]

The need to heighten the public's awareness of the economic, social and health needs of the children in our nation is a continuing problem. But the plight of many of our children is overshadowed by the mounting concern for the enlarging geriatric population. In addition, could it be that the advocates for the aged are better at the public relations game than those who champion the needs of the youngsters in our communities?

For example, in the final days of 1989, the National Committee to Preserve Social Security and Medicare (based in Washington, D.C.) mailed to millions of senior citizens, a "giant" size letter (each sheet of paper measured 15 x 11 inches) with "large type." The letter, signed by James Roosevelt, informed the readers that, "My father founded Social Security fifty-four years ago. Now I need your help to protect Social Security and Medicare.[2] The call was to write to one's senators and representatives to prevent an effort to reduce the benefits associated with these programs. The body of the letter contained the following "facts":

"In January 1988, the Medicare Part B Premium jumped 38.5 percent — nine times the increase in the 1988 Social Security Cost of Living Adjustment (COLA)

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– and it went up another 28.6 percent last year – seven times the COLA increase for 1989."[2]

They were telling the truth; but Medicare Part B monthly premiums had increased a total of $14.00 (including a $4.00 increase for the catastrophic insurance that was repealed). During the same period, Social Security benefits increased by more than $42 (assuming a 1987 monthly benefit of $500). The "gimmick" was that they were using percentages rather than actual dollar figures. Because the percent changes were associated with the small premium figures, these changes rose more rapidly than the percent changes of the much larger benefit dollar figures. In addition, they neglected to note that the premiums for catastrophic insurance had been repealed (Table).

Table ☐ Medicare premiums and social security benefits.[2,3]

Medicare Part B monthly premiums			
Year	Premium	Percent increase	Actual dollar increase
1987	$17.90	–	
1988	$24.80	38.5	$6.90
1989	$31.90 ($27.90 + $4.00)	28.6	$7.10 ($3.10 + $4.00)
		Total increase	$14.00

Note: The extra $4.00 premium for catastrophic insurance was repealed

Social Security Benefits			
	Assume: $500 monthly benefit in 1987		
Year	Percent increase	Benefit amount	Actual dollar increase
1987	–	$500.00	
1988	4.2	$521.00	$21.00
1989	4.1	$542.36	$21.36
		Total increase	$42.36

Call it a "gimmick," "game" or whatever, the National Committee reached millions of potential (probable?) writers who would carry the message to their legislators that there was a need to preserve Social Security and Medicare. No doubt these same legislators would remember when they were deluged by the carefully prewritten and preaddressed and personally signed correspondence, that compared with teenagers (i.e., eighteen- to twenty-year-olds), a higher percentage of these same senior citizens exercise their voting rights.

Under most circumstances, it would be difficult for the numerous advocate groups for children to match such a public relations effort. But maybe things are changing, at least a little. Within the past few years, increasing attention to the needs of our children has been raised in reports by various community foundations and detailed in congressional reviews on the status of the health and social welfare of our children. It has become almost commonplace to have political leaders issue statements on the plight of our nation's children.

"With mayors across the country, I see our children victimized by the epidemics of homelessness, drug use, and violence that have cut deep into the heart of urban America. We stand at a critical juncture."[4]

If we are to generate a continuing awareness and interest in the needs of the youth in our nation, we must counter (or at least equal) the public relation efforts of the advocates for other population groups. A wealth of necessary information is available to make the case for increased attention to our children. The need is to publicize repeatedly these facts to the public in general and specifically to the legislative leaders of our local, state and national governments. We must generate as much attention to the concerns of our children as the media generally affords to the concerns of the aged. But we can accomplish this only if we know more of the facts. That was the object of any earlier presentation in the *Journal of Dentistry for Children.*[5] The following material is an added inventory to provide the needed information for a national public relations effort to draw attention to the status of many of the children in our communities.

For example, imagine the impact of the following items as front page headlines in your morning newspaper – instead of having them buried (as they usually are) in some Congressional report, or back-page news item – mixed in with advertisements for the latest Nintendo game or sales on some ladies' or men's apparel.

"Nationally, at least 100,000 crack babies are born annually at a cost of more than $3 billion in medical care."[6]

"State welfare agencies in ('just') eight cities (New York, Los Angeles, Chicago, Miami, Phoenix, San Francisco, Tacoma and Fort Wayne) reported that nearly 9,000 babies were born in 1989 to mothers addicted to crack...cost of preparing these children for school could exceed $1.5 billion."[7]

Who knows, we might even generate as much interest as the mailing by National Committee to Preserve Social Security and Medicare. And how much interest would be generated, if we had wider distribution of the following information about the plight of the children in our nation?

HOW MANY CHILDREN LIVE IN POVERTY AND WHAT ARE THE CONSEQUENCES?

☐ At a time when poverty is on the decline, the poverty rate for children under six years of age is rising. Nearly one of every four children under six in the nation is poor. Starting life poor often

relegates a child to a lifetime of struggle and poverty. "Early childhood experiences contribute to poor children's high rates of school failures, dropout, delinquency, early child bearing and adult poverty."[8]

- ☐ By the late 1980s, 23 percent of the children under six years of age lived in poverty; compared to 19 percent for those six through seventeen years, 11 percent for those eighteen through sixty-four and 12 percent for those sixty-five years and over.[8]
- ☐ Children are now the poorest age-group in the United States. One out of five children (20.6 percent) were living in a poor family in 1987. In comparison, 15.1 percent of children were living in poverty in 1970.
- ☐ The poverty rate for children living in female-headed, single-parent families is more than twice as high (54.7 percent in 1987) as children in general. The poverty rates in 1987 were 15.0 percent for white children, 45.1 percent for black children, and 39.3 percent for Hispanic children.[9]
- ☐ Low-income children in the U.S. are about twice as likely as higher income children to be born at low birthweight, two to three times more likely to experience postnatal mortality, and three times more likely to have delayed immunizations and lead poisons. Children in poverty are almost 50 percent more likely to have a disability than children from higher income families.[10]

HOW HAVE FAMILY SETTINGS CHANGED?

- ☐ In 1988, almost one quarter (24.3 percent) of children lived in a single-parent family; double the proportion in 1970.

America ranks 22nd among industrialized nations in terms of infant mortality.

- ☐ While 18.9 percent of white children and 30.2 percent of Hispanic children lived with only one parent in 1988, more than half (54.1 percent) of all black children did.
- ☐ In 1988, 52 percent of mothers with children under age three were in the labor force.[9]

HOW DO WE COMPARE TO OTHER NATIONS?

- ☐ In 1986, there were 472,100 births to women below twenty years of age in the United States. Of these births, more than 61.5 percent occurred outside of marriage; compared to 30.5 percent in 1970. Among thirteen industrialized countries, teenage fertility is highest in Hungary and the United States (52 and 51 births per 1,000 women, ages 15-19, respectively) followed by the Soviet Union (44 births per 1,000 women, ages 15-19, and the United Kingdom (29 births per 1,000 women, ages 15-19). In the early 1980s, 10 percent of teenage women in the U.S. became pregnant.[9]
- ☐ The U.S. ranks behind twenty-one other industrialized nations in infant mortality; and sixteenth among twenty industrialized nations in death of infants under age one who survived the first month of life.
- ☐ U.S. black infants are at least three times more likely to die from respiratory disease in the post-neonatal period than babies in Canada, France, and Norway and more than twice as likely to die as a result of perinatal conditions than infants in Canada, France and the Netherlands.
- ☐ In 1985, 61 percent of U.S. preschool children were immunized against measles. This was 30-50 percent lower than in Denmark, Norway, and the Netherlands.
- ☐ Immunization rates for preschool children against diphtheria, tetanus, and pertussis average 41 percent higher in many western European countries than in the United States.
- ☐ Among U.S. children, aged one to four, motor vehicle accident mortality rates for males range from 36 percent to more than 300 percent times those reported by France, Canada, England and Wales, Norway, and the Netherlands.[10]

DRUGS ARE EVERYWHERE

- ☐ More than half of all children (53.9 percent) report that they have used an illicit drug before completing high school.

- ☐ Nearly all high school seniors (92 percent) surveyed in 1988 have used alcohol. Heavy drinking was reported by 35 percent.
- ☐ The number of twelve to seventeen-year-olds admitted to emergency rooms following cocaine use increased more than five-fold between 1984 and 1988.[9]

AND WHAT ABOUT HEALTH INSURANCE?

- ☐ In 1987, 37 million non-elderly had no health insurance. Of these, more than 12 million were children, a 14 percent increase since 1981.
- ☐ Babies whose parents have no health insurance are 30 percent more likely than those from insured families to die or be seriously ill at birth.
- ☐ Uninsured low-income children received 40-50 percent less physician and hospital care than low-income insured children.[10]

SOME MORE MEASURES OF THE HEALTH OF OUR CHILDREN

- ☐ If smoking during pregnancy was eliminated, we could expect a 10 percent reduction in infant mortality and a 25 percent reduction in low birthweight. In the late 1980s, this translates into 3,840 fewer infant deaths and 65,580 fewer low birthweight births. Small improvements in the average birthweight of low birthweight infants would result in an immediate savings of $70 to $90 million in short term acute-care costs. The Office of Technology Assessment reported that for every low birthweight birth averted, we save between $14,000 and $30,000 on health costs. The total cost of neonatal intensive care approaches $2.5 billion per year.
- ☐ If alcohol consumption during pregnancy was eliminated, we could expect to have a minimum of 5,000 fewer cases of fetal alcohol syndrome and 50,000 fewer alcohol affected infants.[11]
- ☐ Almost a quarter (24.1 percent) of all live births in 1986 were to women who did not begin prenatal care in the first three months of pregnancy.
- ☐ Late or no prenatal care was received by 38.4 percent of black mothers; 45.1 percent of unmarried mothers, 51.5 percent of mothers fifteen to seventeen years of age and 42.0 percent of mothers with 9 to 11 years of education.
- ☐ Over the past two decades, black infants have been twice as likely as white infants to die in the first year after birth.
- ☐ The U.S. infant mortality rate ranked 18th among industrialized nations in 1986: behind such countries as Japan, Finland, France, Canada, East and West German, Spain and Ireland.[9]

ARE CHILDREN READY FOR SCHOOL?

- ☐ Low-income and minority children are less likely than other children to receive early childhood education.
- ☐ About one of four eighteen- and nineteen-year-olds have dropped out of high school. By race and ethnicity, 23 percent of white children, 35 percent of black students, and 45 percent of Hispanic students did not complete their high school education.[9]

ON STARTING A SNOWBALL DOWNHILL

Joining a popular cause is not too difficult. Joining a large crowd is comfortable and not too threatening. But it is those times that measure the mettle of our convictions when each of us makes the decision to work for a just cause that has not captured the imagination of the general public.

"The primary need is not to develop a national awareness for the dental needs of our children...An awakening to the dental needs of our children and a need for financial support for these services will come as a natural extension of an appreciation of the historic imbalance in our priorities."[5]

In addition to a National Committee to Preserve Social Security and Medicare, why not a National Committee to Preserve Our Children? Surely we have sufficient data to prove that many of our children are in desperate need.

As I prepare this material in the spring of 1990 (the season of graduation from our nation's schools), I am reminded of the flowery orations of commencement speakers telling their audiences that the young men and women who are being honored, represent the future of our nation and our world. Surely we could not hope for a more appropriate "gimmick" in our efforts to redirect the concerns of our political leaders. Then why have we not been able to galvanize support for the needs of our children; the kind of support that seems to be inherent in the many programs to aid the geriatric programs? Yes, the elderly vote and children do not. It may be that society for too long has taken our children for granted (assuming they have the resiliency to bounce back as they grow) and equates the older ages with disease and an increasing terminal de-

cline in general health and physical prowess.

But increasingly we are finding that the deficiencies in life faced by our children (both before and after birth) can have permanent impact on a child's life. The deprived child, the malnourished and maltreated child, and many who commence life and proceed through their early years with the proverbial "two strikes" against them, may never reach their full potential.

We need continuously to sell this story. Who is a better public relations expert on the needs of children than a pediatric dentist?

"...we've seen just how badly we're failing our children in just about every kind of community all across this country. The problems are frightening, the needs are staggering, and most of it isn't new... We've got to help our children and their parents, or we have no future."[12]

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ETCHING GLASS IONOMER CEMENTS

Until such time as there is a long-term reliable dentine bonding resin which will ensure freedom from micro-leakage at the margin between dentine and composite resin there will be a need to utilize glass ionomer cements as a base in these restorations. However, the chemistry of the glass ionomer system is relatively complex and not all formulas on the market are the same. It has been shown that not all glass ionomer cements that are marketed for lining under composite resin respond in the same way to etching with orthophosphoric acid. With most cements a 15 second etch time is sufficient to remove excess matrix and provide a surface into which a very low viscosity resin bonding agent will penetrate and initiate a satisfactory union with composite resin. However, Ketac Silver appears to be a little more resistant to etching than the others tested. In addition several cements showed a tendency to expand, crack and distort for at least a week after mixing and it is suggested that these should be used clinically with caution.

Further investigation is required to determine the quantity of cement removed by etching to assist the clinician to decide the thickness of the lining required in building a restoration by the 'sandwich' technique.

Fuss, J. *et al*: The effects of etching on a number of glass ionomer cements. Aust Dent J, 35:338-344, August 1990.

Directors of pediatric dentistry programs

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

Most reports on developments in pediatric dental training programs have emphasized the changing numbers of these programs and variations in the residents receiving the training.[1,2] Limited attention has been directed, however, to the individuals responsible for the training programs. The following presentation will summarize available information on the directors of pediatric dental and other specialty training programs.*

SOURCE OF DATA

The American Dental Association's "Annual Report on Advanced Dental Education" provides a continuing listing of all recognized graduate training programs and general summary data on the numbers of enrolled students and graduates, as well as some summary data on the qualifications of program directors and their time commitments to the programs. Since 1984,** the annual report has included information on the program directors by individual specialties.

TIME COMMITMENTS

All specialty programs

Since the 1970s, there has been a continuing increase in the percent of program directors in both dental and nondental school affiliated programs who are full-time in their particular positions. The percent of dental school specialty program directors who are full-time, however, has been consistently greater than the percent of program directors who are full-time in nondental school programs. By 1989, 95 percent of dental school and 85 percent of nondental school program directors were full-time (Table 1).

Pediatric dental programs

Since 1984, virtually all directors of pediatric dental programs based in dental schools have been full-time (> 97 percent). But as with the findings for "all specialties," a smaller percentage of directors of pediatric dental programs not based in dental schools have been full-time (83 percent in 1989) (Table 1).

BOARD CERTIFICATION

All specialty programs

Since the 1970s, approximately two-thirds of the directors of all the specialty training programs based in dental schools have been board-certified. During this same period, between 83 and 85 percent of the directors of all the specialty programs not based in dental schools have been certified (Table 2).

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*The review will not include directors of general practice residency and advanced programs in general dentistry.

**Throughout this presentation, the use of a particular year will represent the start of an academic year. For example, 1984 represents the 1984-85 academic year.

Table 1 ☐ Full-time directors of pediatric dental and all specialty programs: selected years, 1975-1989.[3]

Year	Dental school				Nondental school				Total			
	Pediatric dentistry		All specialty programs		Pediatric dentistry		All specialty programs		Pediatric dentistry		All specialty programs	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1975	–		262	88.8	–		130	67.7	–		392	81.5
1980	–		280	93.0	–		131	80.8	–		411	88.8
1984	39	97.5	273	92.9	15	78.9	138	84.6	54	91.5	411	89.9
1985	41	100.0	273	93.8	13	72.2	135	82.8	54	91.5	408	89.9
1987	38	100.0	262	94.9	13	72.2	139	85.3	51	91.1	401	91.3
1989	36	97.2	259	95.2	15	83.3	137	85.1	51	92.7	396	91.5

Note: "All specialty programs" do not include general practice residency and advanced general-dentistry programs

Table 2 ☐ Board certified directors of pediatric dental and all specialty programs: selected years, 1975-1989.[3]

Year	Dental school				Nondental school				Total			
	Pediatric dentistry		All specialty programs		Pediatric dentistry		All specialty programs		Pediatric dentistry		All specialty programs	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1975	–		194	65.8	–		164	85.4	–		358	74.1
1980	–		203	67.4	–		136	84.0	–		339	73.2
1984	20	50.0	192	65.3	10	52.6	137	84.0	30	50.8	329	72.0
1985	21	51.2	193	66.3	7	38.9	135	82.8	28	48.2	328	72.2
1987	18	50.0	183	66.3	8	44.4	139	85.3	26	46.4	322	73.3
1989	21	56.7	183	67.2	7	38.9	135	82.8	28	48.2	328	72.2

Note: "All specialty programs" do not include general practice residency and advanced general-dentistry programs

Pediatric dentistry programs

Whereas on average, two-thirds of the directors of specialty programs based in dental schools have been board certified, since 1984, slightly more than half of the directors of dental-school-associated pediatric dental programs have been board-certified. The difference between the percentages of board-certified directors of nondental-school pediatric dental and nondental-school all-specialty dental programs is even more pronounced (between 39 and 52 percent of pediatric dental directors vs. approximately 83 percent of all-specialty directors) (Table 2).

It seems reasonable to call for more information.

OVERVIEW

Only minimal information is available about the directors of specialty programs. While the percentage of pediatric dental program directors who are full-time approximates the national rate for the average of all-specialties program directors, the percentage of pediatric dental directors, who are board certified is much lower than the average for all-specialty directors: particularly for nondental-school programs.

It would seem natural to suggest that there is need to increase the rate of board certification for pediatric dental program directors. Yet, so little information is published (available?) about program directors and their relationships to the various programs, that the call should not be merely to increase this particular rate. Instead, the need is to increase dramatically the overall availability of information on advanced dental-education programs.

Over the years, publications by the ADA have emphasized predoctoral education. Unfortunately, information on the directors of advanced education programs has been summarized annually in a single table. It just seems reasonable to call for more information.

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Williams (Elfin Facies) syndrome: review of the literature and report of a rare case

Case reports

Robert A. Boraz, DDS

Williams (Elfin Facies) syndrome was first described in four unrelated children in 1961.[1,2] The disorder is characterized by multiple anomalies, including mental deficiency, an unusual (elfin) facies, supravalvular aortic stenosis, prenatal and postnatal growth deficiency, infantile hypercalcemia, a small mandible, and frequent dental problems.[2-15] The etiology of Williams syndrome is unknown and all of the approximately 100 cases reported in the literature have been sporadic.[2,3,15] The clinical features strongly suggest that Williams syndrome has an intrauterine onset. There is no evidence of excessive vitamin D intake by mothers or children. It has been hypothesized that a placental abnormality increasing fetal serum calcium levels may be responsible for the condition.[3]

Mild prenatal growth retardation is a common finding in Williams syndrome. This trend continues after birth with a postnatal growth rate of approximately 75 percent of normal.[2] Mild microcephaly may also be found. In early infancy, children with Williams syndrome tend to be fretful and have severe feeding problems with a frequent finding of failure to thrive.[2,5,15] During childhood, they tend to be outgoing and loquacious, although 15 percent exhibit severe behavior problems.[2,3,6] The average IQ for these children is 56 with a range of 41-80.[2,6] The vast majority of adults with Williams syndrome reside in sheltered environments.[2]

The classic elfin facies results from a number of head

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Oligodontia, enamel hypoplasia, and dental caries are frequent findings.

and neck anomalies. There is a medial eyebrow flare and shortened palpebral fissures. The nasal bridge is depressed and epicanthal folds are apparent. Periorbital fullness of subcutaneous tissues contributes to the classic appearance.[2,3,6,11] The eyes are blue and there is a stellate pattern to the iris.[1,3,16] The mandible is frequently small in contrast to a prominent maxilla. An anteverted nares results in a long philtrum and prominent lips with an open mouth.[1-3,5,15] Oligodontia, enamel hypoplasia, and dental caries are frequent findings in Williams syndrome patients.[2,9]

Many affected individuals have supravalvular aortic stenosis and some have mild stenosis of the peripheral pulmonary arteries, hypoplasia of the aorta, or atrial or ventricular septal defects.[1,3,10] Some patients develop nephrocalcinosis with impaired renal function.[1,3,7,8,12] Neurologic dysfunction with severely reduced perceptual and motor function is another common finding in Williams syndrome.[2,15]

CASE REPORT

An eight-year-old Caucasian male presented in the dental clinic at the University of Kansas Medical Center with a chief complaint of multiple decayed teeth. The patient had been diagnosed with Williams syndrome at the University of Missouri-Columbia, five years previously. The patient had a significant developmental delay and an IQ measured at 42. He presented with a heart murmur and a stellate pattern to the iris. The classic elfin facies was quite apparent (Figure 1). The patient was undergoing evaluation by a nephrologist for possible renal disease.

Visual and radiographic evaluation of the dentition revealed multiple gross carious lesions (Figure 2). The patient's mother reported that he complained of occa-

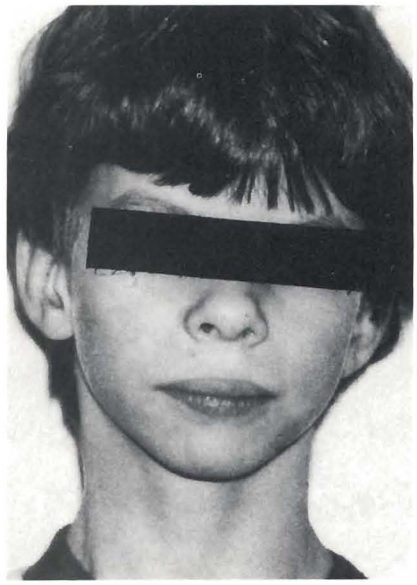

Figure 1. Facial view of patient depicting elfin facies.

Figure 2. Preoperative view of rampant dental caries.

Figure 3. Postoperative view of anterior restorations.

Figure 4. Postoperative view of mandibular restorations and space maintainer.

Figure 5. Postoperative view of maxillary restorations.

sional dental pain. This was the initial dental visit for the child. The patient demonstrated extremely uncooperative behavior and a decision was reached to provide the restorative care in an outpatient surgery setting. The patient's cardiologist recommended American Heart Association routine prophylactic antibiotic coverage for the patient, because of the heart murmur and the possibility of further cardiac anomalies.

The patient was taken to the operating room, where, under nasoendotracheal intubation, general anesthesia was instituted. He received 850 mg of aqueous penicillin G intravenously, thirty minutes before the procedure. Four amalgam restorations, seven stainless steel crowns, two pulpotomies, and four extractions, all on primary teeth, were performed (Figures 3-5). Orthodontic bands were fitted on the mandibular right and left permanent first molars and an alginate impression was taken for the fabrication of a mandibular lingual arch that was cemented at the two-week postoperative examination appointment. The patient tolerated the procedure well and was discharged in satisfactory condition. The patient received 1 gm of oral penicillin, six hours after the first dose.

CONCLUSION

Williams (Elfin Facies) syndrome is a rare, devastating, sporadic disorder. Craniofacial anomalies including severe dental caries are frequent occurrences in the syndrome. Because of these problems, the children's dentist plays a significant role in managing the Williams syndrome patient. Early dental evaluation and parental counseling are important in all cases, but it is of the utmost significance in these medically compromised patients. Preventive dental regimens and dietary counseling must be individually designed and implemented. This is especially the case because of the high caries rate and frequency of cardiac anomalies seen in these individuals. Appropriate and safe dental care for patients with Williams syndrome can be rendered in consultation with the medical staff and is essential for maximizing the quality and quantity of life.

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The management of self-inflicted oral trauma secondary to encephalitis: a clinical report

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Encephalitis is defined as an inflammation of the brain. Diagnosis is confirmed only by a histological examination of the brain tissue; the clinical diagnosis is frequently made, however, on the basis of neurological examination and epidemiological findings. The majority of cases are viral in origin, often transmitted through an arthropod vector such as a mosquito. There are many other etiologies, however, including humanly transmitted viral and nonviral infections and an allergic form, in which infection causes a cell-medicated antigen-antibody complex.

The clinical symptoms of encephalitis may include: an undifferentiated acute fever, headache, and nausea. As the temperature rises, new neurological symptoms appear. These symptoms can include: mental dullness, dyskinesia, and convulsions.[1,2] The dyskinesia can include all skeletal muscles, and may include lip- and tongue-biting behavior. Self-inflicted biting-behavior has been found in cases of mental retardation, neurological damage due to anoxia, or congenital syndromes such as the Lesch-Nyhan syndrome.[3-6] Other articles have dealt with the management of this problem.[3-9]

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This paper discusses the dental management of trauma resulting from oral dyskinesia in cases of encephalitis.

CASE 1

D.F., a seven-year-old white female, was admitted to UCLA Medical Center for treatment of seizures, five weeks of somnolence, and progressive retardation. Headaches and a fever, accompanied by lethargy and hallucinations, were labeled "viral syndrome" by her physician. After two weeks, she apparently felt better and she returned to school. One week after that, she again developed a fever and experienced confusion and memory lapses. Concurrently, she demonstrated a progressive decrease in muscular coordination. One week later, she was admitted to her local hospital, where a tentative diagnosis of encephalitis was made. She did not respond to treatment, and after seven days was transferred to the UCLA Medical Center.

Continuous movement of her extremities, a lack of responsiveness, and a high fever were noted on the admission physical. A history revealed that there were no family pets or proximity to farm animals. Her mother did report that she was bitten by mosquitos two weeks before the onset of the first symptoms. The diagnosis of encephalitis was confirmed; the etiology, even after a battery of tests, however, was uncertain.

On admission, the pediatrician noted that her lower lip was ulcerated and attributed it to trauma. A hard, plastic airway was initially placed by another service, to prevent her from chewing on her lip. This resulted

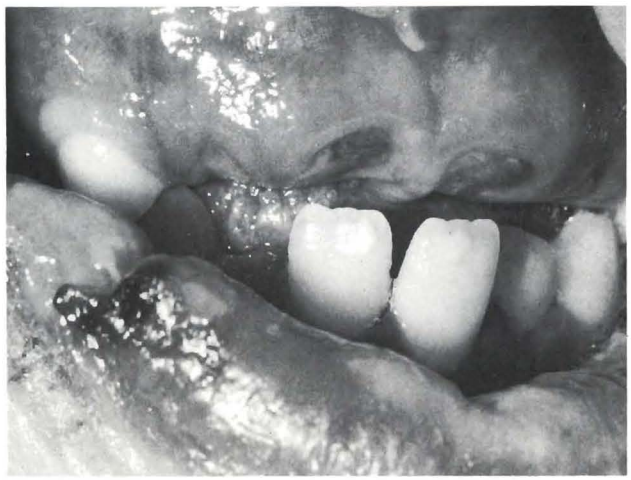

Figure 1. The ulcerated lip lesion and displaced mandibular incisors are evident in this view.

Figure 2. The acrylic splint was fabricated on the mandibular cast with extra bulk in the anterior region to keep the lip out of traumatic mastication.

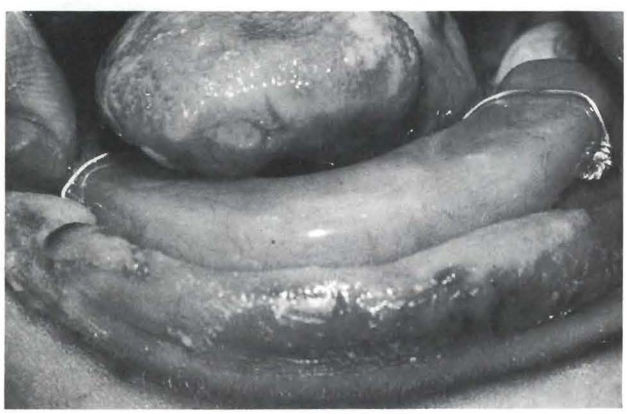

Figure 3. The acrylic splint is shown in place in the mouth tied in with brass ligature wires.

in the loss of her two maxillary primary lateral incisors, the loosening of her mandibular permanent incisors and the large ulceration on the lower lip. A pediatric dentist was consulted and the severity of the trauma was confirmed (Figure 1). The patient also showed an unusual amount of nondirected masticatory effort. Alginate impressions of the maxillary and mandibular arches were taken, and poured in stone. An acrylic splint was fabricated on the mandibular model, covering the occlusal surfaces and the occlusal thirds of the buccal and lingual surfaces. The acrylic was built out in the anterior region on the labial side to protect the lip from further traumatization (Figure 2). The splint was then adjusted so that the maxillary teeth occluded evenly on it. The splint was tied in place with brass ligature wires passed through the interproximal areas of the primary molars (Figure 3).

After several weeks, the oral ulcerations had healed, the oral dyskinesia had abated, and the splint was removed (Figure 4). One mandibular incisor continued to be mobile, and it was splinted in place with a twenty pound-test fishing line, bonded in place with a light-cured composite resin. The patient's symptoms subsided over several weeks, and she was discharged to the care of a pediatrician and pediatric dentist in her local area.

CASE 2

D.C. was a fifteen-year-old white female who had an unremarkable health history until she developed a fever. A diagnosis of acute febrile viral syndrome was made. She was admitted to the local hospital when her fever failed to subside and she developed seizures. She was later transferred to UCLA Medical Center when her seizures continued unabated, her temperature remained elevated and she became unresponsive. After examination, a presumptive diagnosis of viral encephalitis was made; studies failed, however, to reveal an exact etiology. A consultation was requested with a pediatric dentist to learn whether anything could be done for an ulceration on her lower lip that was caused by lip biting (Figure 5). A splint was constructed, similar to the one for the previous patient. This was placed in the patient's mouth and ligated in place with brass ligature wires. Instructions for oral hygiene and care of the appliance were given to her nurse.

When her condition worsened, suffering from a very high fever, hypertension, and pulmonary infiltrates, a tracheotomy performed and a tube was placed. She showed no signs of recognizing familiar people. One week after the appliance was placed, it was out of the

patient's mouth, and the nurse was unsure how to replace it. The appliance was replaced; but two weeks after that incident, the appliance was again out and broken into several large pieces. The ligature wires were recovered as was most of the acrylic, except one piece approximately 2-cm square. Chest x-rays were taken, but proved negative. Eighteen days later, D.C. expired due to an amassment of complications from the encephalitis. The autopsy examined both the G.I. tract and the lungs, but the lost piece of acrylic was not found.

CASE 3

S.F., a 9.5-year-old black female, was admitted to UCLA Medical Center after she developed fever and headaches of several days duration, followed by a progressive decrease in coordination, and the presence of delirium and disorientation. Her medical history was unremarkable. After admission a diagnosis of neurologic encephalitis was made, of undetermined origin. Her mental status deteriorated rapidly after her admission, and she became responsive to only very noxious stimuli. She developed a severe choreoathetoid movement disorder, and several different medications were tried to control her movements, with little success.

At the time of consultation with a pediatric dentist to consider the value of protective splints, she showed reddish lesions on her tongue, ulcerated and fibrotic lesions on her lips, and exaggerated tongue thrusting and lip biting (Figure 6). Alginate impressions were taken of the maxillary and mandibular arches. The impressions were poured in dental stone, and soft plastic football-type mouthguards were fabricated on the

The soft plastic, football-type mouthpiece is preferred.

Figure 4. Extraoral view of D.F. several weeks after placement of the splint, with healing of the lip occurring.

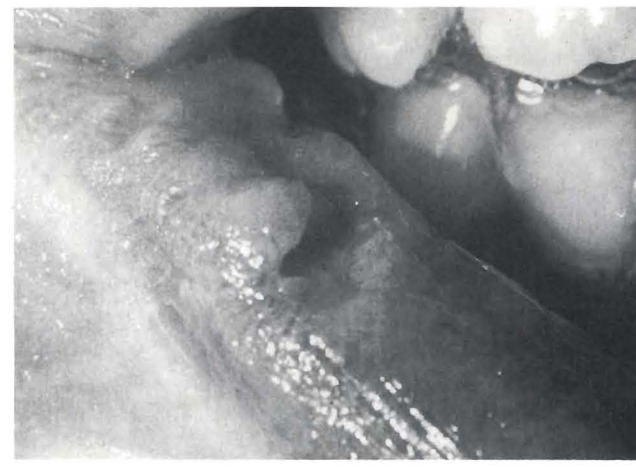

Figure 5. Extraoral view of D.C. showing lesion on lower lip caused by traumatic mastication.

Figure 6. Extraoral view of S.F. with large ulcerated lesion on lower lip evident.

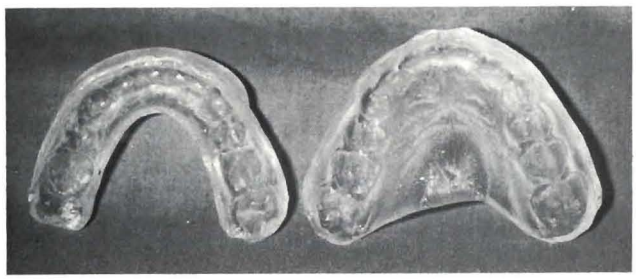

Figure 7. View of mouthguards. The double thickness is evident in the anterior region.

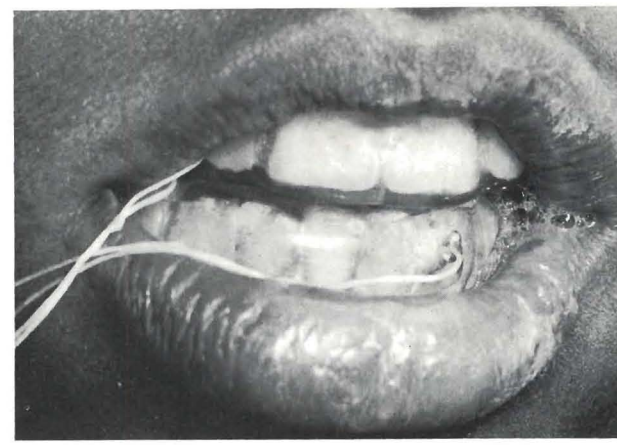

Figure 8. View of mouthguards in place in the mouth. The healing lip is also evident.

casts. The mouthguards were fabricated from .150'' soft vinyl, with a double thickness in front to keep the lips away (Figure 7). After the mouthguards were fabricated, they were trimmed and the edges smoothed, taking care to keep the borders away from any frenum attachments and the floors of the vestibules. A hole was placed in each guard through which floss was threaded, thus providing a means of removal (Figure 8). The appliances proved stable, and they were frequently checked. The lesions on the tongue and the lip healed. When she improved to where she could be released from the hospital, her care was continued at home. Instructions on the proper care of her dentition and the appliances were given to her family upon discharge.

DISCUSSION

There have been a large number of treatment modalities proposed for the treatment of self-injurious behavior. These treatments can include behavior modifications, processed hard acrylic splints, wire and acrylic splints, tongue stents, and football-type mouthguards. The advantages of the football type mouthguard have never been fully explored. When it is possible, behavior modification appears to be the best method, based on its successful use with retarded children.[9,10] This approach is not always possible, however, especially when the patient is nonresponsive. In these cases, an appliance must be fabricated to protect the patient; other means such as drug therapy may suffice.[7,12]

The experience of the pediatric dental department demonstrated that the custom-fitted, football-type mouthguards were the most effective in the treatment of self-inflicted oral trauma. The processed acrylic and wire and acrylic forms require much more extensive laboratory time. The custom-fitted, football-type mouthguard is very easily and quickly fabricated. These appliances are very easy for ward personnel involved in the patient's care to remove, facilitating oral hygiene and cleansing of the appliance. If these appliances are constructed from a good cast, they are remarkably stable. When upper and lower appliances are fabricated, they are long-wearing. If only one arch receives the appliance, however, it may wear through quickly. Most importantly, they are safer. Clinical experience at UCLA has shown that it is very difficult for the patient to dislodge or break this appliance. Our experience with the hard acrylic appliances demonstrated that they may fracture under the extreme occlusal loading seen in these patients, and the possibility of aspirating one of these nonradiopaque fragments is great. For these reasons, we feel that the soft plastic, football-type mouthguard is the preferred treatment for these unfortunate children.

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Mandibular and dental development subsequent to thyroid therapy in a boy with Down syndrome: report of case

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Jos M.H. Dibbets, PhD

A characteristic of Down syndrome (trisomy 21) is a retarded growth pattern. When, in addition, individual downward deviations of the syndrome's specific growth curves occur, there is an indication for additional disturbances, among which hypothyroidism is not uncommon. Thyroid hormones are essential for normal growth and growth related processes. They act on the pituitary gland and result in an increase of growth hormone, including the somatomedins. Animal experiments have shown a direct action of thyroid hormones on skeletal growth. This concerns primarily bone differentiation, rather than bone growth.[1,2] In normal children hypothyroidism leads to retarded growth of the epiphyses in long bones and to characteristic brachycephalic faces, a delayed dental development, and malocclusion.[3] The literature on Down syndrome likewise reports delayed dental development, smaller teeth and shorter roots, and an underdevelopment of the face.[4-8]

The development of craniofacial morphology in Down syndrome is well documented. From longitudinal radiographic investigations, the following characteristics appear to be typical. The morphology of the lower jaw is normal, but the symphysis is not.[9] Several authors assign to the mandible smaller dimensions and a smaller surface area, growing however at a rather normal rate, and positioned normally, relative to the anterior cranial base.[8,10-13] In contrast to these publications, Clark reported that the length of the body of the mandible is normal.[14] Fisher-Brandies finally, on a very large mixed-longitudinal sample of Down syndrome children, concluded that mandibular size starts at normal values, but becomes mildly hypoplastic at age fourteen.[15] The gonial angle develops normally. The presence of an Angle Class III malocclusion is often reported.[16,17]

Because of the retarded growth in Down syndrome, it may become difficult to make a timely diagnosis of an accompanying hypothyroidism. Discrepancies between dental age and the age of the transition of the dentition may be indicative, however, of hypothyroidism in Down syndrome. The dentist is in the position, therefore, to make a timely diagnosis of the additional complication of hypothyroidism and to initiate appropriate therapy.

In this case report, the age of a boy with Down syndrome and additional hypothyroidism was assessed at three different time-points and with three different methods: chronological age, dental age, and the age of the transition of the dentition. Discrepancies between these three estimates together with their significance are evaluated and the role of thyroid hormone therapy is discussed.

MATERIAL AND METHODS

A boy with Down syndrome, confirmed trisomy 21, was first seen for a routine dental examination at the

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Figure 1. Panoramic radiographs of the left side. Left, age 6.3 years; center, age 14.7 years and right, 15.9 years old. Immediately after the center radiograph was taken, thyroid hormone therapy was induced.

age of 3.2 years. At that time a completely erupted primary dentition was present. The first panoramic radiograph was made at the age of 6.3 years and showed that all permanent teeth were present. At the age of 14.7 years, a second panoramic radiograph was made and, following the diagnosis hypothyroidism, treatment was induced with 62.5 microgram thyroid hormone daily. A third panoramic radiograph was made fourteen months later.

On the three time-points at which the radiographs were made, chronological age was registered, dental age was assessed in the left mandibular half according to Demirjan *et al* and the age of the transition of the dentition was estimated on the radiographs according to Kahl and Schwarze.[18,19] Due to a technical problem, only the buccal teeth were visible in the first radiograph.

An appreciation of mandibular growth was obtained by tracings from the panoramic radiographs. These tracings were superimposed as well as possible on stable mandibular structures, as advised by Björk.[20]

Furthermore, observations on the individual crown and root development were noted.

RESULTS

The radiographs of the left halves are depicted in Figure 1. Chronological age, dental age and the age of the transition of the dentition were assessed at three time-points, listed in Table 1. At 6.3 years of age, the age of the transition of the dentition was judged to be at an equal level. The permanent incisors and first molars had erupted in the oral cavity. The primary molars were resorbing and in the second permanent molar crown-formation had started. The vertical bony dimension of the lower jaw was not well developed (Figure 1, left). Some eight years later, at 14.7 years, the age of the transition of the dentition lagged considerably compared to dental age and both lagged behind chronological age (Figure 1, center; Table). The roots of the primary canines and molars had resorbed only partially, although the radiolucencies around the premolar and canine crowns appeared to be normal. The roots of the premolars had reached approximately two thirds of their full length. In the second permanent molar, root formation had started. Except for the presence of the third molar crypt, the transition of the dentition resembled that of an eight-year-old boy.[18] Premolar and canine apices were situated close to the lower border of the mandible. In the maxilla, a comparable atypical process had occurred and the premolar and canine apices were projecting well above the palatal plane.

After 1.2 years of thyroid therapy at age 15.9, dental age had changed parallel to the time elapsed but the transition of the lower dentition had progressed dramatically and all mandibular teeth had erupted. Thyroid hormone therapy had not stimulated dental age progression, since the delay remained 2.1 years behind chronological age (Figure 1, right; Table 1). Because of discomfort, some very loose mandibular primary teeth

Table □ Chronological age, dental age, and the age of the transition of the dentition were assessed at three time-points in a boy with Down syndrome and additional hypothyroidism. In February '88 thyroid therapy was induced.

Record date	Oct 79	Feb 88	May 89
Chronological age	6.3 y	14.7 y	15.9 y
Dental age[19]	?	12.5 y	13.8 y
Age of the transition of the dentition[18]	± 6 y	8 y	>>12 y

had to be extracted six weeks before the radiograph (Figure 1, right) was made. The mandibular permanent dentition erupted without much progress of root formation. The teeth drifted vertically in a fairly straight trajectory, despite curved root form.

The posterior relocation of the ramus of the mandible can be seen in Figure 2. In the first period of 8.4 years the amount of resorption of the anterior ramus and the amount of vertical growth of the coronoid and condylar processed had been roughly two thirds that of the second period of 1.2 years. Lengthening of the corpus was the result.

Figure 2. Tracings made from the panoramic projections depicted in Figure 1, and superimposed at best fit on common structures. It illustrates posterior relocation of the ramus with vertical growth of the coronoid and condylar processes. During the first period of eight years, the amount of growth was roughly two thirds of the amount in the second period of fourteen months during thyroid therapy. The vertical dimension of the corpus did not change appreciably.

DISCUSSION

Up to the age of six years, the transition of the dentition paralleled chronological age norm, a situation that is comparable to the first transitional period in normal children.[21] There was no sign of the generalized delay in tooth development reported in Down syndrome.[5] This is in agreement with the reports of Townsend, who noted that the delay in tooth development in Down syndrome is more pronounced in the permanent than in the primary teeth.[7]

Some eight years later, at nearly fifteen years (Figure 1, center), dental age lagged by 2.2 years. Except for the presence of the third molar crypt, the transition of the dentition resembled that of an eight-year-old boy. This condition is highly indicative of an additional disturbance. The diagnosis 'hypothyroidism' was then made.

On the radiograph in Figure 1, center, the canine and premolars appear to be retained. The roots of these teeth extended downward, reaching the lower border of the corpus and even bulging the mandibular outline. A situation quite exactly as described by Kosowicz and Rzymski, in cases of pituitary dwarfism, in which there is a deficiency in growth hormone.[22]

Presumably, due to lack of occlusally directed drift of the permanent teeth, together with lack of the normal vertical development of the alveolar margin, root development proceeded downward. Root formation appeared to be not affected by thyroid hormone deficiency. A similar result is found in persons with a deficiency of growth hormone.[22,23] These findings support the conclusion of Kovacs, who showed that two thirds of root formation is under genetic control, and that the

This selective deficiency in growth hormone, still present after therapy, may explain the delay in dental age in the patient with Down syndrome.

remainder one third is under local (environmental) influences.[24]

After treatment with thyroid hormone (Figure 1c and Table 1) the progression of the dental age changed only in accordance with chronological age. In contrast, the transition of the mandibular dentition progressed significantly. It is known that thyroid hormones accelerate dental development and eruption.[25-28] Although the boy received thyroid therapy for a period of fourteen months, his delayed dental age remained the same and was still retarded. Salzmann *et al* describe a similar result after thyroid treatment in a boy with growth hormone deficiency.[23] Down syndrome patients are not simply somatomedin-deficient, like hypopituitary dwarfs; they show a selective deficiency in growth hormone as reported by Annerén *et al*, which is suggested to be responsible for the observed growth retardation.[29] This selective deficiency in growth hormone, still present after therapy, may explain the delay in dental age in our Down syndrome boy. It seems that dental age is more closely related to the effect of the syndrome than to thyroid hormone therapy. This conclusion is in agreement with Garn *et al* who hold that growth hormone is rather more essential to dental development than is thyroid hormone.[29]

After thyroid therapy, the transition of the mandibular dentition was accelerated more than in the maxilla. The mandibular teeth erupted rapidly into the oral cavity without much progress in root formation. Eruption apparently does not result from elongation of the roots, since root-length did not change. This result is in accordance with the findings of Cahill and Marks, who cut the roots from teeth by surgical manipulation, after which, nevertheless, normal eruption proceeded.[31] Consequently, eruption and root formation must be considered separately regulated phenomena. The roots in Figure 1, center and right, were clearly curved. Yet, the teeth drifted in a straight vertical direction. These observations again stress the delicate and perfect synchronization between the processes of deposition and resorption during eruption.[32]

Formation of alveolar bone apically of erupting teeth is claimed to be a mechanism of tooth eruption. Thyroid hormones can influence the local metabolic activities of the alveolar bone. Since the formation of bony trabecula at the base of the roots was relatively insignificant, however, as is evidenced by the apical radiolucencies (Figure 1, right) eruption apparently had taken place independently of bone deposition.

Thyroid hormones stimulate growth of the epiphyseal plates in long bones, together with bone remodeling, and accelerated and growth in height was seen.[33] Simultaneously, growth of the mandible was observed (Figure 2). During the first period of eight years, the amount of relocation of the dorsal ramus together with vertical growth of the coronoid and condylar processes was roughly two thirds of the amount of growth observed in the second period of fourteen months. Unfortunately the technique of panoramic projection does not allow precise measurement. Superimposition of mandibular tracings on so called stable references as advised by Björk, however, is shown to be reproducible.[20,34] Figure 2 shows that the ramus was relocated posteriorly, providing space for the second and third molars. No special effect of thyroid hormone on the growth of the mandibular condyle may be inferred from these tracings.

In general, after thyroid therapy, growth of the mandible occurred harmoniously, albeit that the vertical dimension of the corpus changed only slightly, as to be seen in Figures 1,center and right. A local selective deficiency of growth hormone according to Annerén *et al* may explain the mildly hypoplastic mandibles in Down syndrome.[15,29] This growth process in the mandible of the boy illustrates that growth regulation by different classic endocrine hormones (thyroid and growth hormone) may act locally at different sites via growth factors by paracrine mechanisms.*

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*In the paracrine mechanisms the growth factor effects a neighboring cell that has receptors sensitive to it.

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BONE DENSITY IN ADOLESCENT GIRLS WITH ANOREXIA NERVOSA

In this study, we found marked deficits in bone mineral density to be a frequent complication of anorexia nervosa in adolescent girls. Two thirds of a group of young patients with this disorder had bone mineral density measurements greater than 2 SD less than the normal value for age. In half of these girls with osteopenia, the interval since diagnosis of anorexia nervosa was 1 year or less. This may indicate that osteopenia occurs early in younger patients with anorexia nervosa or that the illness had been present but not recognized for a longer period. In addition, we found that bone mineral in our patients corresponded to levels predicted from the normal regression of body mass and bone density. Thus, low body mass is a major predictor of bone deficit in teenage girls with anorexia nervosa.

Bachrach, L.K. *et al*: Decreased bone density in adolescent girls with anorexia nervosa.

Pediatrics, 86:440–447, September 1990.

Treatment costs for carious primary teeth related to fluoride exposure

Costs

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Ast *et al* reported almost twice the cost to treat carious primary and permanent teeth in five- and six-year-old children from a nonfluoride than from a fluoride community.[1] Lower dental caries experience of primary teeth in preschool children relating exposure to adequate fluoride in the drinking water has been documented.[2-6] Although it is generally acknowledged that there will be lower costs associated with reduced caries in primary teeth, these reports did not present information linking fluoride exposure to the costs of treating only carious primary teeth.

Head Start programs serve preschool children. The dental costs for treating carious primary teeth are borne principally by the agency and represent a significant portion of the health care budget. Differences in costs between programs in fluoride-adequate and fluoride-inadequate areas is information that will aid in estimating funds necessary to provide appropriate services. This study was conducted in order to provide these baseline data to calculate treatment costs for restorations and/or extractions.

METHODS

A random cluster design was employed to obtain a 10 percent representative sample of Mississippi Head Start

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children, three to six years of age, for examination.[7,8] For this study, subgroups from fluoride-adequate (n = 562) and fluoride-inadequate (n = 370) areas were selected. The fluoride status of drinking water was verified from records obtained from the Mississippi State Department of Health.[9] Although histories of exposure to fluoride in the drinking water were not obtained, Head Start officials confirmed that almost all of the children were life-long residents of their respective communities. All children in this sample were from low-income families and an overwhelming majority were black. Preventive oral hygiene practices in Head Start centers were similar with regard to frequency, method, toothbrush, and dentifrice. The only known difference between the two groups was the exposure to the level of fluoride in the drinking water.

Dental caries experience of primary teeth was determined by visual examination, utilizing a portable dental light and recorded as described by Gruebbel.[10] Owing to the extremely small number of three- and six-year-olds, the findings are reported by combining the three- to four-year-olds and the five- to six-year-olds for each area. Since the dental caries experience exhibited no pattern of differences between the sexes, the data were combined and estimates were made for each age-group. Racial differences were not calculated because the sample contained an insignificant number of white children. Cost estimates were made for each age-group by applying the Mississippi EPSDT/Medicaid fee schedule to the type of treatment needed.[11] In addition, for four- and five-surface lesions, it was assumed that treatment would require pulpotomies and stainless steel crowns.

The t-test was utilized to test for differences in rates of dental caries from one area to another. The Chi-square test was employed when the total number of children with treatment needs was sufficient to use the test (one-, two-, and three-surface lesions). The Fisher's Exact test was used when the Chi-Square test was not appropriate (four-, and five-surface lesions and teeth indicated for extraction).

RESULTS

The dental caries experience of the primary teeth by age-group can be seen in Table 1. In each age-group, children from the fluoride-inadequate centers had a significantly (t-test) higher number of carious primary teeth than the children from fluoride-adequate centers.

The treatment needs for carious primary teeth by type (restorable surfaces or extraction indicated) and number of restorable surfaces can be seen in Table 2. When these data were subjected to either the Chi-Square or Fisher's Exact test there were significant differences between the children from fluoride-adequate and fluoride-inadequate areas in all treatment needs, except for both age-groups for teeth indicated for extraction and in the three- to four-year-olds for five-surface lesions.

Costs for treating the carious lesions of primary teeth by age-group are shown in Table 3. The cost of treating a three- to four-year-old child from a fluoride-adequate area is $30.09 less or 21.5 percent of the cost of treating a child from a fluoride-inadequate area. Similarly, the cost of treating a five- to six-year-old child from a fluoride-adequate area is $40.09 less or 28.4 percent of the cost of treating a child from a fluoride-inadequate area.

DISCUSSION

As expected, the number of five-surface lesions in three- to four-year-olds was insignificant. Since there was an

Table 1 ☐ Mean def teeth per child from fluoride-adequate and -inadequate areas, by age-groups.

		Fluoride-adequate		Fluoride-inadequate	
		3–4 n = 192	5–6 n = 370	3–4 n = 227	5–6 n = 143
def teeth	Mean	2.00*	3.53*	3.99*	5.42*
	S.D.	2.95	3.71	3.97	4.27

*significant at $p < 0.01$

Table 2 ☐ Mean treatment needs of carious primary teeth, by category of lesion and by age-groups.

		Age groups	
		3–4	5–6
		Fluoride-inadequate/adequate	Fluoride-inadequate/adequate
Restorable surfaces	1	1.03/0.27*	1.16/0.43*
	2	0.63/0.06*	0.87/0.24*
	3	0.17/0.04*	0.23/0.04*
	4	0.03/0.00*	0.11/0.01*
	5	0.04/0.02	0.12/0.04*
Extractions indicated		0.04/0.01	0.03/0.03

*significant at $p < 0.01$

Table 3 ☐ Mean costs of treating carious primary teeth per child from fluoride-adequate and -inadequate areas, by age-groups.

Age	Fluoride-inadequate	Fluoride adequate
3–4	$38.33	$ 8.24
5–6	56.01	15.92

There is a substantial increase in multisurface lesions in children from fluoride-inadequate areas.

insignificant number of carious teeth indicated for extraction, it appears that treatment is being received in a timely manner.

The importance of considering exposure to fluoride in the drinking water for preschool-age children during budgeting for treatment is supported by these results. Head Start programs with groups of children from fluoride-adequate and fluoride-inadequate areas will be able to modify their financial need according to each site location. At present, budgeting of Head Start dental programs in Mississippi is based on the estimated cost per child, regardless of the fluoridation status of the water supply. Programs located in areas that have adequately fluoridated water supplies will be able to provide care to more children, shift dental care dollars to other programs, or provide more complete treatment.

The presence of multi-surface lesions contributes to higher costs, thus any reduction in multisurface lesions tends to be beneficial to Head Start programs.[1] These data indicted a substantial increase in multisurface lesions in fluoride-inadequate areas when compared to fluoride-adequate areas for all ages (Table 2). The proportions of multisurface lesions to total surfaces provide a strong indication of the importance of fluoride to the programs. For the three- to four-year-old age-group, the proportion was 30.8 percent for the fluoride-adequate area and 45.8 percent for the fluoride-inadequate area. The five- to six-year-old age-group had similar results, i.e., 43.4 percent for the fluoride-adequate and 53.4 percent for the fluoride-inadequate area.

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ABSTRACTS

Raghoebar, Gerry M.; Boering, Geert; Stegenga, Boudewijn; Vissink, Arjan: Secondary retention in the primary dentition. J Dent Child, 58:17-22, January-February 1991.

Secondary retention refers to cessation of tooth eruption after emergence. The aim of this study was to evaluate the clinical, radiographic, and histological characteristics of secondary retention as well as the treatment results in a group of thirty-four patients with seventy-seven secondarily retained primary molars. The most important clinical and radiographical criterion for diagnosing secondary retention was infraclusion. Percussion was not a reliable diagnostic tool. Secondary retention in the primary dentition may predispose to a similar disorder in the permanent dentition. In many cases, occlusal disturbances and underdevelopment of the alveolar process disappeared spontaneously after eruption of the permanent successor, unless a similar disorder was observed in the permanent dentition. Active therapy is necessary only in case of severe infraclusion, severe malocclusion, dislocation or agenesis of the successor.

Retention, secondary; Infraclusion; Malocclusion; Eruption

Levy, Steven M. and Shavlik, David A.: The status of water fluoride assay programs and implications for prescribing of dietary fluoride supplements. J Dent Child, 58:23-26, January-February 1991.

Although community water fluoridation has long been recognized as the most efficient, cost-effective method of providing the recommended levels of systemic fluoride, about 46 percent of all Americans do not have such access. Little has been known about the states' programs for providing assays of individual patients water supplies. The status of these programs was surveyed, with collected data showing patterns among the states. Thirty-nine programs (76 percent) reported assay services available, with most of these provided by state laboratories.

Fluoride; Drinking water; Assay programs, fluoridated water; Caries

Vermeulen, Maria; Vinckier, Frans; Vandenbroucke, Jan: Dental general anesthesia: clinical characteristics of 933 patients. J Dent Child, 58:27-30, January-February, 1991.

To initiate a study on the usefulness of dental treatment with general anesthesia, we investigated clinical characteristics of 933 patients who received total oral rehabilitation using general anesthesia at the Department of Restorative and Pediatric Dentistry of the University Hospital Leuven, Belgium. The median age of the patients was 10 years. The overall male-to-female ratio was 53 to 47. The principal indications for treatment using general anesthesia were rampant caries, fear, and a mental or physical handicap. The mean number of decayed teeth was 10.9 (sd 4.9). Nearly 50 percent of the patients were referred by a dentist.

Anesthesia, general; Rehabilitation, total oral; Caries, rampant; Fear, dental; Handicap, mental (or) physical

Del Gaudio, Dino J. and Nevid, Jeffrey S.: Training dentally anxious children to cope. J Dent Child, 58:31-37, January-February 1991.

This investigation compared the relative effectiveness of exposure-based, multicomponent treatment of grammar-school-aged children with dental phobia in a school-based program. Multicomponent treatment was administered in three group sessions consisting of coping-skills training, administered in a school dental operatory setting, combined with exposure to a coping-model videotape. Comparison conditions were exposure-based coping-skills training; modeling videotape; classroom-based (non-exposure) coping-skills training; information dissemination/discussion group; and waiting- list control. Results supported the relative efficacy of exposure-based, multicomponent treatment in reducing subjective anxiety compared with the waiting-list control, information dissemination/group discussion, videotape-modeling condition, and non-exposure-based coping-skills-training conditions. No treatment group differences were found for pulse or behavioral ratings of anxiety.

Phobia, dental; Anxiety; Schoolchildren; videotape modeling; Coping-skills training

Gonzalez, Cesar D.; Frazier, P. Jean; Messer, Louise B.: Sealant use by general practitioners: a Minnesota survey. J Dent Child, 58:38-45, January-February 1991.

A 1987 random-sample mail survey on the use of sealants by general dentists in Minnesota (71 percent response, N = 375) found that almost all (95 percent) reported using sealants. Usage was predominantly for the six- to fourteen-year-old patient age-group. Frequency of use per week ranged from 1-25 (mean ± S.D. = 3.3 ± 3.6). More frequent use was associated positively with employing more dental hygienists, having more sources of information about sealants, having higher knowledge scores, and having more favorable opinions about sealants. While reported use of sealants is high in this state, the frequency of use and proportion of child patients receiving sealants were both relatively low.

Pediatric dentistry; Sealants; Min-

continued on page 14

ABSTRACTS *continued from page 6*

nesota; Practitioners, general; Attitudes

Gerlach, Robert W. and Senning, John H.: Managing sealant utilization among insured populations: report from Vermont's "Tooth Fairy" program. J Dent Child, 58:46-49, January-February 1991.

The potential for overutilization of dental sealants is cited as one rationale for limitations in third-party coverage for such care. To evaluate the validity of these concerns, provider behavior was reviewed, using twelve months of claims data from one insured population with pre-existing coverage for dental sealants. A total of 13,512 procedures from Vermont's "Tooth Fairy" program for low-income children were reviewed for several variables; these related to provider, patient, procedure type, and tooth number. Although sealants were the third most frequently rendered service, only 10.5 percent of patients received sealants. Treatment was largely consistent with professional guidelines for targeting care according to patient age. The absence of excessive or unnecessary utilization, combined with evidence of caries development in older children, suggests that insurers should review the appropriateness of protocols for sealant coverage.

Sealants; Insurance, dental; Caries; Pediatric dentistry

Waldman, H. Barry: 'I know you've heard it before, but...' (A litany for change—Part II). J Dent Child, 58:50-54, January- February 1991.

Once again, an effort is made to stimulate and motivate pediatric dentists to lead the way in developing a community awareness in the care of our children.

Demography; Pediatric dentistry; Sociology; Economics

Waldman, H. Barry: Directors of pediatric dentistry programs. J Dent child, 58:55-56, January-February 1991.

A review is provided of time commitment and board-certification status of pediatric dentistry and all specialty program directors. The need for additional information on the directors of advanced dental education programs is emphasized.

Pediatric dentistry; Program directors, specialty; Board certification

Boraz, Robert A.: Williams (Elfin Facies) syndrome: review of the literature and report of a rare case. J Dent Child, 58:57-59, January-February 1991.

Williams (Elfin Facies) syndrome is a rare, devastating, sporadic disorder first described in 1961. Approximately 100 cases have been reported in the literature. The disorder is characterized by multiple anomalies including mental deficiency, an unusual (elfin) facies, supravalvular aortic stenosis, prenatal and postnatal growth deficiency, infantile hypercalcemia, a small mandible, and frequent dental problems. Because of these anomalies, the dentist contributes significantly to the successful management of these patients. Infant dental care, nutrition counseling, and restorative care are extremely important for maximizing the quality of life for patients with Williams syndrome. A review of the literature and the successful management of a patient with Williams syndrome are presented.

Williams syndrome; Anomalies, dental; Facies, elfin; Pediatric dentistry

Finger, Stephen T. and Duperon, Donald F.: The management of self-inflicted oral trauma secondary to encephalitis: a clinical report. J Dent Child, 58:60-63, January-February 1991.

Encephalitis is a neurological condition that can present with self-inflicted oral trauma from fever-induced dyskinesia as one of its complications. Three cases of encephalitis are described in this report. The management of this trauma, through the use of soft plastic mouthguards, is discussed.

Encephalitis; Dyskinesia; Biting, lip- and tongue-; Mouthguards, plastic

RATION HEALTH CARE?

There is "surprising public support" for the idea of rationing health services, a leading insurance company reported at a November 14 forum of health policy makers.

But the public insists that any rationing scheme be based on "fair play" for all ages, incomes and lifestyles, said the Northwestern National Life Insurance Co. of Minneapolis, which sponsored the national public opinion poll. If rationing occurs, the public would trust health care professionals rather than elected officials or consumer groups to make the decisions.

The findings thus provide little support for Oregon's rationing initiative, the Medicaid Prioritization Project, which seeks to allocate limited public health care dollars based on rationing, the NWNL Group reported at the National Press Club forum.

Rationing was defined as denying care to certain individuals according to preset rules.

The poll found support by 85 percent of Americans for at least one of six types of rationing to keep health care affordable and available, though there was disagreement on which type to use. Only 16 percent supported a rationing program applying only to people whose health care is paid by public funds.

"We seem to be moving toward agreement on the principle of rationing even as we remain divided on the specific techniques," said Michael Conley, NWNL senior vice president.

Rationing is practiced in Canada and Great Britain but has been viewed as extreme and unlikely in the United States.