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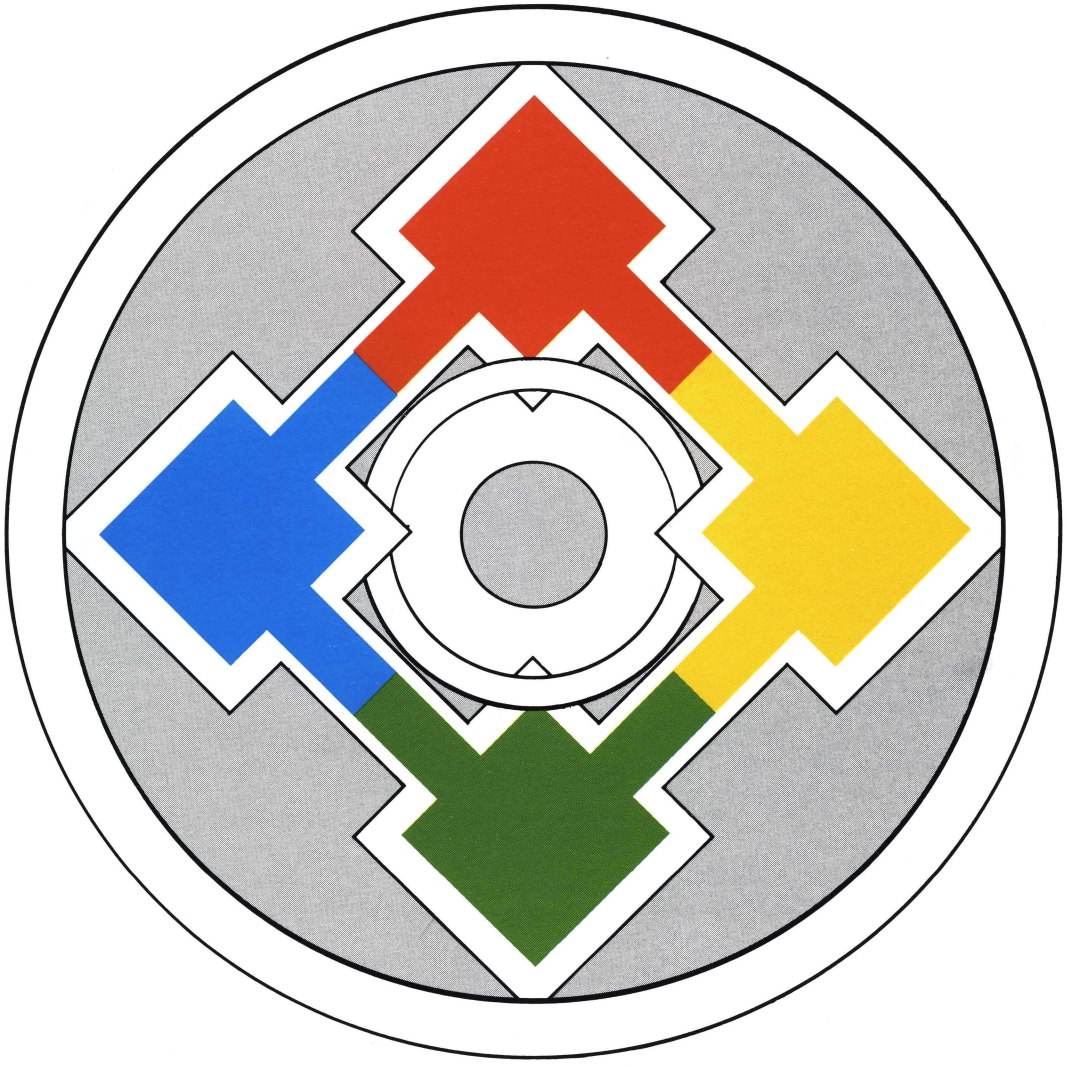

The child whom many fathers share
Hath seldom known a father's care.

The Hare and Many Friends
George Berkeley, 1685-1753

SHARING THE RESPONSIBILITY—AND THE PRIVILEGE

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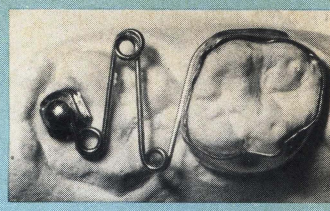

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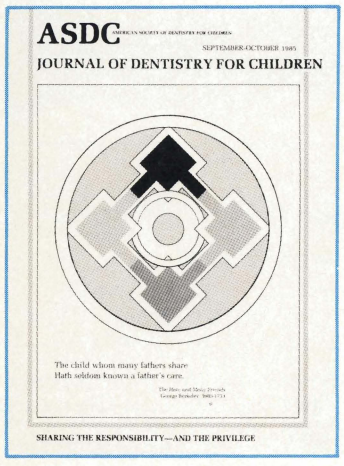

The cover is an abstract expression of the multidisciplinary care required to assure the proper care of children. Multidisciplinary care requires a generalist to provide the weights and balances that assure objectivity and a minimum of disciplinary bias in diagnosis and treatment planning.

PEDODONTICS

BEHAVIOR

FLUORIDE

CLINIC

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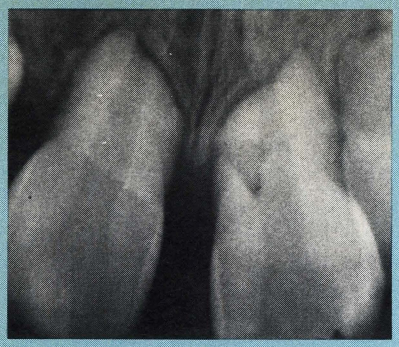

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Update on pedodontics in a period of improving dental economics

Pedodontics

H. Barry Waldman, DDS, MPH, PhD

The dental services sector of the economy is a growth industry—that's the conclusion of an extensive study of the long-term relationship of dentistry and the constant dollar gross national product (i.e., eliminating the effects of inflation).[1] Since 1950, the United States has experienced five periods of economic recession (based upon decreases in the constant dollar gross national product). During each of the first four periods (1953-54, 1957-58, 1969-70, 1973-75), constant dollar aggregate dental expenditures increased. However, during the 1979-80 period of economic downturn, constant dollar dental expenditures decreased.[1-3] In addition, during the last recession, constant dollar expenditures for dentistry per active private dentist decreased.[4]

UPTURN IN DENTAL ECONOMICS

Many changes have occurred, however, since the 1979-1980 recession. For example, between 1980 and 1983 (the latest year for which data are available):

- ☐ The percent increase in actual dollar expenditures for dentistry has been much greater than the comparable increases in the gross national product, overall medical care expen-

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ditures, and slightly greater than the percent increase in physician expenditures.[2]

- ☐ The percent increase in constant dollar expenditures for dental services has been greater than the percent increase in the constant dollar gross national product, overall medical care services and physician services.[2,5]
- ☐ The percent increase in constant dollar expenditures for dental services as a percent of the constant dollar gross national product has increased at a rate greater than that of overall medical services and physician services.

And most important, between 1981 and 1983, "despite continuing increases in the number of practitioners, constant dollar expenditures per active practitioner had increased."[4]

This increase in constant dollar national expenditures per practitioner is reflected in the Department of Commerce report on the dental supply industry for 1983.[6] Industry shipments increased by 2 percent (after adjustment for inflation) following a nongrowth year in 1982. In addition, industry employment increased to 18,000 from 15,400 in 1982.[7]

Yes, there are local areas and particular practitioners experiencing difficulties. And there are potential difficulties which may arise as the Congress considers limitations on tax-free fringe benefits and a host of other unforeseen developments. But as the numbers of graduates from dental schools continue to decrease and the dental economy shows signs of improvement, the future of the profession would seem to be far more secure than those "dark days" of the late 1970s.

During this period of change, how has the specialty of pedodontics fared?

Table 1 ☐ United States population under eighteen years of age and percent of total populations: selected years 1970-1983.[12]

Year	Population under eighteen (in thousands)	Percent of total population
1970	69,700	34.2
1975	66,300	31.1
1980	64,000	28.2
1983	62,500	26.6

Table 2 ☐ The percent of children under age seventeen by the time since last dental appointment: selected years 1970 through 1981.[13,14]

Last visit	1970	1975	1980	1981[a]
Under 6 months	32.3	36.6	36.2	36.2
6-11 months	14.7	14.8	13.9	13.8
1 year	9.5	9.6	10.8	10.8
Subtotal	56.5	61.0	60.9	60.8
2-4 years	6.7	6.6	6.7	6.2
5 or more years	1.3	1.5	1.5	1.8
Never	34.5	30.0	30.1	30.4
Unknown	1.1	0.9	0.8	0.8

a. Dental visit data were not included in the 1982 Current Estimates report. Data are not available for 1983.

Table 3 ☐ Number of dental visits for male and female children under age seventeen: selected years 1970 through 1981.[13,14]

	(in thousands)		
Year	Male	Female	Total
1970	45,163	49,708	94,871
1975	47,245	50,252	97,497
1980	44,690	52,568	97,258
1981	46,593	49,608	96,201

Table 4 ☐ Number of dental visits per male and female child under age seventeen: selected years 1970 through 1981.[13,14]

Year	Male	Female	Total
1970	1.3	1.5	1.4
1975	1.5	1.7	1.6
1980	1.5	1.8	1.7
1981	1.5	1.7	1.6

UPDATE ON PEDODONTICS

While no direct national economic data are available about pedodontic practice during this most recent period of economic change (the 1982 and 1984 ADA Survey of Dental Practice reports data on generalist and combined specialist categories), a variety of other information is available which reflects on the pedodontic specialty during these changing times.[8]

Recent reports in the literature have stressed the growing oversupply of pedodontists and the need for a better response to the geographic distribution of patients.[9-11] Many of the problems identified in the earlier reports have continued. For example:

- ☐ Number of children

  The population under age eighteen, both in number and as a percent of the general population, has continued to decrease (Table 1).
- ☐ Use of dental services

  Since the mid-1970s, there was essentially no change in the percent of children who visited

Table 5 ☐ Number of pedodontists: selected years 1976 through 1982.[15,16]

Year	Number
1976	1,218
1979	1,776
1982	2,949

Table 6 ☐ Pedodontists per 100,000 population: selected years 1960 through 1982.[17,18]

Year	Pedodontists per 100,000 population
1960	0.1
1965	0.3
1970	0.5
1975	0.7
1980	0.9
1982	0.9

Table 7 ☐ Percent and number of senior dental students expressing an interest in pedodontic training programs: 1978 through 1983.[19]

Year	Percent	Number
1978	2.3	122
1979	2.4	130
1980	2.4	126
1981	2.1	116
1982	1.7	91
1983	1.7	98
1984	1.8	96

Table 8 ☐ Number of students enrolled first year of pedodontic programs: selected years 1972-73 through 1983-84.[17,20]

Year	First year enrollment
1972-73	163
1974-75	177
1976-77	165
1978-79	173
1980-81	190
1981-82	178
1982-83	158
1983-84	149
1984-85	164

a dentist in the past six or twenty-four months (Table 2).

Since the mid-1970s there was an overall decrease in the total annual number of dental visits by children. Although there was an increase in the overall number of visits by male children, this number was more than offset by the decrease in the number of dental visits by female children (Table 3). The decrease in total number of visits was reflected in the slight change in the number of visits per female child between 1980 and 1981 (Table 4).

Unfortunately, the National Health Interview Survey did not collect dental visit data in 1982. Any change in visit data which resulted from the upturn in the economics of the nation must await future survey reports.

☐ Number of pedodontists

The American Dental Association reported a 66 percent increase, between 1979 and 1982, in the number of pedodontists (Table 5). However, the number of pedodontists per 100,000 population remained constant between 1980 and 1982 (Table 6).

☐ Pedodontic specialty training program enrollment

Interest among graduating senior dental students in pedodontic specialty programs has leveled off since 1982 (Table 7). Between the 1980-81 and 1983-84 academic years there was a progressive decrease in the number of students enrolled in the first year of pedodontic specialty programs. This trend was reversed in the 1984-85 academic year (Table 8).

OVERVIEW

Although aggregate national statistics since the last recession are now available to document the turnaround in the economics of dentistry, unfortunately minimal information is available regarding the specific changes (if any) in the economics of pedodontics.

Nevertheless, despite reports that continue to indicate:

- ☐ Decreasing number of children,
- ☐ Decreasing numbers of dental visits by children during the period of the recession and shortly thereafter,
- ☐ Changing disease patterns,
- ☐ An oversupply of pedodontists in some geographic areas (primarily urban);

the number of pedodontists continues to increase dramatically. (It is too soon to determine whether the 1984-85 academic year increase in the number of first year enrollees in pedodontic specialty programs is a return to a higher enrollment level or a one-year aberration.)

The developing trends and economics in the delivery of dental services (particularly for younger vs older population groups) has been considered in other presentations by this writer, as a rationale for dental educators and practitioners to emphasize services for the geriatric patient.[21-23] While such a discussion may carry with it the overtones of avarice or the inclinations to mercenary actions, the realities are that the profession must achieve reasonable financial returns, if it is to attract young men and women to serve the general public. From the perspective of the dental profession:

- ☐ There has been and will continue to be a marked increase in the number of practitioners.
- ☐ Major changes are occurring in the arrangements for the delivery of dental services.
- ☐ Major changes are occurring in the incidence and prevalence of dental diseases.
- ☐ Although in the past, the elderly reported limited use of dental services, in recent years, the elderly are increasing their use of dental care at a rate greater than that of all other age groups.

While the provision of dental services to younger population groups will continue to be an essential role of the general practitioner and pedodontic specialist, the profession must emphasize areas of service where the increasing numbers of practitioners can anticipate a reasonable return on their investment. (Again, the introduction of traditional marketing terminology seems to pervade the discussion. Unfortunately, the once four-letter scatological term, "sell", has become an essential aspect of dentistry in the 1980s.)

The difficulty is that, despite the improving economic picture of the dental profession, available national data do not support increasing (or possibly maintaining) the current level of pedodontists—at least in some locations.[11] As information on the economics of pedodontic practice in the post-1979-1980 recession period becomes available, further evaluation of the viability of increasing numbers of pedodontists in a changing market will be possible. Until this time, it would seem prudent for dental educators to encourage students to emphasize service for patients (e.g., older population groups), which are both increasing in number and in their use of dental treatment.

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Pedodontists' attitudes toward parental presence during children's dental visits

Behavior

Monica H. Cipes, DMD, MSD
Mary Miraglia

National surveys conducted from ten to twenty years ago indicate that a large proportion of dentists routinely excluded parents from the treatment room.[1,2] A more recent survey suggests that only a small percentage of pedodontists recognize the parent's presence in the operatory as a behavior management technique.[3] Recent literature on the beneficial effects of parental presence and involvement during children's medical care and hospitalization point to the possibility that the parent could exert a positive influence on the preschool child's adjustment to dental treatment.[4-9] However, the results of research on the impact of parental presence or absence in the dental setting are inconclusive.[10-13] In this paper, the findings of a survey of Connecticut pedodontists conducted in November 1983 are reported. The purpose of the survey was to determine whether trends in the philosophy of pedodontic practice had changed since earlier surveys and to determine the prevailing attitudes and practices of pedodontists concerning parental presence during children's examination and treatment visits.

METHOD

A letter and questionnaire were mailed to all of the

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fifty-two pedodontists practicing in Connecticut, as well as to the nine pediatric dental residents at the University of Connecticut. The five pedodontic faculty members at the University of Connecticut were not surveyed. The questionnaire asked whether the respondent generally allowed the parents of three-to-five-year-old patients in the operatory, during dental examination and treatment; in addition, the respondent was asked for an estimate of the percentage of three-to-five-year-olds examined and treated with their mother, father, both or neither parent present.

A fourth question addressed the percentage of three-to-five-year-olds brought to their appointment by each parent. An open-ended question asked the pedodontists for special circumstances where they preferred the parent not be in the room. The final question asked how many years the respondent had been in practice.

RESULTS

Practitioner response to the letter was overwhelmingly high; forty-seven of the fifty-two pedodontists responded to the written questionnaire within two weeks, suggesting a high degree of interest in the topic. Four more practitioners were interviewed by phone, while only one practitioner could not be reached. All of the nine pediatric dental residents returned their questionnaires promptly. Thus, responses could be tabulated based on sixty of the sixty-one pedodontists or pedodontic residents in the state.

The responses to the survey indicated that 71 percent of the pedodontists in the state generally allow parental presence during the examination visits of three-to-five-year-old patients. On the other hand, only 55 percent generally allow parental presence during the same children's treatment visits.

When Connecticut pedodontists were asked to estimate a percentage of three-to-five-year-old children examined with their parent in the room, the mean percentage cited was 67 percent; however, the range was from 0 to 100 percent. Responding to the same question, the pediatric dental residents unanimously stated that 100 percent of three-to-five-year-old patients were examined with the parent in the room. Practicing pedodontists estimated on the average that only 47 percent of three-to-five-year-old patients were

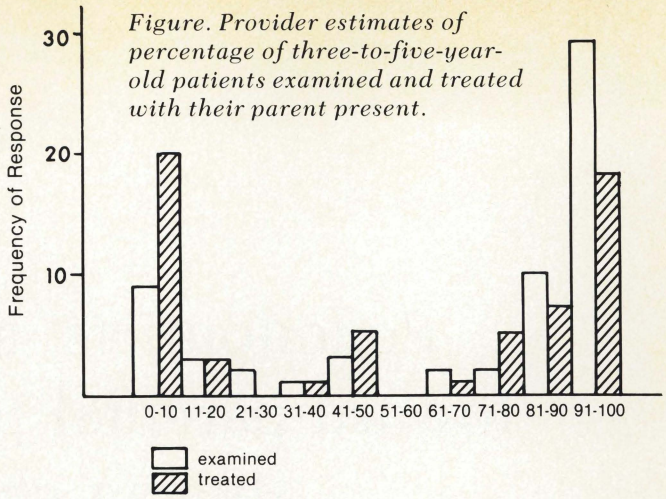

Figure. Provider estimates of percentage of three-to-five-year-old patients examined and treated with their parent present.

treated with their parent present (range 0-100 percent), while the residents stated an average of 99 percent of their three-to-five-year-old patients were treated with the parent in the room (range 90-100 percent). The wide range of these estimates and their bimodal distribution are illustrated (see Figure).

The estimates of number of patients examined and treated with the parent present were analyzed for a relationship with number of years in practice (range 0-45) using Pearson correlations and two variable regression analyses. Not surprisingly, the number of years in practice was significantly correlated with both parental presence during examination ($r = -.5495$, $p < .0001$). Those pedodontists who had been practicing longer were more likely to exclude parents from the operatory during both examination and treatment of three-to-five-year-old patients. Number of years in practice alone accounted for 31 percent of the variance (R^2) in parental presence during examination and 28 percent of the variance (R^2) in parental presence during treatment.

The open ended question "Are there special circumstances where you prefer the parent not be in the room?" elicited responses from fifty-seven of the sixty respondents. There was an interesting consensus concerning these circumstances: twenty-four respondents mentioned when the parent interfered with management or prevented communication; nineteen mentioned when the child was uncooperative; seven practitioners cited surgical or stressful procedures; and seven practitioners cited the need for sedation. Only three practitioners mentioned either the parent's or the child's preference, while four mentioned excessive fear on the part of the parent as a reason to exclude the parent.

DISCUSSION

The prompt response by pedodontists to this questionnaire indicates an encouraging

willingness on their part to share their views on topics pertaining to patient management. The responses showed considerable variation in provider acceptance of parental presence during dental treatment, and some variation in their acceptance of parental presence during examination. The striking bimodal response pattern suggests that the respondents held strong views on the topic. This difference of opinion was more pronounced where parental presence during treatment was concerned. It was also found that pedodontists who had been practicing longer were less likely to examine and treat their patients with the parent present. One explanation of this result is a changing philosophy of pedodontic practice, leading to greater acceptance and encouragement of parental presence by younger practitioners. An alternative explanation is the effect of years of clinical experience on older practitioners' behavior.

Regardless of the fact that practitioners seem to be more receptive to parental presence during examination and treatment of cooperative children, responses to the open-ended question indicate that providers often regard the parent as interfering with patient management and do not perceive a beneficial role of the parent in managing an uncooperative child. While the concept has never been tested prospectively, both Venham *et al* and Frankl *et al* suggested that, in spite of practitioner belief to the contrary, the presence of a parent does not seem to be associated with more negative behavior on the part of the child and may even be associated with greater cooperation and less anxiety.[12,13]

The results of this survey point to a need to study this question prospectively, to determine the actual effect of parental presence on children's anxiety and uncooperative behavior during examination and treatment.

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MALOCCLUSION IN ADOLESCENTS

The already high percentage of children with significant malocclusion increases in the adolescent years. The prevalence of crowding increases even though incisor alignment may improve somewhat, presumably because canine displacement allows more room for incisors. Class II problems tend to be more severe and more obvious, and Class III problems become apparent in adolescents. Approximately 70 to 75 percent of adolescents are judged to have malocclusions of some degree.

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The need for general anesthesia for the dental treatment of mentally handicapped patients: a follow-up study

Joost Roeters, DDS
Rob Burgersdijk, DDS, PhD

In 1968, the pedodontic department of the Catholic University of Nijmegen was the first in Holland to be given a structural facility for the complete dental treatment of handicapped patients under general anesthesia. Since its opening, approximately 500 complete dental treatments were performed under general anesthesia. The majority of the patients were mentally retarded and came from institutions in the Nijmegen area or were sent to the pedodontic department of the University by the family dentist.

Indication for treatment under general anesthesia was determined either by dentists in the employ of these institutions or by staff members of the pedodontic department. Children in the pedodontic department come from smaller institutions which are not visited by dentists or are children referred by general practitioners. Selection of patients for the study was made with the principle in mind that general anesthesia should be avoided whenever possible. Three groups of mentally retarded patients were considered qualified for the study:

- ☐ Patients who despite psychologically justified procedures (supported by premedication if necessary) remain totally unmanageable because of insufficient will power or ability to cooperate.
- ☐ Patients who, after an expenditure of much time and effort by the dentist, might be treated according to standard procedures, but whose dental care has been neglected. Because of the neglect, the number of teeth in need of treatment is so high that treatment under general anesthesia is justified.
- ☐ Patients whose cooperation is so poor that dental work of acceptable quality cannot be assured.

All treatments were performed by staff members of the pedodontic department. General anesthesia by nasal intubation was administered by an anesthesiologist. A description of the dental and anesthesiological aspects of the treatment was reported by Burgersdijk and Holthuis.[1]

After treatment under general anesthesia, the responsibility for the dental care of the patients who resided in the institutes mentioned above was returned to the dentists who worked there.

If and when the institutional dentists considered it necessary, the patient was put on the waiting list for further treatment under general anesthesia. Unfortunately, only these last patients were seen again by the pedodontic staff, so that we could not evaluate later dental treatment of the other patients.

In order to obtain information on the status of

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their dental care we inquired into the nature of the follow-up care. We hoped to learn the nature of the structural needs for dental treatment under general anesthesia, in the Nijmegen area.

MATERIALS AND METHODS

The records of all of the patients from three large institutes were retrieved from our anesthesia file.

Patients who were treated for the first time after 1980 were not considered for this study, because of the short period of time elapsed since treatment under general anesthesia. The three institutes have a relatively constant number of approximately 1780 registered patients. In the years 1968-1980, 248 patients received treatment under general anesthesia. Of these patients, twenty-seven underwent total extraction, so they did not qualify for this study.

The treatment under general anesthesia was classified in four groups (Table 1).

If we omit the six patients who needed only removal of plaque and calculus, it appears that for the remaining 215 patients, an average of 5.2 restorations and 3.8 extractions were performed, during the general anesthesia session.

RESULTS

Adequate knowledge of the dental care received by the patients after the treatment under general anesthesia was obtained from the patients' files, kept by the dentists working in the three residential establishments (Table 2). It appeared that twenty-nine (13.1 percent) of the former anesthesia patients, could not be treated by the institutional dentists, despite oral premedication. Of the twenty-nine patients, twenty-two received a second course of treatment under general anesthesia.

The average elapsed time between the two courses of treatment was five years and one month. In the years following the second course of treatment, it was possible to treat nineteen of the twenty-two patients normally, in the dental chair. About four years later, the remaining three patients were treated a third time under general anesthesia. From their records, it appeared that finally they could also be treated in the normal way. For undetermined reasons seven patients had no further dental treatment with or without general anesthesia.

DISCUSSION AND CONCLUSIONS

Over a period of years, it appeared possible to provide routine treatment without the use of general anesthesia for nearly all the patients. The conclusion can be drawn that the majority of these patients required treatment under general anesthesia because of their lack of previous dental care.

Considering the fact that in Holland, circa 1970, the program for providing dental care for handicapped people residing in institutions was poorly organized, the conclusion cannot be called surprising.

Only a small number of devoted dentists was willing to spend time on simple, but essential dental care in the institutions.

Since the mid-1970s, dental care for the handicapped improved considerably by:

- Including special dental care in a National Health Insurance system. This meant that dental care of institutionalized patients became an integral part of the total health-care package. Adequate dental care was assured, because dentists working in these boarding establishments were to be paid on the basis of the time spent and not per treatment, as was customary in standard dental insurance systems. It became possible, therefore, to spend sufficient time on patients who were unmanageable, without financial hardship for the dentist. This new system permitted an

Table 1 □ Treatment under general anesthesia was classified in four groups.

	Number	Percent
a. Removing plaque and calculus	6	2.7
b. Removing plaque and calculus, extractions	38	17.2
c. Removing plaque and calculus, restorations	37	16.7
d. Removing plaque and calculus, extractions and restorations	140	63.4
	221	100.0

Table 2 □ Nature of dental care provided by institutional dentists after a course of treatment under general anesthesia.

	Number	Percent
Inspection only	17	7.7
Removal of plaque and calculus	44	19.9
Restorations and/or extractions	131	59.3
No treatment possible	29	13.1
	221	100.0

institute to employ a full-time dentist for every 800 patients and a full-time oral hygienist for every 1000 handicapped patients.

- ☐ More attention in the dental curriculum to the dental care of handicapped patients.

Because of these improvements, it is anticipated that the percentage of mentally handicapped patients who will be considered for treatment under general anesthesia will decrease to the point where only a very small percentage of all institutionalized patients will require it. According to Burgersdijk and Holthuis (1977), 4 percent of all the institutionalized mentally handicapped patients were found to be totally unmanageable in the dental chair.

An increase in percentage can be expected only if more complicated restorative treatment, such as prosthetic dentistry and periodontal surgery, become necessary. The conclusion remains, however, that if sufficient time and manpower for regular treatment in the chair is available, general anesthesia will be required only in exceptional cases.

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PERMANENT TOOTH LOSS IN CHILDREN AND TEENAGERS

The number of missing permanent teeth in children of all ages has declined dramatically since the mid-1960s.

In the Hagerstown studies in 1937, Klein, Palmer, and Knutson found that 20 percent of the 12-year-old boys and 26 percent of the 12-year-old girls were missing one or more permanent teeth. The mean number of missing teeth per 12-year-old was 0.4 for boys and 0.5 for girls. By age 15, nearly half of the children examined were missing at least one permanent tooth.

In a 1979-80 National Preventive Dentistry Survey conducted by the National Institute of Dental Research, the figure dropped remarkably to 0.04 teeth per child (12-year-olds). The sharp reduction in tooth loss, in the people seen in the national surveys was confirmed in three statewide surveys. In Massachusetts, a state with a traditionally high caries rate, the mean number of missing teeth per 12-year-old child dropped from 0.40 in 1951 to 0.07 in 1979-81. In North Carolina, the figure went from 0.6 to 0.3 from 1960 to 1976, in whites. The pattern was inconsistent among nonwhites.

In New York, a 1979-80 survey was reported in terms of missing surfaces. For eighth-graders, the number of missing surfaces ranged from 0.0 for children of high socioeconomic status to 0.38 for children of lower socioeconomic status.

The decline in the number of missing teeth among children and teenagers since 1960 is of a tenfold order of magnitude.

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Variation among fluoride concentrations of water from domestic wells in a four-county area

Mark D. Siegal, DDS, MPH
Elizabeth T. Degnan, RDH, MPA

Dental caries is considered to be the most prevalent chronic disease of childhood. Water fluoridation is the most cost-effective method for preventing dental caries in a population, reducing the incidence of new caries lesions by approximately 50 percent at an average annual per capita cost of about twenty cents.[1]

Many Americans, however, do not enjoy the benefits of fluoridated water, either because their public water systems do not have adequate fluoride levels or they are not served by public water systems. A public water system has at least fifteen service connections or twenty-five individuals regularly served.[2] Of the 229.8 million U.S. residents in 1980, an estimated 195.6 million (85 percent) were served by public water systems and 34.2 million (15 percent) were not.[3] Most private water supplies are domestic wells. The fluoride content of domestic wells may vary considerably between wells, requiring laboratory analysis for reliable fluoride information.

Children who do not drink fluoridated water benefit from dietary fluoride supplementation, if

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it is conscientiously administered.[4] Both the appropriateness of a decision to prescribe a fluoride supplement and its dosage are determined by a patient's age and the fluoride concentration of his or her primary source of drinking water.[5,6] Dietary fluoride supplements may be prescribed as tablets, drops, solutions or lozenges and may be incorporated into a preparation with vitamins. Table 1 presents the dosage recommendations of the Council on Dental Therapeutics of the American Dental Association.[5] The Committee on Nutrition of the American Academy of Pediatrics developed similar dosage recommendations.[6] The latter dosage schedule provides for supplementation from two weeks of age to sixteen years. For the purposes of this paper, the ADA's dosage schedule will be used.

The distribution or prescription of dietary fluoride supplements for home use is not an effective means for caries prevention in large groups, owing to generally poor compliance with the daily regimen, which should continue through age thirteen years.[5,7] On an individual basis, however, the combination of a knowledgeable and enthusiastic dentist, physician or nurse practitioner with a highly motivated parent, may result in the sustained conscientious administration of a fluoride supplement.[7]

Before compliance becomes an issue, a dentist, physician or nurse practitioner must correctly prescribe a fluoride supplement. Unfortunately, surveys have demonstrated that errors in fluoride supplementation practices are common.[8,9] It has been reported that when fluoride is prescribed for a child whose family has a domestic well, the fluoride content of the well water is generally not determined prior to making the decision to prescribe.[10] This situation creates the potential for an inappropriate decision to prescribe fluoride or the prescription of an incorrect dosage.

In 1981, the New Mexico Health and Environment Department implemented a statewide infant fluoride supplementation program through health offices in the state's six health districts (see Figure 1). In conjunction with the fluoride supplementation activity, the Third Health District developed a program for analyzing fluoride levels of domestic wells within its four counties. Consistent with national data, approximately 63,000 (13 percent) of the district's 493,000 residents were not served by public water systems in 1982. After two years of the program, more than five hundred water samples from domestic wells were analyzed for fluoride. The purpose of this paper is to report the findings of these analyses during the program's first twenty-four months.

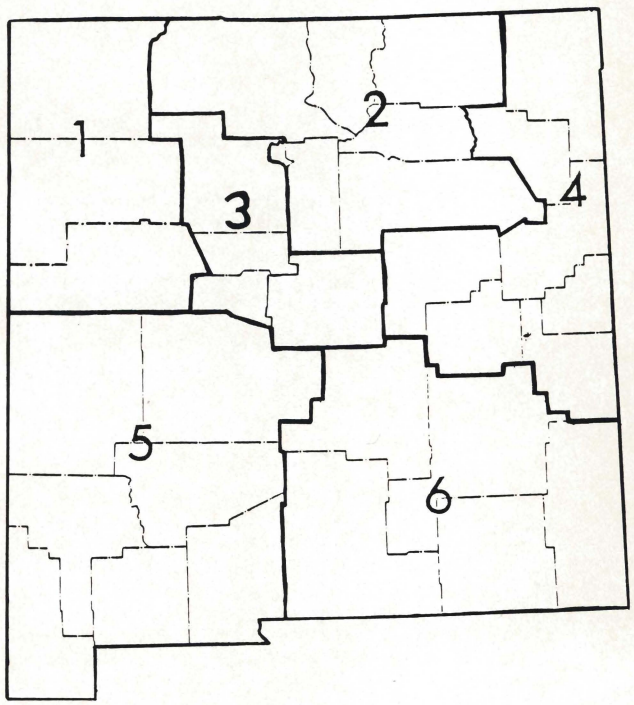

Figure 1. Map of New Mexico indicating the six health districts of the Health and Environment Department's Health Services Division.

Table 1 □ ADA Council on Dental Therapeutics' fluoride dosage schedule (in mgF/day*) according to age and fluoride concentration of drinking water, 1979.

	Concentration of fluoride in water (ppm)		
Age (Years)	< 0.3	0.3-0.7	> 0.7
Birth to 2	0.25	0	0
2 to 3	0.50	0.25	0
3 to 13	1.00	0.50	0

* 2.2 mg sodium fluoride contain 1 mg fluoride

Table 2 □ Fluoride levels of water from domestic wells tested between March 1982 and February 1984, according to county and fluoride concentration category.

		Fluoride concentration categories (ppm)		
County	Number of samples analyzed	< 0.3	0.3-0.7	> 0.7
Bernalillo	191	13	153	25
Sandoval	42	3	25	14
Torrance	74	6	54	14
Valencia	196	11	140	98
Total	503	33	372	98
(%)	(100)	(6.6)	(73.9)	(19.5)

METHODOLOGY

Water samples were received from families whose children were seen in either the health department's well child, dental, or Women, Infants and Children (WIC) clinics between March 1982 and February 1984. Clinics were held at ten local health offices throughout the district's four counties. Parents of children thirteen years of age and younger, who attended well child and dental clinics and whose primary sources of drinking water were domestic wells, were asked to return water samples. WIC clients were referred to well child clinics for evaluation of their fluoride supplementation needs.

Each parent was given a plastic bottle, a laboratory information form and written instructions on the water collection procedure. Parents were instructed to collect the samples from the site most frequently used for drinking water. The information form requested the family name, type and location of water source, and well depth. This information was recorded before the water sample was sent to the state laboratory. Water samples were analyzed for fluoride using a specific ion electrode.*

The results of the assays were recorded and plotted on county maps. The unit "milligrams per liter" (mg/L) is equivalent to parts per million (ppm). Laboratory results were rounded to tenths of a milligram per liter and categorized according to the fluoride concentration groupings of the Council on Dental Therapeutics' dosage schedule: < 0.3 ppm, 0.3-0.7 ppm, and > 0.7 ppm.

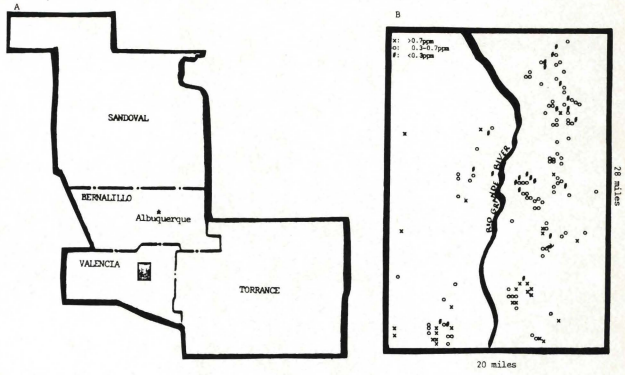

Figure 2. (A) Map of the Third Health District's four counties. The shaded area is shown in greater detail to the right. (B) with indications of the fluoride levels of 142 domestic wells assayed.

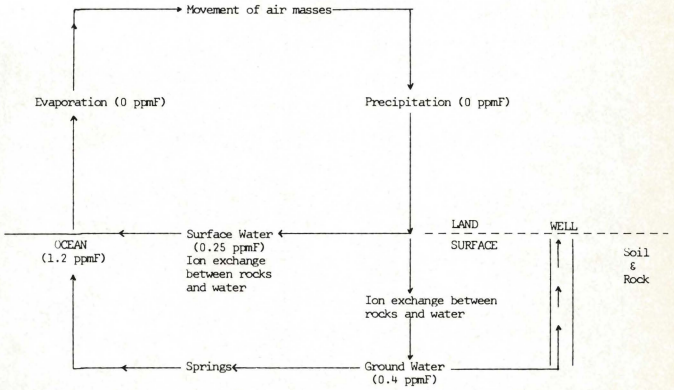

Figure 3. Simplified diagram of the hydrological cycle. Fluoride levels indicated represent averages. The actual range of values may be considerable.

RESULTS

During the twenty-four months from March 1982 through February 1984, 503 water samples from domestic wells in New Mexico's Bernalillo, Sandoval, Torrance and Valencia Counties were analyzed for fluoride. The fluoride concentrations of the water samples ranged from 0.1 to 6.4 ppm. The mean fluoride concentration of water samples tested was 0.6 ppm (S.D. = 0.6) and the median was 0.5 ppm.

Table 2 shows that 98 (19.5 percent) of the domestic wells tested had greater than 0.7 ppm of fluoride. Whether members of the families served by the remaining 405 (80.5 percent) required supplemental fluoride depended on the ages of the children. Figure 2 shows the distribution of fluoride concentrations of well water in an area from which a large number of samples (142) were submitted. Of note is the considerable variation in a relatively small area (20 x 28 miles).

Of the 503 water samples submitted, 239 (46.5 percent) were accompanied by information on well depth. Figure 3 indicates the relationship between well depth and fluoride concentration for the 239 wells of known depth. At each 100-foot interval of well depth, the mode for fluoride concentration was the 0.3 - 0.7 ppm group. With one exception, 200-299 feet deep, there were more wells with 0.7 ppm than with 0.3 ppm of fluoride at each depth interval.

*Orion Ionalyzer #901

DISCUSSION

The fluoride concentration of a particular water source is influenced by several factors related to the hydrological cycle. Data from the present study indicate that fluoride levels may vary considerably among domestic wells in an area. Although the data have certain limitations, the findings of the study should have practical significance for individuals and communities.

Essentially all private and most public water systems use ground water as opposed to surface water. Ground water bearing formations, called aquifers, exist under the earth's surface. It is to these aquifers that wells are drilled to return ground water to the earth's surface for use. Figure 3 illustrates, through a simplified diagram of the hydrological cycle, that ground water collects primarily from precipitation that filters through the soil and rocks of the earth's crust by means of gravity. Ground water may be found at depths of less than three feet to more than three thousand feet.[11]

Precipitation contains essentially no fluoride before it reaches the ground.[12] As water traverses the earth's crust it may gain fluoride through ion exchange with the minerals of rocks. Fluoride ions and hydroxyl ions exchange readily because they have the same radius and electrical charge.[13-15] The concentration of fluoride in water depends principally on the solubility of the fluoride-containing rocks that it contacts.[13]

The fluoride concentration of ground water often varies by area and, although relatively stable, may vary over time.[16] Ground water with greater than 1 ppm of fluoride may be obtained from a variety of geologic terrains.[14] The fluoride concentrations of U.S. waters have been reported to range from less than 0.1 ppm in several areas to 32 ppm in an area of southeastern Arizona.[14,15] The average fluoride concentrations of ground water and surface water have been reported as 0.4 ppm and 0.25 ppm, respectively.[17]

Two factors that affect the fluoride content of water are pH and the concentration of calcium ions. Fluoride content increases with increasing pH and decreasing concentration of calcium ions.[11,14] These factors, however, are not prerequisites for a water source having a high fluoride concentration.[14]

Certain aspects of the present study's design placed limitations on the usefulness of the data collected. The primary limitation was the fact that the 503 water samples analyzed for their fluoride content came from domestic wells that were not randomly selected. The study sample of an estimated 2.4 percent of District 3 residents not served by public water systems was a convenience sample composed of health department clients. Furthermore, a record review at one health office found that only half of the water sample bottles distributed were returned. Due to the lack of randomness in sample selection, it would be inappropriate to generalize a mean fluoride content for domestic wells from the study sample to the entire district or beyond. The data from the study demonstrate the potential for a considerable amount of variation among domestic wells in a given area. This fact is evidenced by the considerable standard deviation and the wide range of values.

Information on the depth of each well was requested, but it frequently was not known by the person submitting the water sample. The well depths that were reported were not verified for accuracy. Although it might be reasonable to expect that water from a deeper well is more likely to have a higher fluoride concentration, evidence either from the literature or from this study's data did not support this hypothesis. The data displayed in Figure 4 indicate that the variation in fluoride concentration was found for water from wells at various depths.

A 1970 survey of New Mexico community water systems found the fluoride levels in drinking water statewide to be heterogenous. The mean fluoride concentration of the 135 sites tested was 0.95 ppm (S.D. = 1.22) with a range of 0.08 to 7.40 ppm. Perhaps of greater significance than the mean was the fact that 61 percent of the sites sampled had 0.7 ppm of fluoride or less.[8] Since the time of the survey, Albuquerque and several other New Mexico cities have fluoridated their community water systems.

Consideration should be given to the practical significance of the potential for variation among the fluoride levels of domestic wells. If the variation crosses between the fluoride concentration categories of the ADA Council on Dental Therapeutics dosage schedule (<0.3 ppm, 0.3-0.7 ppm, >0.7 ppm), the appropriateness of an individual decision to prescribe fluoride and the dosage would be affected. It is of particular concern

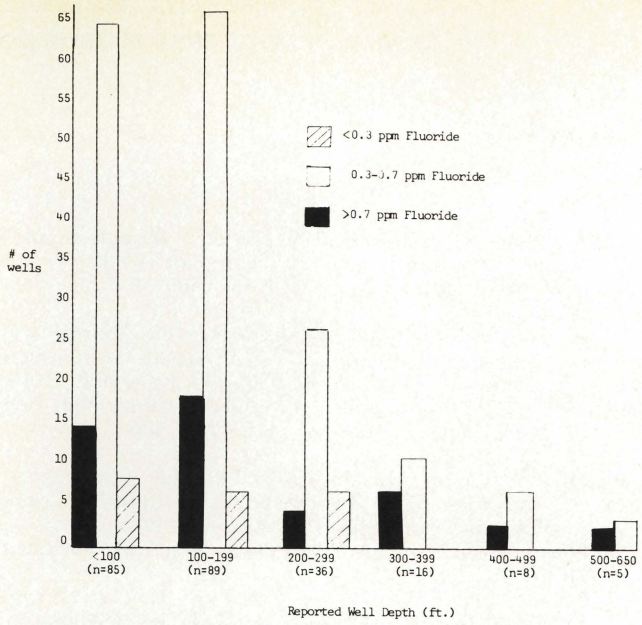

Figure 4. Distribution of domestic wells for which depth was reported (N = 239) according to depth and fluoride concentration.

that many, if not most, providers who prescribe fluoride supplements for their patients served by domestic wells, do not have water assayed for fluoride before writing a prescription. The findings of this study reemphasize the importance of water analysis in assessing a child's fluoride needs. The consequence of prescribing too much fluoride when dental enamel is developing is an increased risk of enamel fluorosis. If too little fluoride is prescribed or necessary fluoride is not prescribed at all, a child will not receive the maximum caries-preventive benefit.

On a community basis, two types of programs would be affected by knowledge of the potential for interwell variation of fluoride concentrations. Programs that provide fluoride supplements to children must assay water before prescribing fluoride in order to minimize the risk of fluorosis and maximize the caries preventive benefit. Community programs for the home use of fluoride supplements, however, are not generally effective on a large scale due to poor compliance. A more effective community program for the distribution of systemic fluoride supplements would be a self-administered fluoride tablet program in school, pre-school or daycare center. When such a program is offered to children whose families use domestic wells, a water sample from each well should be analyzed for fluoride. Only those children who have an inadequate amount of fluoride in their primary source of drinking water should receive fluoride supplements.

The significance of this study's findings depends on the prevalence of the considerable variation among fluoride concentrations of water from domestic wells. Whether the situation described is a local phenomenon or one that is widespread in nature is not evident from the literature. The present study offers an example of the extent to which fluoride concentrations may vary among domestic wells in an area.

If one wished to visualize the variability of fluoride concentrations among domestic wells in a particular region, data maintained by the state laboratory could be reviewed. Fluoride concentrations of individual wells would then be plotted on local highway maps using color-coded pins to indicate the three fluoride concentration categories of the dosage schedule.

CONCLUSIONS

- ☐ There was considerable variation among the fluoride concentrations of 503 water samples from domestic wells in a four-county area of New Mexico.
- ☐ Variation in fluoride concentration among domestic wells was found at all intervals of well depth reported.
- ☐ Because of variation among fluoride concentrations of water from domestic wells, a water sample from a given well should be assayed for fluoride before prescribing a supplement.

SUMMARY

Water samples from domestic wells in a four-county area of New Mexico were analyzed for fluoride over a twenty-four month period, using a specific ion electrode. Of the 503 nonrandomly selected samples analyzed, 33 (6.6 percent) had less than 0.3 ppm, 372 (73.9 percent) had between 0.3 and 0.7 ppm and 98 (19.5 percent) had greater than 0.7 ppm of fluoride. The Council on Dental Therapeutics of the American Dental Association considers fluoride concentrations of greater than 0.7 ppm to be acceptable caries preventive levels in drinking water. Variation in fluoride concentration was found at all well depth intervals considered.

It is important for dentists, physicians and nurse practitioners to be aware of the potential for variation of fluoride concentrations among domestic wells. When assessing a child's fluoride needs,

the fluoride concentration of his or her drinking water must be known in order to optimize the benefits of fluoride supplements and to minimize the risk of enamel fluorosis. The fluoride level of community water systems is generally known by a town's water or health department. Water from domestic wells, however, must be assayed for fluoride on an individual basis to make the determination.

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CARE OF THE CARE-GIVERS

Denial, avoidance, resistance, and hostility are feelings common to both patient and doctor when a physician is called upon to treat an emotionally or even physically ill colleague. This is why the directions to such doctors abound with phrases like "Why don't you try. . .?", "Get yourself some. . .", or "Just tee up a barium enema for yourself." The explicit instruction, the lifting of the burden or the planning of a program of rehabilitation are often left unspoken in the mistaken belief that the doctor can stand outside himself, properly interpret the remonstrances of his body and even pacify the turbulence of his mind.

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Patient assessment of the value of bleaching tetracycline-stained teeth

Clinic

J.S. Reid, BDS, PhD, FDS

Ever since the discovery of chlortetracycline in 1948 by Dugar, this drug and related tetracyclines have been used in children for the treatment of such conditions as cystic fibrosis, chronic bronchitis and some penicillin-resistant infections.[1] The use of these drugs in young children has been shown to cause discoloration of bone and the dental hard tissues.[2] The crowns of permanent incisor teeth are often discolored and patients may seek advice and treatment to improve their appearance. One such method of treatment is the technique of bleaching. This method has previously been described in detail.[3] A review of patients attending Glasgow Dental Hospital who had received bleaching of their maxillary permanent anterior teeth was undertaken, because long-term studies of patient satisfaction with this method of changing tooth color have not been reported.

MATERIAL AND METHODS

One hundred patients who had undergone bleaching of the anterior teeth were recalled to ascertain whether the patients considered their treatment successful and to help the operator predict which cases in the future would give the patients an aesthetically pleasing result.

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RESULTS

Eight-three patients were examined at both *baseline* and *recall* giving a response rate of 83 percent.

☐ *Age of patient*

The patient population was divided into two age-groups, thirteen to fifteen years and sixteen years and older, in order to assess whether age had any effect on the outcome of treatment. Table 1 shows the results of patient assessment of the effect of bleaching. In the thirteen-to-fifteen-year group, 58.6 percent of the patients were satisfied with the end result and in the sixteen-year-and-older group, 48.2 percent were satisfied with the color change.

☐ *Baseline discoloration*

Baseline tooth discoloration was divided into three color groups, namely yellow, grey and a combination of the first two. The patients assessment of the bleaching was compared with the discoloration at baseline. Table 2 shows the total number of patients treated in each baseline color group and the patient assessment of the success rate. The best results were obtained for patients with a combination of colors and the least success was obtained for patients with grey discoloration, where only 8.3 percent were satisfied with the result. The majority of the sample (63.8 percent) had a yellow discoloration of the teeth; a success rate of 60 percent was achieved for this group.

☐ *Age and discoloration*

An attempt was made to ascertain the effect of baseline discoloration and the patient's age on the success rate of the bleaching. Table 3 shows that in the yellow stain group, 62.5 percent of thirteen-to-fifteen-year-old patients were satisfied with the result and 58.5 percent were satisified in the sixteen-year-plus group. Only 14.3 percent (thirteen-to-fifteen-year group) and 5.9 percent (sixteen-years-plus group) who had the grey stain at baseline were satisfied with the result.

Table 1 ☐ Patient assessment of the results of bleaching.

	Age group			
	13-15 years		16 years and over	
	No.	Percent	No.	Percent
Satisified	17	58.6	26	48.2
Not satisified	12	41.4	28	51.8
Total	29	100.0	54	100.0

Table 2 ☐ Patient assessment of the value of bleaching according to baseline discoloration.

	Baseline discoloration					
	Yellow		Grey		Combination	
	No.	Percent	No.	Percent	No.	Percent
Satisified	27	60.0	2	8.3	14	100
Not satisified	18	40.0	22	91.7	-	-
Total	45	100.00	24	100.0	14	100

Table 3 ☐ The effect of age and baseline discoloration on the patients' assessment of the success of bleaching.

Age	Color of stain					
	Yellow		Grey		Combination	
	No.	Percent	No.	Percent	No.	Percent
13-15 years						
Not satisfied	6	37.5	6	85.7	-	-
Satisified	10	62.5	1	14.3	5	100
Total	16	100.0	7	100.0	5	100
16 years and over						
Not satisfied	12	41.5	16	94.1	-	-
Satisfied	17	58.5	1	5.9	8	100
Total	29	100.0	17	100.0	8	100

DISCUSSION

The results show that 43 of the patients treated (52 percent) were satisfied with their tooth color after bleaching. The best results were obtained for patients with a combination of colors, but good results were obtained in patients with yellow discoloration, where 60 percent were satisfied. Although a slightly higher percentage of success was obtained for patients under sixteen years, the most important factor seems to be the original baseline discoloration. The poorest results obtained were for patients with grey discoloration and no reason can be offered for this finding. A possible explanation could be the light oxidation effect.[4]

It was reported that the effect of bleaching tetracycline-stained teeth in dogs gave an improvement in appearance, but that color change was temporary.[5] However, in the present study, improvements in appearance were obtained in almost half the treated cases and the color changes were maintained to the patients' satisfaction. Thus, these results do not agree with the findings of the animal experiments and show true value of a longer term follow-up, the lack of which was alluded to by Walton *et al* in their animal study.[5] A typical end-result of bleaching is shown in Figures 1 and 2. Many patients may not wish to express their disapproval of a clinical procedure to

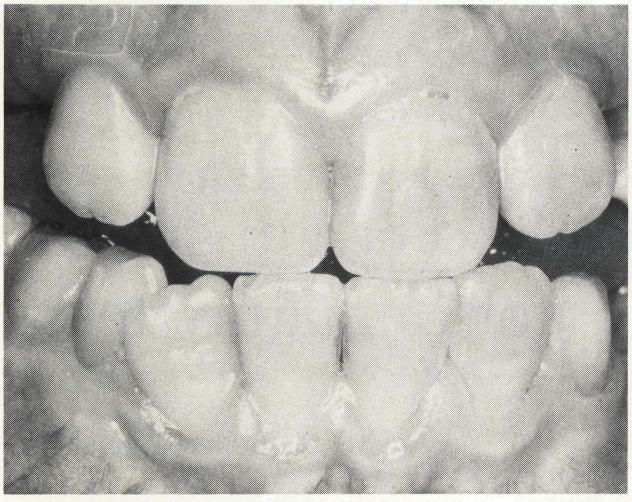

Figure 1. Shows a patient aged twelve years before treatment.

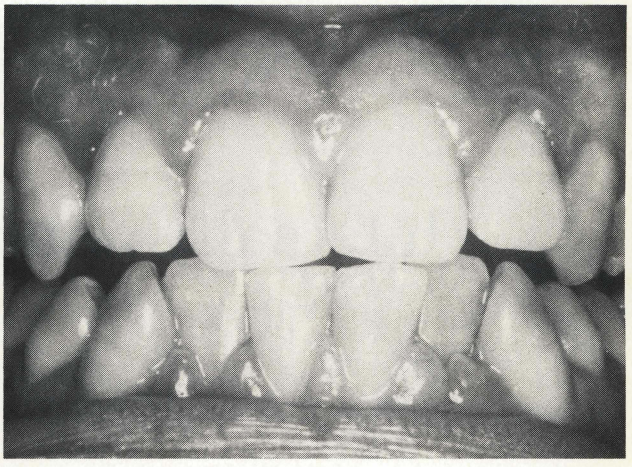

Figure 2. Shows the same patient four years after treatment with the maxillary incisors improved in appearance.

the dental surgeon who had undertaken the bleaching program. This study, therefore, used two final-year students to record the patient's assessment of the success of the color change. A questionnaire was administered to the patients in order to record a baseline assessment of their perceptions of the color of the teeth to be bleached. One year later a follow-up examination took place. The patients were asked their opinions on the success of the bleaching program. The ratings were recorded by two final-year students. There is no doubt that patients with tetracycline-discolored teeth can become very depressed and cause problems both at home and school. It is disappointing to discover, that in spite of warnings about the ingestion of tetracyclines in children under eight years of age, the author has received a total of twenty-three new cases of tetracycline staining between November 1982 and June 1983. It is of great importance that the dental professional continue to advise in the strongest possible terms that tetracyclines should not be prescribed to children younger than eight years of age by general medical practitioners.

CONCLUSIONS

This study investigated the effect and result of bleaching tetracycline-stained teeth and showed that approximately half were successful. Treatment of teeth with a combined stain and yellow stain were more successful than teeth with grey discoloration. The improvements in appearance have been maintained over the annual follow-up. It is, therefore, possible to assess the potential success of bleaching on the initial color of the teeth. Those patients with grey discoloration would be well advised to seek an alternative solution to their aesthetic dental problem.

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Internally reinforced porcelain crowns for immature teeth

Alastair N. Stokes, BDS, MSc

Children in the seven-to-eleven-year-old age-group are most likely to suffer trauma to permanent anterior teeth, and the immaturity of these teeth is a constraint on treatment options.[1,2] Where there has been frank exposure of the pulp, capping or pulpotomy provides a good prospect of continued apical development.[3,4] These procedures may fail if there is leakage, due to both the solubility of calcium hydroxide materials and bacterial contamination.[5,6] It is in this same age-group that legitimate demands arise for a restorative solution to disfiguring anomalies of enamel development. In all these circumstances the clinician is faced with the task of providing medium-term restorations that will enhance appearance and maintain function.

Acid-etch retained composite resin and laminate veneer restorations have gone some way toward meeting these requirements.[7,8] However, circumstances exist where they are unlikely to succeed; for example, where fractures involve substantial hard tissue loss, leaving little enamel available for bonding. Wear and discoloration have justified the term "semi-permanent" for composite resin restoration, and their lifespan is often distressingly short.[9,10]

THE DECKGOLD CROWN

A technique for the production of reinforced porcelain jacket crowns using colloidal gold to bond porcelain to platinum matrix has been described by Dorney.* These crowns consist of a platinum matrix to which is fused a layer of colloidal gold. (Deck-Gold, normal Degussa, Frankfurt, West Germany), over which is fused a layer of porcelain (Vita VMK-68, Vita-Zahnfabrik, Säckingen, West Germany). The layer of colloidal gold reduces the formation of internal microcracks in the porcelain, resulting in a crown unit of considerable strength with minimal thickness (Figure 1).[11]

CLINICAL PROCEDURES

The shade is recorded using the VITA-lumin shade guide. This is followed by a veneer preparation with enamel reduction as little as 0.5mm, (compared with 1.0mm for a porcelain jacket and 1.3mm for a bonded crown). Where a fracture has created a knife-edge margin it need not necessarily be further prepared, but elsewhere a chamfer margin is preferred. There is no need for a shoulder preparation. Margins may be placed supragingivally, wherever there is no overriding

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*L.S. Dorney, Alternative reinforced jacket crown construction, Martin Halas Dental Co., Sydney, June/July, 1978.

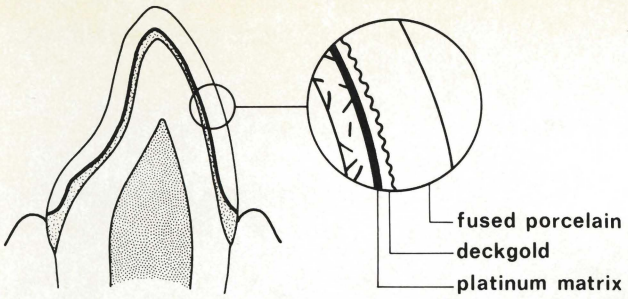

Figure 1. Components of the Deckgold system.

aesthetic or mechanical reason to enter the gingival crevice.[12,13] Supragingival margins also avoid the need for mechanical gingival displacement during impression procedures. A critical requirement for retentive form is minimal reduction of the cingulum region. The thinness of Deckgold crowns makes possible the creation of a very small taper even in partly erupted teeth. An elastic impression of both arches and temporary coverage with a proprietary resin form completes the first operative appointment.

Cementation is straightforward. On removal of temporary coverage it is often unnecessary to employ local analgesia as much of the preparation is in enamel alone, while dentin exposed by fracture will have been well protected at the first appointment. The luting cement does not appear to be critical to success. Both zinc phosphate cement and, more recently, glass ionomer cement have been used with excellent retention and no evidence of adverse pulpal reaction.

LABORATORY PROCEDURES

Models and dies are prepared in the normal manner, after which a 20μm layer of die-spacer is painted on the die, except for the marginal region. A platinum foil is then adapted, after which it is coated with a thin layer of Deckgold normal, which is fired without vacuum to 1060°C. Vita VMK paint-on opaque is then applied according to instructions, followed by selected dentin and enamel powders, which are fired and trimmed in the usual manner. A veneer crown of excellent appearance and surprising strength results.

It is possible to trim the labial foil to present a porcelain margin, but some weakness must result where a thin wedge of porcelain is presented at a margin without the metal backing.

CASE REPORTS

Two case reports illustrate situations where Deckgold crowns have been successful.

☐ *Traumatic injury*

A twelve-year-old girl presented with a severe oblique fracture of her upper left central incisor. The pulp was vital, and after the placement of a calcium hydroxide base, a composite resin restoration was placed using the acid-etch technique. This, and a subsequent composite resin restoration were displaced during function, and it was decided to place a Deckgold crown with a view to replacement by a bonded crown when the patient reached maturity. The Deckgold crown, with slightly supragingival margins, was cemented with zinc phosphate cement in 1971 (Figure 2). The crowned tooth remained

Figure 2: Deckgold crown on fractured upper left central incisor at cementation (1971).

Figure 3: Same crown as in Figure 2 at review in 1982.

Figure 4: Severe pitting of all teeth.

Figure 5. Deckgold crowns after four years' service.

symptomless, and when at review in 1982 the patient was offered the originally planned bonded crown she declined on the grounds that her existing Deckgold crown was trouble-free and of excellent appearance. The labial enamel exposed by passive eruption did not adversely detract from the patient's appearance (Figure 3).

□ *Pitted hypoplastic enamel*

An eleven-year-old girl presented with severe hypoplastic pitting of all her teeth (Figure 4). The enamel was fractured from her teeth during function, and the combination of relatively small clinical crowns, a somewhat nervous attitude, and a very high salivary flow suggested that conventional restorative options would be difficult and prone to failure. The six upper anterior teeth were prepared to slightly supragingival chamfered form. Relative analgesia alone ensured sufficient patient cooperation. After routine impression and temporization procedures, Deckgold crowns were cemented with glass ionomer cement, one week later. Subsequent parental reports confirm that these restorations led to a positive personality change in the patient. They have now been in service for four years (Figure 5).

CONCLUSION

Very thin porcelain jacket crowns, internally reinforced by means of a platinum-foil-colloidal-gold matrix have been shown to be extremely reliable, functionally and aesthetically. They are realistic restorations for immature teeth where longevity and appearance are overriding factors.

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Idiopathic external root resorption of the entire permanent dentition: report of case

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The resorption of root structure is a normal, necessary and physiologic process of the primary dentition, which allows for loss of primary teeth before the eruption of their permanent successors. Orban stated that root resorption of primary teeth may be stimulated by eruption forces generated from underlying secondary teeth, by increased forces developing in the masticatory systems of growing children, and/or to an inherent resorptive potential of primary root structure.[1] Although permanent teeth are not usually thought of as undergoing root resorption, Henry and Weinman found that most secondary teeth display microscopic evidence of external root resorption.[2] Massler and Perreault found radiographic evidence of some degree of root resorption in four or more teeth in all 301 of their subjects.[3] All secondary teeth may, therefore, demonstrate some minor amount of external root resorption, even though the amount is clinically insignificant.

A potential to undergo clinically significant external root resorption is seen in secondary teeth when they are affected by certain stimuli. This potential may be triggered by a number of factors or situations which, according to Shafer, Hine, and Levy, include:

- ☐ Periapical inflammation
- ☐ Reimplantation of teeth
- ☐ Tumors and cysts
- ☐ Excessive mechanical or occlusal forces
- ☐ Tooth impactions
- ☐ Idiopathy

The term "idiopathic" is applied in situations where a cause for external root resorption cannot be determined. In some cases initially diagnosed as idiopathic external root resorption, however, testing and careful evaluation for more obscure factors can lead to a successful determination of a likely etiology. Idiopathic external root resorption has been determined to occur as a result of "endocrine" disturbances, in Paget's disease, hypophosphatasia, hyperparathyroidism, and even as a result of "anachoresis."[4-8] The attempt to determine an etiology can include historical, clinical, radiographic, laboratory, histologic, and possibly other areas of investigation. The different conditions and various stimuli which have been associated with idiopathic external root resorption, unfortunately, still leave undetermined the underlying factor which links together these phenomena. Consequently, idiopathic external root resorption remains an appropriate term to be used when the condition exists without a known etiology.

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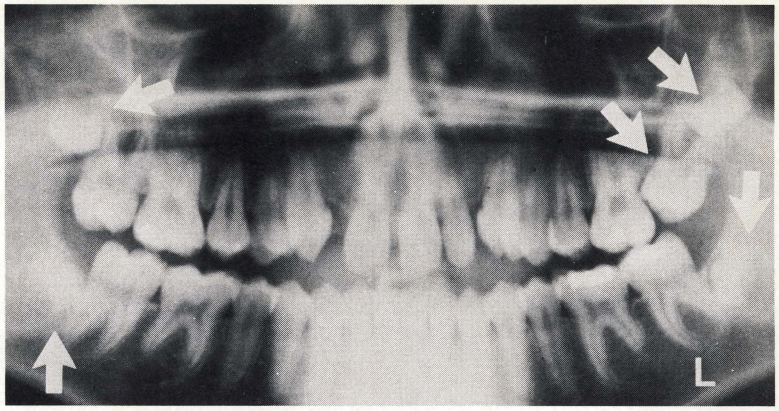

Figure 1. Panoramic view of the patient taken in December, 1980, six days before his fourteenth birthday. Note the impacted molar teeth (arrows). A significant amount of external root resorption is seen, particularly in those teeth which erupted first.

Animal studies have shown bone and tooth resorption to be governed by genetic factors, and in humans external root resorption may display familial patterns.[4] In addition, several genetic conditions affecting the dentition may produce root abnormalities (along with other findings) including dentin dysplasia, Types I and II, and odontodysplasia.[9] In these conditions, though, there are other clinical, radiographic and histopathologic changes besides root abnormalities that are detectable.

Most cases of external root resorption affect single teeth, although occasionally several teeth may be involved.[10] Orthodontic movement of teeth probably accounts for most cases of generalized external root resorption. Dougherty claims that treatment of all cases of malocclusion will result in some root resorption.[11] Nitzan *et al* state that there is little possibility of external root resorption beginning after age 30; they also speculate that the predominance of external root resorption found in males, in their study, could suggest a relationship to male sex hormones.[12] Kerr *et al*, however, reported two unusual cases of idiopathic external root resorption occurring in females (ages thirty and sixty-eight) which started at the cementoenamel junction, became progressively more extensive, and later involved nearly all teeth.[10] Soni and LaVelle reported a case of idiopathic external root resorption involving the posterior dentition only.[13]

The following case report is unusual and differs from previously reported cases because the idiopathic external root resorption affects all of the permanent teeth.

CASE REPORT

In April 1981, a fourteen-year-old Caucasian male was referred to the University of Colorado School of Dentistry by his family dentist to help evaluate "foreshortened roots." The physical examination revealed a healthy-appearing fourteen-year-old boy, active in social and athletic affairs in school. The medical history was noncontributory. The patient's dental history was unremarkable during his primary and mixed dentitions. The permanent upper right lateral incisor was extracted at age twelve "because it was loose." Dental care consisted of prophylaxis and fluoride treatments and occlusal amalgam restorations. The patient specifically denied having had any form of previous orthodontic treatment or having suffered any type of dentofacial trauma. The clinical dental examination revealed a normal complement of teeth, except for the absence of the lateral incisor. There was no active dental caries or periodontal disease. Occlusal amalgam restorations were in the permanent upper right first and second molars, the upper left first molar, and the lower left first and second molars. The gingiva was healthy and there was no excessive mobility associated with erupted teeth. The radiographic examination of a panoramic film taken four months previously (Figure 1) revealed the following:

- ☐ The permanent maxillary left second molar and all the third molars were unerupted. The second molar was a mesioangular impaction, and the four third molars appeared impacted.
- ☐ There was a generalized pattern of apical root resorption (both horizontal and diagonal), which appeared more prominent in the maxillary dentition.
- ☐ All other panoramic anatomy was within normal limits; no other dental radiographs were available.

The family history revealed that the patient had an older brother and younger half-sister. Neither is affected with the root condition shown by the propositus. His biologic mother and father have most of their teeth remaining with normally-appearing roots. The mother is currently being treated for periodontal disease.

In May 1981, the patient had a chemical evalua-

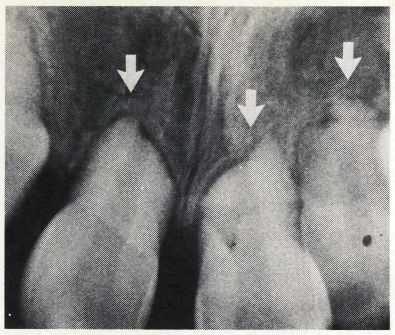

Figure 2. Maxillary anterior periapical view of the patient taken approximately six months after Figure 1. The external root resorption is more clearly seen.

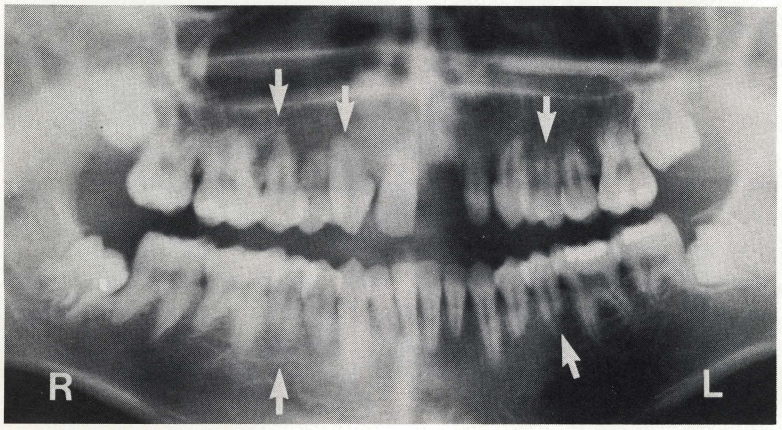

Figure 3. Panoramic view of the patient taken in April, 1983, when he was sixteen years, three months old. The progression of the external root resorption and apparent involvement of all the erupted teeth can be seen. (See arrows for examples)

tion of the blood and urine through pediatric microchemistry at the University of Colorado Health Sciences Center. Any detectable abnormal values may have been suggestive of a systemic or pathologic condition relatable to the external root resorption. Chemistry values of particular interest were alkaline phosphatase, calcium, and phosphorous; however, these values and all others were subsequently reported to be within normal limits. A decision was made not to pursue additional long-bone radiographic surveys, based on the normal laboratory values. At this time the patient and his parents were informed of the results and were told that the prognosis was guarded (Figure 2).

It was intended to observe the patient regularly, but he was not seen until almost two years later. During the intervening time he reported no change in his medical or general health, but admitted to having been recently injured in an athletic accident. His maxillary dentition has been splinted, but the left maxillary permanent central incisor was subsequently extracted, because of excess mobility. It had been saved and microscopic examination of the tooth showed normal dentin and cementum with no evidence of globular dentin or an abnormal reduction of dentin. This finding eliminated dentin dysplasia I and II and odontodysplasia from the differential diagnosis. The patient also reported that the family dentist had previously recommended and extracted the left maxillary permanent second molar, because of its impaction. There was no change in the dental caries or periodontal status. A panoramic radiograph taken in April 1983 (Figure 3) revealed the following:

- ☐ The right maxillary permanent lateral incisor, the left maxillary permanent central incisor, and the left maxillary permanent second molar were missing. The left maxillary third molar appeared to have erupted successfully into occlusion in the position of the second molar, but the other third molars remained impacted.
- ☐ All erupted maxillary teeth displayed continued apical root resorption compared to the panoramic film taken twenty-eight months previously (Figure 1). Significant apical resorption was more obvious on most mandibular teeth.

The patient and his parents were informed that the external root resorption was progressively worsening but that the etiology could still not be determined. No treatment could be recommended that would definitely arrest the external root resorption, but pulp extirpation and treatment with either calcium hydroxide or gutta percha were discussed as theoretical possibilities. This possibility was also discussed in more limited terms in an effort to arrest the external root resorption of

certain key teeth, which would be important for partial dental prostheses in the event of the further loss of untreated teeth. Other treatment options (short-term and long-term) which were discussed included:

- ☐ Periodic observation with no definitive treatment other than that required to meet a particular need.
- ☐ Extraction of the most severely affected teeth and fabrication of partial prostheses.
- ☐ "Root submergence" procedures, or amputation of teeth slightly below the alveolar bone height, followed by closure with a gingival flap; this would be intended to maintain vital roots and alveolar height for the optimal stabilization of a dental prosthesis.[14]
- ☐ Extraction of all teeth and fabrication of complete prostheses.

The patient and his parents chose not to avail themselves of any form of treatment and effectively chose option 1. They did plan to return to the family dentist for construction of a removable maxillary partial prosthesis and for regular maintenance dental care.

DISCUSSION

In situations of external root resorption occurring for the more common reasons (tumors, cysts, excessive mechanical or occlusal forces, or tooth impactions), the generation of pressure is likely to be causative. Removal of the pressure can eliminate the resorption process and further treatment is rarely necessary. If a systemic condition including endocrinopathy is causing external root resorption, treatment of the particular condition may successfully arrest it. The case herein reported is puzzling, because it is generalized and progressive throughout the erupted permanent dentition. Furthermore, no local factors relating to pressure, no evidence of a genetic condition, and no abnormal findings suggestive of a systemic alteration could be established. It is possible that the sensitivty of the laboratory testing was not thorough enough to detect an incipient systemic condition or that an undiagnosed condition may be developing. However, no treatment intervention for this patient's idiopathic external root resorption could be justified relating to local or systemic factors. Since the progressive nature of the condition was of concern, it was decided to review other possibilities of arresting its continuation.

Other treatment recommendations have been made when external root resorption occurs in association with inflammation of the periodontal ligament or pulp. Although the teeth were vital in this particualr case, it was decided to review treatment recommendations for those affected teeth associated with periapical inflammation. Under these circumstances, even though the initiation and progression of external root resorption occurs within the periodontal ligament tissues, a positive treatment result can occur through removal of the pulp. The literature is equivocal, though, in regard to the advantages of a particular canal filling material; recommendations for both conventional gutta percha obturation and calcium hydroxide treatment of the debrided root canal have been made.

Cvek compared the healing frequency for pathologic external root resorption between two groups having nonvital incisors.[15] One group was treated with pulp extirpation and gutta percha fill; the second group received extended calcium hydroxide medication of the canal prior to a final gutta percha obturation. No difference in results between groups could be established (with both groups having very high success rates). Cvek concluded that arrest of external root resorption could be ascribed exclusively to the removal of necrotic pulp tissue rather than the use or non-use of calcium hydroxide.

Frank also recommended conventional gutta percha obturation of the root canal without prior use of calcium hydroxide.[16] This recommendation was made for external root resorption due to a necrotic pulp; Frank did not state, however, whether he would recommend the use of calcium hydroxide in cases with vital pulps.

Gerstein advocates the use of calcium hydroxide in cases of idiopathic external root resorption, and differentiates between this situation (in which the pulp is vital) and situations in which the pulp is necrotic.[17] His rationale is that while calcium hydroxide may not absolutely prevent external root resorption, there is presently no other predictable treatment for this malady. Since dental resorption occurs in an acidic environment, the alkalinity of calcium hydroxide may inhibit external root resorption.

Calcium hydroxide has been used clinically for many years in dentistry for a number of different

problems, but its efficacy has been largely empirical. Recent work by Torneck *et al* may help clarify this situation.[18] They found calcium hydroxide to be mitogenic for the fibroblasts of their pulp cell cultures to such an extent that matrix stimulation can occur and thus allow for enhanced mineralization. This would suggest a mechanism by which the production of dentin and/or cementum could potentially occur. With regard to idiopathic external root resorption, it could be theorized that calcium hydroxide stimulates apical calcific repair and prevents progression of the condition.

This hypothesis was presented and it was hoped that the patient and his parents would agree to the pulp extirpation and calcium hydroxide treatment as a possible means of arresting the progressive nature of the condition. A study comparing baseline and serial posttreatment periapical radiographs (possibly to untreated teeth) could have been designed to test the hypothesis that calcium hydroxide would have had a beneficial effect in this case. However, when the patient and his family considered the numerous factors involved in this treatment (including possible discomfort, frequency and duration of appointments, lack of documented benefit, the large number of teeth possibly requiring treatment, etc.) and compared it to future treatment possibilities or eventualities, they chose to pursue a conservative course rather than an experimental one. The patient and his family evidently concluded that future options were preferable to the disadvantages which they associated with the recommended treatment. Nevertheless, idiopathic external root resorption may be a condition in which pulp extirpation with calcium hydroxide treatment should be a treatment option to be considered in other cases.

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IDENTIFYING RISK GROUPS

When a large number of early caries lesions are recorded, a saliva sample should be taken to determine the numbers of S. mutans and lactobacilli. If these numbers are high, the patient should be given intensive preventive care. In the study previously described, such measures reduced the number of new caries lesions from 8.4 to 0.6 during an observation period of two years.

Krasse, B.: Caries risk.
Chicago: Quintessence books, 1985, p 89.

Assessing chloral hydrate dosage for young children

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Sedation frequently is recommended when comprehensive treatment is performed for young children. Orally administered, chloral hydrate commonly is used because of its wide margin of safety and relatively few adverse effects.[1] Numerous investigators have used different dosage regimens determined by the child's behavior, age or weight.[2-8] Varying degrees of success, however, were obtained. Although the manufacturer recommends a dosage of 50 mg/kg to a maximum of 1000 mg, there is little reported research to substantiate this dosage schedule.[9] Higher doses are frequently necessary in order to achieve an optimum effect.[6-8] Judisch *et al*, for example, used 100 mg/kg to a maximum of 3000 mg without significant adverse effects, when children were premedicated for ophthalmological procedures.[10] Sim reported that the effectiveness of chloral hydrate would be augmented, if supplemented by the administration of nitrous oxide.[11] This study was performed to compare the effectiveness in behavior management of the standard dose of chloral hydrate (50 mg/kg) with a higher dose (75 mg/kg) together with nitrous oxide, when young children were sedated for dental treatment.

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METHODS

Subjects

The subjects consisted of seventeen children, ten male and seven female, ages twenty-one to forty-six months (mean = 31 months, median = 29 months), weighing 11-21 kg (mean = 14 kg), from the clinic of the New Jersey Dental School Department of Pedodontics. The children had no previous dental experience and they were selected because it was determined in a screening examination that they required treatment with sedation at two different appointments.

Medication

At the first appointment, each child was randomly assigned either the high or low dose, and on the second visit, the child received the alternate dose. The chloral hydrate was administered in a disposable syringe that was covered with tape to pre-

vent the operator from knowing the amount of medication being given. The child was restrained while standing with the head tilted back over the lap of the seated operator and the arms held by the parent. The medication was deposited in the back of the mouth in suitable amounts to allow swallowing and prevent spitting. The solution was squirted slowly to avoid aspiration, and occasionally the nostrils were momentarily closed to encourage swallowing. The administration took approximately a half minute and the child was then offered one or two ounces of water to reduce the aftertaste of the medication. On one occasion during the administration, the child expectorated. The medication was collected in a plastic bib covering the patient and measured, and an equal dose was then readministered. Since the weight of the subjects ranged from 11-21 kg (mean= 14 kg), the doses of chloral hydrate ranged from 545 to 1547 mg with a mean of 708 mg for the low doses and a mean of 1062 for the high doses.

Subjects were treated during the morning (9 a.m.) or early afternoon (12 p.m.); however, both first and second appointments were scheduled for the same time of day so that the time of day was consistant with each subject. Similar treatment was planned for each of the two treatment visits. On the treatment day, the parent was instructed to feed the child a light meal consisting of a small glass of milk and a bowl of cereal at least two hours before the appointment. The requirement of some food was made to reduce the possible gastric irritation effect of chloral hydrate. Two hours were allowed to elapse in order to reduce the amount of vomitus if it occurred.

Following the administration of the drug, the child remained with the parent in a quiet area separated from the operator for forty-five minutes during which behavior and onset of sleep (defined as closure of the eyes and lack of visible movement) were evaluated. The child was then carried to the operatory and placed in a Papoose* board without auxiliary head restraint. The precordial stethescope and sphygmomanometer cuff were attached and nitrous oxide/oxygen was administered. A concentration of 40 percent nitrous oxide was administered first, but this was raised to 50 percent if necessary to continue treatment. Whenever possible, operative procedures began fifty minutes after the drug was administered.

*Olympic Medical Group, Seattle, Washington 98109.

Evaluation

Two independent raters who were unaware of the drug dosage evaluated the degree of crying and head or body movements before, during, and after the operative procedures. The raters were both dentists; one was the operator (RS), and the other (MH) was the patient monitor. Blood pressure, pulse and respiration rates were also recorded.

The rating scales used to evaluate sleep, crying and movement of the patient appear in Figures 1, 2 and 3. Figure 4 is a flowchart of the entire experimental procedure, from the time that the chloral hydrate was administered to the discharge of the patient, after three hours. Because vital signs and behavior were evaluated every ten minutes in the operatory, an additional summary evaluation was performed using an overall rating scale (Figure 5).

Data analysis

The experiment was designed so that each subject could serve as his own control, with time of day, operator and type of procedure being relatively

Figure 1. Rating scale for sleep.

Fully awake, alert	1
Drowsy, disoriented	2
Asleep, but easily aroused	3
Deep sleep, difficult to arouse	4

Figure 2. Rating scale for crying.

Hysterical crying that demands attention	1
Continuous mild crying that makes treatment difficult	2
Intermittent mild crying that does not interfere with the procedure	3
No crying	4

Figure 3. Rating scale for movement.

Violent movement, interrupting treatment	1
Continuous movement, making treatment difficult	2
Controllable movement that does not interfere with procedure	3
No movement	4

constant. The dependent variable was the effectiveness of the sedation as measured by the degree to which crying and movement interfered with treatment. The independent variable was the dosage of chloral hydrate. Since the rating scales used the ordinal scale of measurement with related samples, the nonparametric Wilcoxon matched-pair-sign-rank test was used to compare the groups for statistically significant differences.

Figure 5. Rating scale for overall behavior.

Very Bad—treatment interrupted and only partial treatment rendered	1
Bad—treatment interrupted, but eventually all completed	2
Good—moderate crying or movements which did not interrupt treatment	3
Very Good—no crying or movement, or some limited light crying or movement, e.g. during anesthesia or mouth prop insertion	4

RESULTS

Reliability

Rater reliability was calculated as the percent agreement of ratings of the two evaluators, and it was found to be 94 percent.

Sleep

Table 1 indicates the degree of sleep in the reception area, before and after treatment. Nine of the seventeen patients who received the low dose and fourteen of the seventeen who received the high dose fell asleep in the reception area, i.e. within forty-five minutes of receiving the chloral hydrate. Consequently, eight of the patients who received the low dose and three who received the high dose were awake, when brought into the operatory. Of those subjects who fell asleep in the the reception area, the high dose appeared to produce sleep somewhat sooner and to last longer than the low dose. The differences between groups after 30, 45, 120 and 150 minutes, were not statistically significant; however, when all ratings were pooled over all periods, the differences between groups were statistically significant at the 0.5 level (Wilcoxon test, T= 29 for 16 differences).

Waiting time to start treatment

As soon as the child was brought into the operatory, and placed in the Papoose board restraint, nitrous oxide/oxygen was administered; and when the crying movement subsided, local anesthesia was administered. The mean waiting time until operative treatment began was twenty-four minutes for patients who received the low dose and nine minutes for patients with the high dose. In five instances, no treatment was accomplished,

Figure 4. Flowchart of experimental procedures.

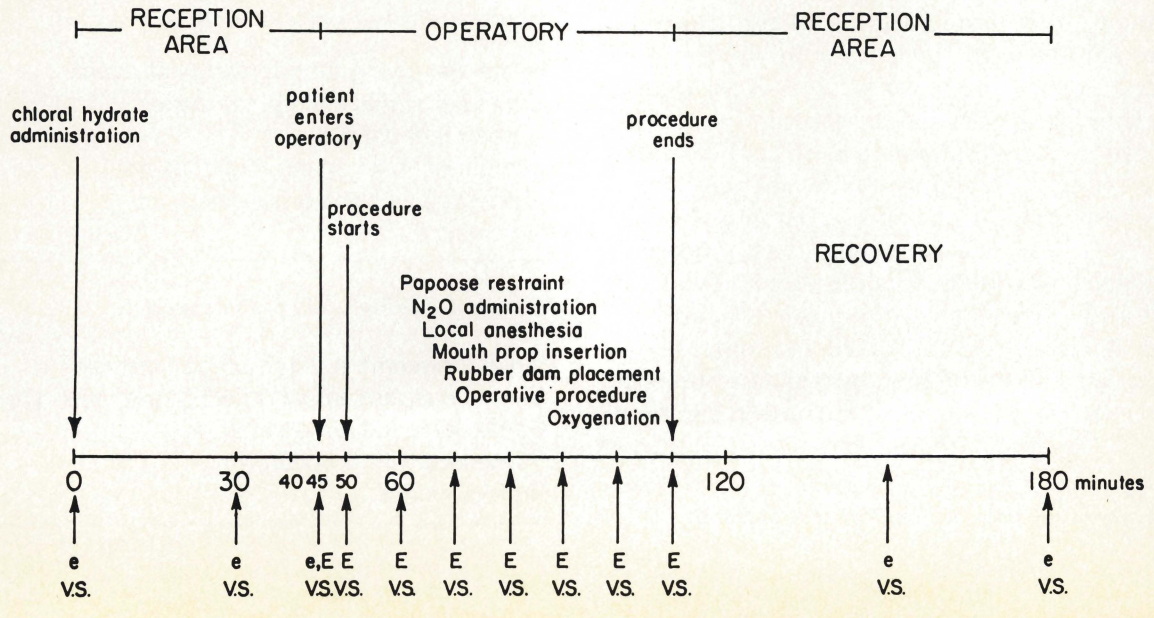

Table 1 □ Ratings of sleep in reception area before and after treatment.

	Time (minutes) from baseline		1 Fully awake	2 Drowsy disoriented	3 Light sleep	4 Deep sleep	Mean rating
Before treatment	30	L	7 (41)*	6 (35)	1 (6)	3 (18)	2.0***
		H	2 (12)**	5 (29)	3 (18)	7 (41)	2.8
	45	L	6 (35)	2 (12)	5 (29)	4 (24)	2.4
		H	1 (6)	2 (12)	5 (29)	9 (53)	3.3
After treatment	120	L	6 (35)	6 (35)	3 (18)	2 (12)	2.1
		H	2 (12)	7 (41)	7 (41)	1 (6)	2.4
	150	L	8 (47)	2 (12)	4 (23)	3 (18)	2.1
		H	2 (12)	2 (12)	12 (70)	1 (6)	2.7
					Summary ratings	L	2.15
						H	2.82

L = Low-Dose group
H = High-Dose group
* = Number of low-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
** = Number of high-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
*** = Average rating of all 17 subjects.

Table 2 □ Ratings of crying at different times in operatory.

		1 Hysterical crying	2 Continuous crying	3 Intermittent crying	4 No crying	Mean rating
Patient brought into operatory	L	6 (35)*	2 (12)	2 (12)	7 (41)	2.6***
	H	2 (12)**	2 (12)	1 (6)	12 (70)	3.4
Drug injection	L	4 (24)	1 (6)	6 (35)	6 (35)	2.8
	H	3 (18)	0 (0)	0 (0)	14 (82)	3.5
During mouth prop insertion	L	10 (59)	2 (12)	0 (0)	5 (29)	2.0
	H	3 (18)	1 (6)	0 (0)	13 (76)	3.4
After 30 minutes in operatory	L	6 (35)	0 (0)	1 (6)	10 (59)	2.9
	H	2 (12)	0 (0)	1 (6)	14 (82)	3.6
				Summary ratings	L	2.57
					H	3.47

L = Low-Dose group
H = High-Dose group
* = Number of low-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
** = Number of high-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
*** = Average rating of all 17 subjects.

because the subjects' behavior was unmanageable. Four of these instances were from the low-dose group and one from the high-dose group.

Amount of work performed

Treatment procedures included extraction, pulpotomy, stainless steel and composite strip crown placement, amalgam and composite restoration and sealant application. Although similar treatment was planned for each visit, approximately half as many procedures were accomplished with the low dose, because of the time required to manage the child.

Evaluation of crying

Table 2 indicates the ratings of crying at different times in the operatory: when the patient was brought into the operatory, during the injection, during the mouth prop insertion, and after thirty minutes in the operatory. The numbers of subjects in the low and high groups receiving each of the four possible rating scores are illustrated, and a mean rating was calculated. At each time interval, subjects in the high-dose group had less, if any, crying than subjects in the low-dose group. An average of the ratings obtained at the four different times indicated that the high-dose group had little, if any, crying (mean rating= 3.47), whereas the low-dose group exhibited intermittent to continuous mild crying (mean rating= 2.57). The differences between low-dose and high-dose groups at various times were not statistically significant; however, when all ratings were pooled over all time periods, the differences between groups were statistically significant at the 0.5 level (Wilcoxon test, T= 18 for 15 differences).

Evaluation of movement

Table 3 indicates the ratings of movement at the

Table 3 □ Ratings of movement at different times in operatory.

		1 Violent movements	2 Continuous movement	3 Controllable movement	4 No movement	Mean rating
Patient brought into operatory	L	6 (35)*	1 (6)	3 (18)	7 (41)	2.6***
	H	2 (12)**	0 (0)	2 (12)	13 (76)	3.5
During injection	L	4 (24)	1 (6)	6 (35)	6 (35)	2.8
	H	3 (18)	1 (6)	0 (0)	13 (76)	3.4
During mouth prop insertion	L	11 (65)	0 (0)	1 (6)	5 (29)	2.0
	H	3 (18)	1 (6)	0 (0)	13 (76)	3.4
After 30 minutes in operatory	L	6 (35)	0 (0)	0 (0)	11 (65)	2.9
	H	2 (12)	0 (0)	1 (6)	14 (82)	3.6
				Summary ratings	L	2.57
					H	3.48

L = Low-Dose group
H = High-Dose group
* = Number of low-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
** = Number of high-dose group receiving this rating (total possible = 17). Bracketed number = percent of total.
*** = Average rating of all 17 subjects.

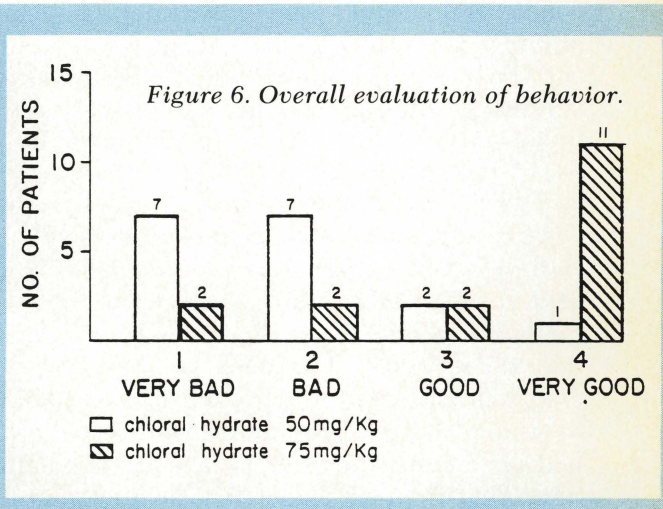

Figure 6. Overall evaluation of behavior.

same times that crying was evaluated. The numbers of subjects in the low and high groups receiving each of the four possible rating scores and the mean of all ratings are indicated. At each time period, subjects in the high-dose group appeared to move less than subjects in the low-dose group. The average of the mean ratings indicated that the high-dose group appeared to have little, if any, movement (mean rating= 3.48), whereas the low-dose group exhibited intermittent to continuous controllable movements (mean rating= 2.57). The differences between low-dose and high-dose groups at the various times were not statistically significant; however, when all ratings were pooled over all time periods, the differences between groups were statistically significant at the 0.5 level (Wilcoxon test, T= 21.5 for 15 differences).

Overall evaluation

Figure 6 illustrates the overall evaluation of behavior. Of the seventeen administrations of the low dose, 82 percent were rated bad or very bad; whereas with the high dose administration, 75 percent were rated good or very good. These differences were statistically significant at the 0.5 level (Wilcoxon test T= 0 for 14 differences).

Effects of nitrous oxide

Nitrous oxide was first administered in the concentration of 40 percent, and then raised to 50 percent, if necessary to continue treatment. The concentration of 40 percent was not adequate in any of the instances of low-dose administration and for three of the seventeen high-dose administrations. Consequently, all low-dose administrations were supplemented with 50 percent nitrous oxide. In order to assess the role of nitrous oxide on the effect of the premedication, all subjects were closely monitored toward the end of the procedure, when oxygen was increased to 100 percent. In all instances, the patients woke up looking for their parents. One patient premedicated with a high dose of chloral hydrate woke up and cried, twenty minutes after initiation of the operative treatment. It was then determined that the hose had become disconnected, and after reconnection, the patient fell asleep within one minute and remained asleep until the end of the procedure.

Vital signs

The vital signs of the patients remained essentially unchanged throughout all treatments, with the exception of a transitory elevation of the pulse rate when there was a major stimulus: For example, mouth prop insertion or local anesthesia administration. The increase in pulse rate was more pronounced in the group receiving the low dose of chloral hydrate (mean pulse rate increase= 31) compared with the high-dose group (mean pulse rate increase= 15). These changes, however, returned to normal as soon as the stimulus was discontinued. Baseline values averaged 110 for pulse, 28 for respiration, and 110/75 for blood pressure.

Adverse effects

The only adverse effects of the premedication were four instances of vomiting. One patient vomited five minutes after administration, and since it was subsequently learned that the patient had eaten a large breakfast, the child was discharged and rescheduled. Two other instances of vomiting occurred in the same patient during the operative treatment with both the high and low doses of the drug. The procedure was continued with the appropriate treatment performed. Although earlier denied, it was learned that the patient had eaten within an hour before receiving premedication. This was contrary to instructions given to parents that only a light meal, no less than two hours before the appointment, was permissible. A third patient vomited twenty minutes post-drug administraion and, since it was not known how much of the drug had been absorbed, the patient was excluded from the study, although treatment was still completed.

One other patient was excluded from the study following breathing difficulties manifested after rubber dam placement. It was determined that the patient was unable to breath through the nose because of enlarged adenoids. The rubber dam was then removed and treatment continued. The patient was dropped from the sample, however, as it was then no longer possible to evaluate the effects of the drug supplemented with nitrous oxide.

DISCUSSION

The results of this study demonstrate that a dose of 75 mg/kg of chloral hydrate, when supplemented by 40 percent nitrous oxide analgesia, provided better sedation than a dose of 50 mg/kg and 50 percent nitrous oxide. The greater effect of the higher dose became evident when the degrees of sleep, crying and movement were evaluated, in addition to the amount of work accomplished at each dosage level. Although statistically significant differences between the two groups were not evident at particular times, the differences in the pooled ratings were statistically significant at the .05 level.

In almost half of the high-dose group, the dose exceeded the manufacturer's recommended limit of 1000 mg. Vital signs, however, were essentially unchanged and no adverse effects were observed.

There were only four instances of vomiting and, in these cases, the patients had not followed the recommended preoperative eating instructions. A light breakfast, no less than two hours before the appointment, appeared to be adequate to reduce gastric irritation of the drug.

Nitrous oxide was employed in this study, because it is currently used by many pedodontists.[1,11] Its effect was to augment the sedation of the chloral hydrate and, consequently, the nitrous oxide probably obscured some of the differences between the two dosage levels. If nitrous oxide had not been used, greater differences in the effectiveness of the two dosage levels would have been evident.

The finding of such low effectiveness of the low dose was rather unexpected. Since much of the lack of effectiveness was due to movement of the child, it is possible that the use of the special head restraint together with the Papoose board would have increased the effectiveness of the low dose of the drug. Nevertheless, without the head restraint, the high dose of the drug provided substantially better effect than the low dose.

CONCLUSION

The results of this study demonstrate that a dose of 75 mg/kg of chloral hydrate supplemented by nitrous oxide is superior to the dose of 50 mg/kg for behavior management, when young children are sedated for dental treatment. Additional clinical studies should be performed to examine the sedation effects of both doses of chloral hydrate without nitrous oxide supplementation. Studies should also be performed to examine the influence of the Papoose board restraint.

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The procedures, possible discomforts or risks, and possible benefits were explained fully to the parents of human subjects involved, and their informed consent was obtained prior to the investigation.

Case reports

Clinical management of multiple maxillary anterior supernumerary teeth: Report of case

John Folio, DDS, MS
Zale H. Smilack, DDS
Michael W. Roberts, DDS, MScD

The presence of supernumerary, or supplemental, teeth has been reported to occur in 0.3 percent to 3.8 percent of the population, and are most often found in the maxillary anterior segment.[1-4] Multiple supernumerary teeth occur in 14 percent of these cases.[5] A conically shaped supernumerary tooth located in the palate near the maxillary midline is referred to as a mesiodens. They may be single or multiple in number and often are inverted. A supernumerary tooth that has an essentially normal appearing crown but a rudimentary root is termed a tuberculate type.[6]

Not all supernumerary teeth present pathologic or orthodontic manifestations. However, complications can be associated with them, including impaction of the maxillary incisors, crowding, oronasal fistulas and follicular cysts with associated destruction of bone and root resorption of adjacent teeth.[7]

Generally, early removal of supernumerary teeth is recommended. However, the surgical procedure can usually be deferred until the child is six to seven years of age, unless the extraneous

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teeth are interfering with normal dental eruption or cyst formation is evident. A supernumerary tooth can result in ectopic or delayed eruption of the permanent tooth and may necessitate orthodontic therapy even with early surgical intervention.

CASE REPORT

A seven-year, five-month-old Caucasian male was referred to the National Institute of Dental Research Dental Clinic with a diagnosis of multiple supernumerary teeth and an impacted permanent right maxillary central incisor. The child's physical development was within normal limits and the medical history was unremarkable.

Dental development

Initial findings included an Angle's class II molar tendency with normal overjet and overbite. The maxillary left permanent central incisor was completely erupted and a mesiodens was visible clinically in the midline. The permanent maxillary right central incisor was unerupted. Radiographic examination revealed three supernumerary teeth and an impacted right maxillary central incisor. Two of the supernumerary teeth were conical (mesiodens); one was erupted and the other unerupted and inverted. The third supernumerary tooth was of the tuberculate type and the primary cause of the impaction of the permanent right central incisor (Figure 1, A and B).

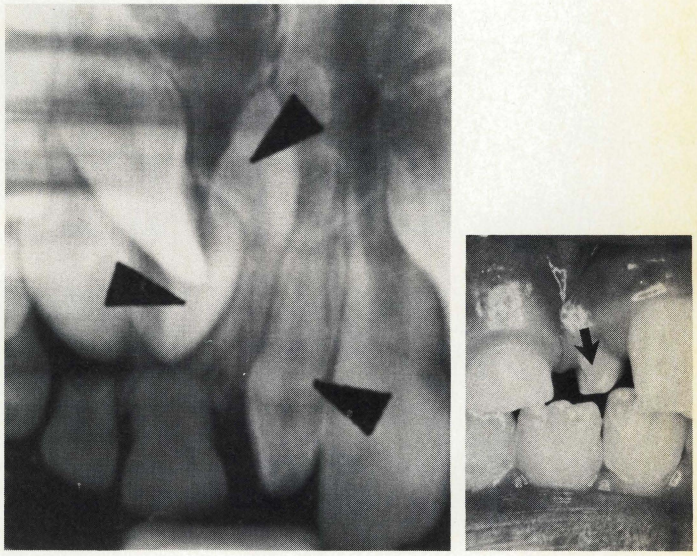


Figure 1, A and B. The patient as seen on initial examination. One supernumerary is partially erupted but all three are evident on the radiograph (arrows).

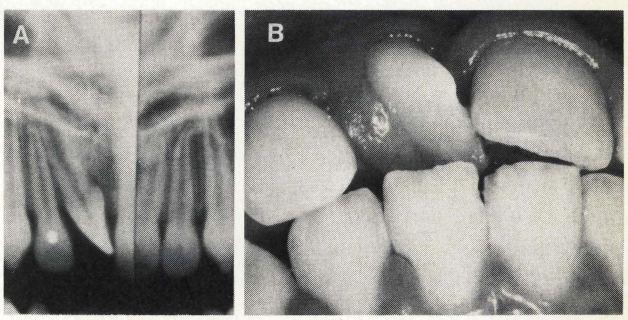


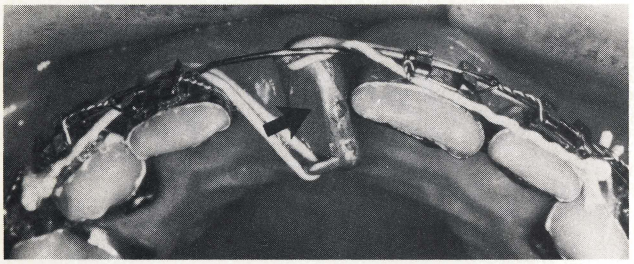
Figure 2, A and B. Four and a half years after initial examination and extractions. The impacted right maxillary central incisor has erupted but is severely tipped and rotated.

Clinical management

The patient was sedated with meperidine and promethazine hydrochloride and a local anesthetic was administered. The primary right maxillary central and lateral incisors and the erupted mesiodens were extracted. The two impacted supernumerary teeth were surgically removed and the crypts curetted before replacing the mucoperiosteal flap. An acrylic splint was not necessary due to excellent palatal tissue adaptation. Healing was uneventful.

A maxillary removable appliance was provided to maintain space for the unerupted right maxillary central incisor. The eruption path and progress of the impacted tooth were observed periodically in radiographs. Three years and eight months after surgery, the impacted right central incisor had continued to erupt but had not become clinically evident. Orthodontic headgear therapy was initiated to alleviate the Angle's class II tendency. Five months later the impacted central incisor erupted into the oral cavity but was severely tipped and rotated (Figure 2, A and B). Leveling and alignment of both arches were begun with full fixed orthodontic appliances, but the partially erupted and malpositioned incisor did not permit the use of a stock band or direct-bond bracket. A custom cast coping with two loops was prepared

Figure 3. A cast gold coping (arrow) with loops provided anchorage for torquing forces to rotate the partially erupted incisor.



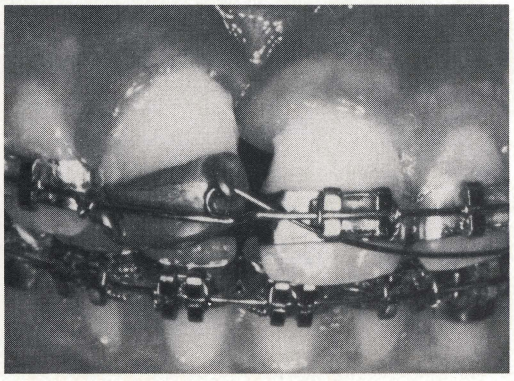


Figure 4. Piggy-back wire aided eruption of the central incisor.

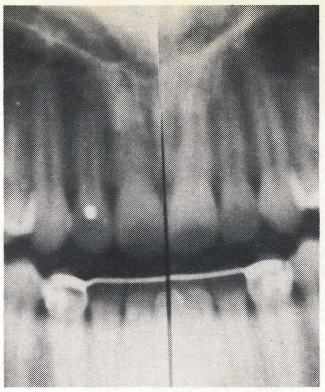


Figure 5. Radiographic appearance after eighteen months of orthodontic therapy. The excellent alignment is stabilized by a fixed mandibular holding arch.

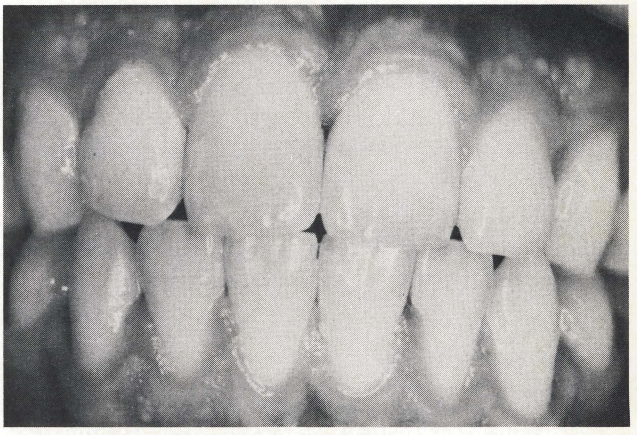


Figure 6. Clinical appearance four years out of retention.

and cemented over the incisal edge of the right central incisor in order to obtain adequate initial retention and leverage (Figure 3). Using piggy-back .014 wire to the full maxillary .020 arch wire, the incisor was brought into the arch within three months (Figure 4). The appliances were removed after eighteen months of active orthodontic therapy and a maxillary removable retainer and a mandibular fixed canine retainer were placed (Figure 5).

DISCUSSION

The presence of a supernumerary tooth should be suspected, if there is a significant delay in the eruption of a maxillary incisor after the contralateral one has appeared. The impacted tooth may erupt into the oral cavity without extensive orthodontic treatment, if the supernumerary is removed early.[8] However, there may be a diminution of eruptive force, if the root of the permanent incisor is complete or nearly complete.[4]

Frequently, there is a discrepancy between the gingival height of adjacent teeth and an impacted tooth when it is brought into the arch. However, in this case the gingival crest was established at approximately the same as the adjacent teeth (Figure 6). Adequate space maintenance and conservative care promoted this result. The impacted central incisor was allowed to erupt through the attached gingiva without applying complex orthodontic forces while the tooth was submerged. Light forces have been shown to be more effective than heavy ones in moving partially erupted teeth, and in encouraging desired gingival position and contour.[9]

SUMMARY

Supernumerary teeth in the maxillary midline can present both esthetic and pathologic concerns that can be difficult to solve.[10] The frequency with which supernumerary teeth occur justifies an oral radiographic survey for preschool children as early detection is most important, if such complications are to be avoided or minimized.[11]

The case presented in this report required both surgical and innovative orthodontic therapy to bring an unerupted, impacted maxillary central incisor into proper alignment. The tooth was moved into the dental arch and injury to the root structure and surrounding oral tissues was

avoided by using a combination of conservative surgical and orthodontic therapy.

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DIRECT PULP CAPPING

This study showed a five-year survival rate of 82 percent when direct pulp capping was done in asymptomatic teeth exhibiting small incisal or occlusal exposures. No statistical difference in success rate was observed between groups where the exposures were made through intact or through carious dentine. Thus, direct capping may appear to be an alternative to more radical treatments in both cases.

Older teeth showed a slightly lower survival rate compared with younger teeth when longer observation periods were considered. Also, survival rate of premolars was slightly reduced compared with molars. This indicated that the age of the patient and the type of tooth have to be considered when prognosticating direct capping of the individual tooth, but neither age of patient nor type of tooth precluded direct capping.

Horsted, P. *et al:* A retrospective study of direct pulp capping with calcium hydroxide compounds. Endodont Dent Traumatol, 1:29-34, February, 1985.

A simplified treatment for correcting an ectopically erupting maxillary first permanent molar

John N. Groper, DDS, MS

Ectopic eruption is a developmental disturbance in the eruption pattern of the permanent dentition. Although it can occur with any tooth, according to published reports, the tooth most commonly involved in this aberration of development is the maxillary first permanent molar.

Bayardo, Grandel, and Milos described normal eruption of the maxillary molar as follows, "during the initial stage of eruption of the upper first permanent molar, the tooth has marked distoaxial inclination with the crown in a position posterior to the roots. Gradually, as eruption continues, the distal inclination decreases and the tooth assumes a more vertical position, depending on the bone apposition on the tuberosity of the maxilla. When ectopic eruption of a first permanent molar is evident, an abnormal mesioangular eruption occurs even in the initial stage. Consequently, a premature, atypical resorption of the second primary molar occurs, and the first permanent molar becomes completely or partially impacted above the prominence of the crown of the primary molar."[1]

REVIEW OF THE LITERATURE

Descriptions of ectopic eruption of the maxillary first permanent molar first appeared in the dental literature in 1923.[2] Since that time many case reports, treatment techniques and etiologic factors have been reported. The most comprehensive study on the subject was one by Pulver in 1968.[3] He concluded that:

- ☐ There is no apparent sex difference nor a preference for left or right side.
- ☐ Ectopic eruption prevalence is about 3.1 percent.
- ☐ The cause of ectopic eruption of the maxillary first permanent molar is a combination of factors:
  - ▫ Larger than normal mean-sizes of all maxillary primary and permanent teeth.
  - ▫ Affected first permanent molars and second primary molars are relatively larger.
  - ▫ Maxillae tend to be small.
  - ▫ The maxilla is positioned more posteriorly in relation to the cranial base than in normal cases.
  - ▫ Abnormal angulation of the path of eruption of the maxillary first permanent molar.
  - ▫ Delayed calcification of the affected first permanent molar, in some instances.

Treatment

The problem of ectopic eruption is usually detected during radiographic examination. In some instances it has been reported the patients experi-

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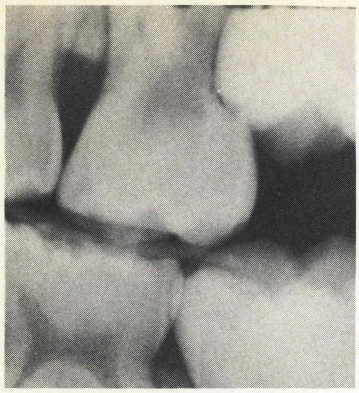

Figure 1. A radiograph of the ectopically erupting maxillary first molar.

ence discomfort; while in others, the condition apparently causes no discomfort.[3-6]

Several methods of treatment have been reported, for example:

- ☐ Extraction of the second primary molar.
- ☐ Reduction of the distal surface of the crown of the second primary molar.
- ☐ Moving the first permanent molar distally by the use of a brass separating wire.[7]
- ☐ The use of separating springs (T.P. Laboratories) and Sep-Clips (DCA).[8]
- ☐ The use of separating elastics.[9]
- ☐ The use of a combination of wire, elastic chain and an occlusal button.[10]
- ☐ Banding the second primary molar and using a wire with a helical bend or a single "S" loop, soldered to the band, to extend distally to engage the first permanent molar. (To engage the first permanent molar and to hold the free end of the wire "fixed", Humphrey inserted the tip of the wire into a small preparation in the central pit of the permanent molar.)[11]
- ☐ Banding the second primary molar and using a wire soldered to the band. The free end of the curved wire is bonded to the occlusal surface of the ectopically erupted tooth.[12]
- ☐ A band to which buccal and lingual helical springs of .018 wire have been soldered is cemented on the second primary molar. The free ends of the two springs engage a concavity created within a composite resin tag which was added to the occlusal surface of the ectopically erupting first permanent molar.[13]
- ☐ Using a twist orthodontic wire and an open coil spring attached between edgewise brackets, one of which is soldered to the buccal surface of the second primary molar band and the other is bonded to the buccal surface of the ectopic first permanent molar.[14]

CASE REPORT

The patient was a healthy seven-year-old white girl. The occlusal third of the maxillary right first permanent molar was clinically visible. The maxillary right second primary molar was vital, and some mobility was present. The patient had experienced no pain or discomfort. The ectopic eruption of the first permanent molar was confirmed radiographically and extensive resorption of the distobuccal root of the second primary molar was observed (Figure 1).

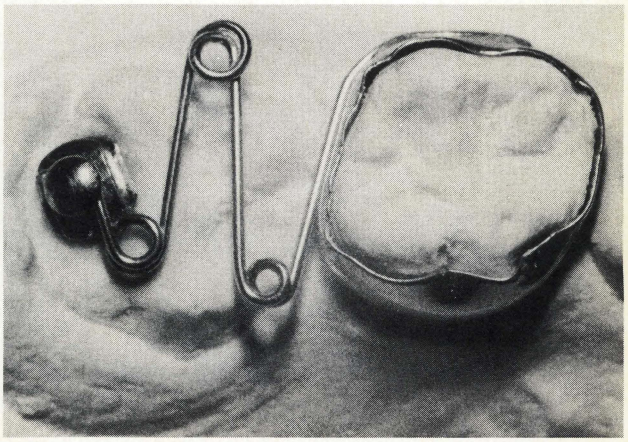

Figure 2. A model showing the appliance in its correct position.

The teeth were in a class I relationship, and a mixed-dentition analysis revealed an arch-length discrepancy.

Treatment consisted of adapting a stainless steel band to the maxillary right second primary molar. A flat lingual pad with button (Ormco) was then bonded to the exposed occlusal surface of the ectopic first permanent molar. An alginate impression was taken with the band and button in place, and poured with fast-set plaster. A double helical wire was made. One end of the wire was soldered to the band, and the free end of the wire was shaped to engage the undercut of the button. Before the appliance was placed in the mouth, the helical wire was adjusted to exert a distal force against the ectopic first permanent molar (Figure 2).

The patient was seen in two weeks for a radiograph and observation of the area. Although some movement of the ectopic permanent molar was noted, there was not enough to clear the distal portion of the second primary molar. The helical spring was disengaged from the occlusal button, adjusted to exert more pressure, and again placed in the undercut of the button.

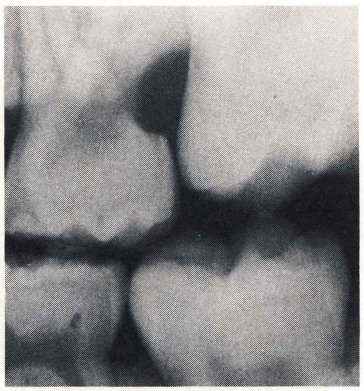

Figure 3. A six-month posttreatment radiograph of the corrected condition.

Three weeks later, the mesial portion of the permanent molar had cleared the distal portion of the second primary molar and the appliance was removed (Figure 3).

DISCUSSION

When a free end wire is used to move an ectopically erupted molar distally, the problem one encounters concerns the stabilization of the wire so that it can exert enough pressure to move the ectopically erupting tooth. With the exception of the approach devised by Rust and Carr, who utilized brackets to stabilize the wire, most of the newer techniques rely upon some type of bonding to fixate the free end of the wire. In this paper, a technique was described that utilized a bonded button to engage the free end of the wire. This technique has one major advantage over the others. By not bonding the free end of the helical wire to the fixed button, the wire can be removed from the button to facilitate adjustment. The adjusted wire can then be replaced against the button, where it is firmly held by the pressure of the spring.

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DIET AND PERIODONTAL DISEASE

Periodontal tissues, as all body tissues, are dependent on utilization and absorption of the nutrients obtained in a balanced diet. No cause-and-effect relationship between specific nutrients and periodontal disease has been adequately shown in humans. The periodontist, however, is vitally concerned with epithelial keratinization, vascular integrity, osteogenesis, wound healing, and tissue repair—all of which are directly related to nutrition at the cellular level.

Fedi, P.F.: The periodontic syllabus.
Philadelphia: Lea & Febiger, 1985, p 22.

Mandibular buccal infected cyst in a six-year-old girl: report of case

Georgina M. Trask, DDS, MSD
Barbara L. Sheller, DDS
Thomas H. Morton, Jr., DDS, MSD

A six-year-old Caucasian female presented to the dental office for examination. According to the patient's mother, the reason for the dental appointment was a "sore and swollen jaw." The medical history reported was that of a well child with no systemic disease or hospital admissions. She was within the normal range for age, height, weight and physical development.

The child was treated by a physician for a streptococcus infection of the throat, two weeks before the dental examination. The patient first reported a sore jaw and her mother noticed a swelling of the left jaw when the sore throat began. The physician advised the patient's mother not to worry about the jaw swelling, it would "go away." Subsequent treatment with penicillin resolved the throat infection and aching of the jaw, and the swelling decreased.

There was no history of trauma to the head or face of the patient. The child had never been examined or treated in a dental office before presenting with this condition.

Clinical examination revealed the following:

- ☐ Marked asymmetry in the left mandibular angle area (Figure 1).
- ☐ Slight, firm swelling localized to the distobuccal aspect of the mandibular left first permanent molar and palpable both intraorally and extraorally.
- ☐ Low-grade pain response to palpation of the swelling.
- ☐ Caries-free teeth with normal morphology.
- ☐ Vital response to thermal and electrical pulp testing.
- ☐ Gingival condition within normal range.
- ☐ Periodontal probings of 6 mm on the lingual surface and ranging from 5 mm at the mesiobuccal to 12+ mm at the distobuccal of the left mandibular first permanent molar.
- ☐ Hypersensitive response to percussion of the left first permanent molar.

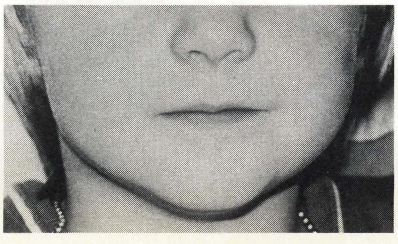

Figure 1. Clinical appearance of patient upon presentation for dental care: unilateral enlargement in left mandibular angle area.

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Dr. Sheller is a pedodontist and graduate student in orthodontics, University of Washington.
Dr. Morton is an Associate Professor in the Departments of Oral Biology and Oral Medicine, University of Washington School of Dentistry, Seattle, WA.

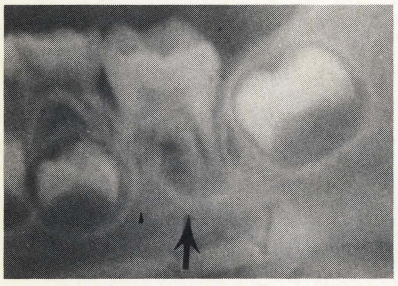

Figure 2. Cropped from panoramic radiograph. Radiolucency extends from mesial roots of mandibular first permanent molar to crypt of developing second molar.

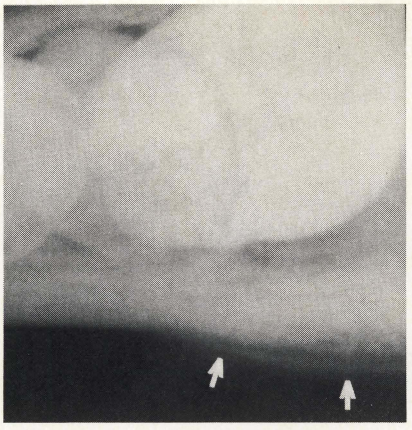

Figure 3. Cropped occlusal radiograph. Laminated "onion skin" bone formation (arrows) is evident on the buccal surface of the mandible.

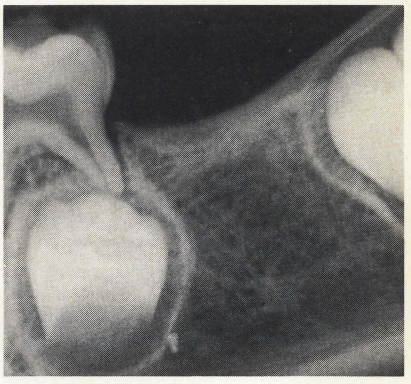

Figure 4. Osseous remodeling demonstrated in periapical radiograph taken nine months post-surgery.

RADIOGRAPHIC EXAMINATION

Findings in a panoramic radiograph were within normal range, with the exception of the mandibular first molar area on the left side. A radiolucency involving the root furcation extended from the distal surface of the mesiolingual root of the first molar, involved the entire distal root and extended distally to the crypt of the developing second molar. The cortex of the crypt wall was attenuated. The periodontal membrane (PDM) of the mesiolingual root was widened distally; the PDM of the distal root was widened mesially and distally. The inferior irregular concave border of the lesion was delineated by a thin layer of cortical bone (Figure 2).

On occlusal view there was evidence of laminated periosteal formation of new bone, well-formed layers of new bone separated from the surface of the jaws and from each other by radiolucent spaces. The inferior cortex of the mandible was without evidence of abnormality. Lingual displacement of the first molar resulted in its apex approximating the lingual cortex of the mandible. The buccal surface of the tooth was denuded of bone (Figure 3).

TREATMENT

The mandibular first permanent molar was extracted. A cystic lesion was curetted and the 1.0 x 0.6 x 0.7 cm specimen sent for histologic analysis. Nine months post-surgery, the site shows evidence of normal healing (Figure 4).

HISTOLOGIC EXAMINATION

Histopathologic examination revealed an inflamed cyst lined by stratified squamous epithelium, focally exhibiting inflammatory hyperplasia (Figure 5). The inflammatory infiltrate was mixed and local epithelial degeneration was noted. No bacterial forms were found. Histologic findings were consistent with the inflamed (infected) buccal cyst.

DISCUSSION

As described by Stoneman and Worth the unique characteristics of a mandibular infected buccal cyst are:

- ☐ The young age of the patient.
- ☐ Involvement of a caries-free, vital mandibular molar.
- ☐ Buccal periostitis.
- ☐ Radiographic preservation of the continuity of the apical lamina dura.[1]

The differential diagnosis in such cases also includes the lateral periodontal cyst. A lateral periodontal cyst was ruled out in this case, because its common features are:

- ☐ Location in the canine-premolar region.
- ☐ Occurrence after age twenty.
- ☐ Absence of clinical symptoms.[2]

The etiology of the mandibular infected buccal cyst is unknown. Both an inflammatory stimulus and a source of epithelium must be accounted for. Localized inflammation may occur as a tooth erupts through the oral epithelium. Stoneman and

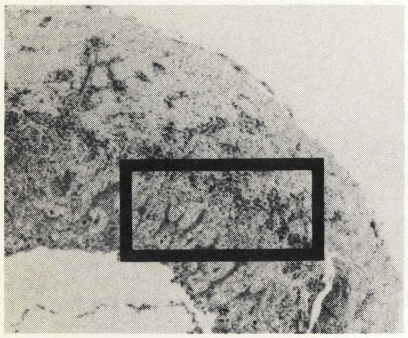

Figure 5. Low-power photomicrograph demonstrating inflamed cyst lined by stratified squamous epithelium. (Hematoxylin and eosin stain. Magnification, x20.)

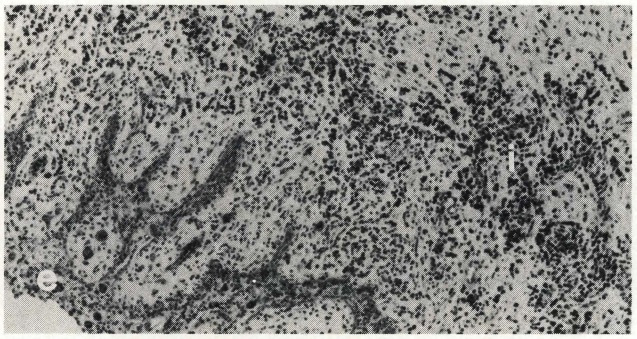

Figure 6. Mixed inflammatory infiltrate (i) and epithelial degeneration (e). (Hematoxylin and eosin stain. Magnification, x40.)

Worth postulate that the epithelium could be derived from the cell rests of Serres, the cell rests of Malassez, or the epithelial cuff, which migrates to cover the cementum apical to the cementoenamel junction.[1] The cyst may also represent an infected dentigerous cyst that persists after eruption.

It seems worthy of comment that the patient was initially examined by a physician and advised "not to worry" about the swelling. This clinical entity has not been widely reported in the medical or dental literature. The mandibular infected buccal cyst should be included in the differential diagnosis for children with painful swellings in the mandibular molar area.

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PREPUBERTAL PERIODONTITIS

Severe forms of periodontitis are known to occur in children whose antibacterial defenses are impaired. For example, children with blood dyscrasias, such as neutropenia, agranulocytosis, or aplastic anemia, develop severe periodontal infections leading to tooth loss. In these cases the marked depression of the white blood cell population disrupts the delicate balance between the host's antibacterial defenses and microbal assaults. The result is the transformation of what would be relatively benign cases of gingivitis into highly destructive local infections.

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Nutrition

A review of the symposium "Diet and behavior—multi-disciplinary evaluation"

Diane H. Morris, PhD, RD
A. Harold Lubin, MD

In the broadest sense, behavior can be defined as the response of an organism to its environment. For an organism as developmentally sophisticated as a human being, the nature of these responses is complex and often poorly understood. One factor that has the potential to affect human behavior is diet, which includes the variety, pattern, quantity and combination of foods and beverages consumed.

Because the relationship between diet and behavior is an emerging area of scientific investigation and public concern, a symposium "Diet and Behavior: A Multidisciplinary Evaluation" was sponsored by the American Medical Association, the International Life Sciences Institute and The Nutrition Foundation, Inc., on November 27-29, 1984 to:

- ☐ Examine the existing data related to the effect of diet on behavior;
- ☐ Discuss and evaluate methodologies for the assessment of behavior, nutrient intake and their interactions; and
- ☐ Recommended strategies for improving research related to diet and behavior.

This report reviews the major issues discussed in the symposium's three sessions.

American Medical Association, 535 North Dearborn Street, Chicago, IL 60610

EFFECTS OF FOODS AND NUTRIENTS ON BRAIN FUNCTION

The brain consists of a vast network of neurons that communicate with each other via the release of neurotransmitters; the integration of this network, along with the spinal cord, forms the central nervous system and produces the complex phenomenon called behavior.[1,2] As many as forty compounds that function as neurotransmitters have been identified. Most neurotransmitters are nitrogenous compounds derived from dietary protein.[3]

Numerous factors may affect neurotransmitter synthesis, including the availability of precursor compounds from the diet and thus from the bloodstream, the availability of vitamins and minerals for use as cofactors in biosynthetic processes or in the conduction of nerve impulses, and the control of nutrient and precursor transport across the blood-brain barrier by special transport systems.[1,3,4]

Neurotransmitter synthesis may also be affected by the profile of plasma amino acids. In feeding studies with rats, a high-carbohydrate meal triggered the secretion of insulin, which lowered the blood levels of other large neutral amino acids relative to tryptophan, allowing more trytophan to cross the blood-brain barrier and result in increased brain serotonin synthesis.[5] A high-protein meal had the opposite effect.[6] Thus, for serotonin, physiologic changes in brain substrate (i.e., tryptophan) levels influence the synthesis of these neurotransmitters. Whether other neurotransmitters are affected by the profile of plasma amino acids is not known conclusively at the present time.[1]

EFFECTS OF FOODS AND NUTRIENTS ON BEHAVIOR

Existing knowledge indicates there is an effect of foods and nutrients on several specific behaviors.

Sleep

According to Dr. Ernest Hartmann of Tufts University School of Medicine, the administration of tryptophan at levels of 450-600 mg/kg to rats reduced sleep latency (time to sleep). In humans, tryptophan administration to normal subjects or persons with medical or psychiatric problems or with severe insomnia produced inconsistent results; persons with mild insomnia, however, generally showed a positive response to tryptophan administration.[7]

In his study of sleep behavior in twenty healthy, full-term infants, Dr. Michael Yogman, Harvard Medical School, reported that infants fed a modified formula containing tryptophan entered quiet and active sleep phases sooner than they did after being fed a commercial infant formula.[8]

The limited research available indicates that when administered in therapeutic doses, tryptophan may affect sleep patterns in some individuals. It is not known whether human sleep patterns are affected by tryptophan as a normal constituent of a typical meal.

Alertness and performance

Dr. Bonnie Spring, Texas Technical University, has studied the effects of carbohydrate (CHO) and protein (PRO) "meals" (actually, single-food items) on alertness and performance. Subjects were given either a high-PRO meal (trimmed turkey breast) or a high-CHO meal (sherbet). The subjects, particularly females, felt less alert after the CHO than the PRO meal. Older subjects who ate the high-CHO meal for lunch showed impaired concentration on a test of sustained selective attention compared to those who ate the high-PRO meal.[9]

The effects of meal size and composition on post-lunch performance were reviewed by Dr. Angus Craig of the University of Sussex, England. Dr. Craig reported that the reduction in mental efficiency after lunch appeared to be greatest when a heavy, three-course meal of about 1,000 kilocalories was consumed. This was particularly true if the subject wasn't used to a large meal at lunch. Small, balanced mid-day meals appeared to favor optimum performance and mental efficiency. [1] Meal composition and size may affect mental alertness and performance.

HYPERACTIVITY

One of the first reports of a relationship between the consumption of sugar products and hyperactivity was published in 1980 by Dr. Ronald Prinz of the University of South Carolina.[10] At the symposium, Prinz presented the results of a later pre-

liminary study of ninety-one non-hyperactive boys aged four and a half to five and a half years. Based on an analysis of seven-day food records, the boys were divided into high-sucrose and low-sucrose intake groups and were given a behavioral test designed to measure attentional performance. Dr. Prinz reported that the boys with a high-sucrose intake scored lower, indicating a poorer attentional performance than boys with a low-sucrose intake.

The results of several sucrose challenge studies were also presented. Dr. Bruce Ferguson, at Carleton University, studied eight children who were described by their parents as being "sugar responders." The children were given sucrose and aspartame at low, medium and high "doses" and then assessed on a variety of cognitive and behavioral tests. Dr. Ferguson reported that sucrose and aspartame had no effect on behavior or cognitive performance.

Dr. Judith Rapoport with the National Institutes of Mental Health also studied children who were described as "sugar responders" by their parents. Following the administration of glucose, sucrose, and placebo (saccharin) challenges, twenty-one children were given a five-hour behavioral tolerance test. Dr. Rapoport reported that the children were less active following the sugar than the saccharin challenges. In a study of thirty-eight hyperactive children given sucrose, fructose and aspartame in an orange drink, Dr. Keith Conners at the National Medical Center reported that sucrose and fructose decreased activity levels. Aspartame had no effect on activity levels.[1]

Hence, results of the challenge studies suggest that sucrose ingestion does not aggravate hyperactivity or contribute to learning or behavioral problems in children. The data cited on alertness suggests sugar ingestion actually makes children sleepy.

Criminal behavior

Within the correctional community, the belief that violent, aggressive behavior can be controlled by diet is gaining acceptance. The major hypotheses proposed for a diet-criminal behavior link include hypoglycemia, cerebral allergies and addictions, vitamin and mineral deficiencies, environmental contaminants and neurotransmitter imbalances.[11,12] Few reliable tests of these hypotheses have been published.

Dr. Matti Virkkunen with the Helsinki University Central Hospital, Finland, has studied the response of habitually violent offenders and psychiatric personnel to the five-hour oral glucose tolerance test (OGTT). He reported that the violent offenders had a more severe and longer-lasting hypoglycemic response to the OGTT than the psychiatric personnel did.[13,14]

These studies have been criticized because the criteria for defining hypoglycemia were not clearly established, violent symptoms were not reported during the OGTT at the time of the glucose nadir; and the offenders were usually long-term alcohol users, a fact expected to influence the OGTT outcome.

There is no evidence that diet causes criminal behavior. Most studies to date in this area have been seriously flawed.[15] Dr. Simon Young at McGill University speculated that persons predisposed to impulsive aggression may be affected by tryptophan administered at therapeutic levels but cautioned that it is not known yet how aggressive behavior may be influenced by diet.[1]

STRATEGIES FOR IMPROVING RESEARCH

Several strategies for improving research in the diet and behavior area were presented at the symposium:

Adopt an interdisciplinary approach

Because both variables (diet and behavior) are exceedingly complex, it is necessary to employ a multidisciplinary team in the development, design and implementation of research in this area. Experts from such disciplines as nutrition, biochemistry, psychology, psychiatry, biostatistics, endocrinology, epidemiology, and/or other fields will need to be actively involved in all phases of diet and behavior research.

Evaluate nutritional controls in both animal and human studies

To ensure appropriate nutritional control in diet and behavior studies, several issues should be carefully evaluated, including the nutritional adequacy of the diet; the nutritional, physiological and metabolic consequences of dietary modifications; the appropriateness of feeding procedures; the selection of appropriate control groups; the significance of individual variability in response

to diet; and the implications of treatments that have adverse effects on health or physical well-being.

Evaluate and standardize methods for measuring behavorial responses

It is essential that the method or task used in measuring behavioral changes be capable of detecting effects of diet or nutrients on behavior and provide an accurate and reproducible measurement of the behavioral response. A standardized task should provide reliability, stability, validity and accessibility.

Improve study designs

Studies of the effects of diet on behavior should involve a multidisciplinary approach. Study protocols should reflect the appropriate use of sampling techniques, control groups, statistics, double-blind procedures, placebo, minimizing variables, and standardized evaluations. Careful interpretation of research findings is essential.

CONCLUSION

In summarizing the papers presented at the Diet and Behavior Symposium, Dr. Peter B. Dews of Harvard Medical School indicated there was general agreement that diet does appear to affect behavior, but the effects are subtle. For this reason, significant effects of diet on seriously aberrant behavior, such as criminal behavior or hyperactivity in children, would not be expected. Dr. Dews commented that "because the field of dietary pharmacology is still in the experimental stage, it is too early to make regulatory decisions or policy changes."

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EFFECTS OF ORTHODONTIC TREATMENT ON THE GINGIVA

Gingival hyperplasia may sometimes be overlooked by clinicians because color changes may not develop. This is due to the marked limitation of the inflammatory cell infiltration in the local area close to the gingival sulcus. The differential diagnosis between moderate inflammation and mere piling up of tissue due to rapid tooth movement is bleeding, upon probing. Marginal bleeding when a probe is carried gently along the gingival margin is a sign of danger. It should initiate treatment, i.e., improved oral hygiene instruction and motivation, or professional cleaning.

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The use of whole cow's milk in infancy

Committee on Nutrition
American Academy of Pediatrics

Previous statements of the Committe on Nutrition have focused on infant feeding during the first six months of life. The purposes of this statement are to update recommendations concerning infant feeding during the second six months of life and to suggest further needed research in this area.

WHOLE COW'S MILK AND IRON

The appropriate age at which unheated, whole cow's milk (WCM) can be safely introduced into the infant diet is unknown and remains an area of controversy. In numerous reports, the consumption of excessive amounts of WCM has been associated with iron-deficiency anemia.[1-4] This is partly due to the fact that both the concentration and the bioavailability of iron are low in milk. Also, WCM can cause occult bleeding from the gastrointestinal tract. The process by which this occurs is unknown, but Eastham and Walker, in a review of the effects of cow's milk on the gastrointestinal tract, classified the mechanisms involved as enzymatic, toxic and immunologic.[5] They suggested that the occult blood loss and exudative enteropathy syndrome following cow's milk ingestion are more likely toxic in nature because no classic immunologic mechanism has been demonstrated. However, the exact mechanism(s) for these conditions have not been established.

Although studies have shown an association between WCM consumption and anemia, there are some difficulties in using these findings as a basis for recommendations for feeding older infants.[1-4] This is because of the young age at which the infants studied were initially given WCM. In one of the studies, WCM was introduced at age two months; in another study, WCM was introduced at less than four months of age, although the precise age was not specified.[1,3,4] If the developing gut is more vulnerable early in life, it is possible that the deleterious effects of WCM may be avoided by delaying the age at which it is first introduced.

The consequences of feeding WCM for the first time to older infants have been examined in only one study, which will be considered here in some detail.[6] Fomen, *et al*, studied eighty-one normal infants, aged 112 to 196 days, who had not previously consumed WCM: thirty-nine infants were fed WCM and forty-two were fed either a commercial infant formula or heat-treated cow's milk. All infants received a daily supplement containing 50 mg of ascorbic acid and 12 mg of iron as ferrous sulfate. The proportion of infants between 112 and 140 days old who had guaiac-positive stools (as determined by the Hemmoccult slide [Smith, Kline Diagnostics, Sunnyvale, CA]) was signifi-

The Committee on Nutrition, American Academy of Pediatrics, 141 N.W. High Point Road, P.O. Box 927, Elk Grove Village, IL 60007.

cantly greater among infants fed WCM than among those fed Enfamil or heat-treated cow's milk. The infants fed WCM also had a significantly greater number of guaiac-positive stools than the other infants. However, after 140 days of age, there was no difference between groups in the number of guaiac-positive stools. Furthermore, in these infants given iron supplements, no significant differences were observed between feeding groups in mean hemoglobin, hematocrit, serum iron, total iron-binding capacity or transferrin saturation measurements. Hematologic values did not differ significantly between infants with and those without guaiac-positive stools. Fomon, *et al*, concluded that WCM should not be fed before 140 days of age.[6] Although the study demonstrated no adverse effects from feeding WCM after 140 days of age, it must be noted that all infants were receiving a daily supplement of ferrous sulfate. Occult blood loss and iron status have not yet been studied in a group of older infants not receiving supplemental iron. Until such a study is conducted, the role of WCM in producing iron-deficiency anemia in older infants remains unknown.

COW'S MILK ALLERGY

Another area requiring further research is cow's milk-protein intolerance or "allergy." The incidence of milk-protein intolerance has been estimated at from 0.4 percent to 7.5 percent of the infant population in the first two years of life, depending on the strictness of the diagnostic criteria.[7]

As is true of the reports about anemia, many cases of unheated cow's milk-protein allergy are reported, but few are applicable to the question, at what age is it safe to first give an infant WCM?[1-4] In some studies, in which infants showed allergic reactions, cow's milk frequently was introduced when the infant was less than four months old; in one study in which infants were given formulas with a cow's milk base, there were allergic reactions within the first week of life.[1,8-10] Moreover, differentiation has not always been made between WCM and processed formula.

Even if there is agreement that 0.4 percent to 7.5 percent of infants have cow's milk-protein allergy, this is a relatively small proportion of the population. Whether the percentage would decrease if cow's milk protein were withheld from the infant diet for the first four to six months of life is not known. Before a definite recommendation can be made, well-designed studies are needed to evaluate the allergic response in older infants who have had no prior exposure to cow's milk protein.

RENAL SOLUTE LOAD OF WHOLE COW'S MILK

A third factor about which there is little direct evidence is whether the renal solute load of WCM would be too high for an older infant. A recent study (G.H. Johnson: The effect of substitution of whole cow's milk for infant formula and breast milk in the diet of infants, unpublished data available from Gerber Products Co.), using diet diaries, attempted to examine the theoretical effect of substituting WCM for either breast milk or formula in infants two to twelve months old. The solute load imposed by the original diets and the cow's milk-substituted diets of the infants surveyed were compared using estimates based on the method of Ziegler and Fomon.[11] Results showed that substituting WCM for infant formula or breast milk would have resulted in an increase in urine osmolarity at all ages. However, this increase was more dramatic during the first six months of life (49.2 percent increase) than during ages seven to twelve months (18.2 percent). The urine concentrations calculated from cow's milk-substituted diets were well within the range tolerated by infants, if the infants had access to water during hot weather or episodes of diarrhea.[12]

DEFATTED MILKS

The feeding of reduced fat-content milk is not recommended during infancy. Fomon, *et al*, have observed that, although infants fed skim milk *ad libitum* continue to gain weight, they do so at a slower rate than infants fed formula or whole milk. Infants fed skim milk also show a rapid decrease in skinfold thickness, suggesting that body energy stores are being depleted. Although the consequences of rapidly decreasing body stores of fat during infancy are unknown, the effects may be unfavorable.

USE OF SOLID FOODS

Solid and semisolid baby foods, or beikost, may be

introduced when the infant is between four and six months old, depending on neuromuscular maturation and whether the infant is satisfied with breast milk or formula as the sole source of nutrients. Solid foods should be added individually, allowing several days to a week between the introduction of each new food, so food intolerance can be identified. Infant cereals fortified with electrolytic iron are a good choice as one of the first supplement foods. Three level tablespoons of dry infant cereal diluted with WCM or formula provide approximately 7 mg of iron. Commercially prepared combinations of cereal and fruit, which may be given to older infants after tolerance for individual components has been established, provide approximately 5 mg of iron per 4½ ounce jar.[14]

Concerning the appropriate age of introduction of WCM into the infant diet, Formon, *et al*, suggested that when an infant more than six months old is eating approximately 200 gm of beikost daily (the equivalent of approximately 1½ jars of strained food commercially prepared for infants), there is no objection to feeding homogenized, vitamin D-fortified whole milk.[13] As discussed here, both occult blood loss from the gastrointestinal tract and allergic reactions can occur, but most reports of these effects of introducing WCM have been in infants less than six months old, or those fed in excessive amounts.[1-4,6]

IRON STATUS

The iron status of the six-to-twelve-month-old infant depends mainly on whether most of the infant's calories come from human milk, an iron-fortified commercially prepared formula, or whole cow's milk, and/or an iron supplement is consumed on a regular basis.

When either human milk or WCM accounts for a major portion of the total calories ingested by older infants, an additional iron source is necessary.[15] The most convenient source of iron for an infant on formula is an iron-fortified formula. For an older infant receiving human milk, cow's milk or a formula that is not iron-fortified, the best source of supplemental iron is iron-fortified cereal.[16]

RESEARCH NEEDS

There are many unanswered questions concerning the use of WCM in the second half year of life including:

- ☐ What is the rate and variability of maturation of infant gastrointestinal function?
- ☐ What is the relative importance of the amount and bioavailability of iron in the total diet when WCM is substituted for iron-enriched formula at six months of age? Does iron-fortified cereal meet the infant's need for iron?
- ☐ Can the change to cow's milk when the infant is six months old produce anemia from occult blood loss when the milk is fed in excessive amounts and there is no iron supplementation?
- ☐ What is the relative importance of the high-solute load of WCM in the total feeding regimen of a six-to-twelve-month-old infant? For example, how much of the high-solute load of WCM is diluted out by other foods in the diet?
- ☐ What is the relative importance of the nutrients not present in WCM but present in infant formula and breast milk, i.e., essential fatty acids, tocopherol, ascorbic acid? How many of these nutrients are obtained from the other foods commonly used in the six- to twelve-month age group?

CONCLUSIONS

Breast feeding with appropriate supplementation is the preferred method of feeding infants six to twelve months old. Although many mothers will continue to breast feed or formula feed their babies through the first year of life, there is at present no convincing evidence from well-designed research studies that feeding whole cow's milk after six months of age is harmful if adequate supplementary feedings are given.

Research to answer the crucial questions discussed here must be carried out before firm recommendations can be made concerning the age at which it is safe to introduce WCM in infants' diets. Until these questions can be answered, the following recommendations for feeding infants six to twelve months old pertain.

If breast feeding has been completely discontinued and infants are consuming one third of their calories as supplemental foods consisting of a balanced mixture of cereal, vegetables, fruits and other foods (thereby assuring adequate sources of both iron and vitamin C), whole cow's milk may be introduced. The amount fed should be limited to less than one liter daily. Most infants who are not breast fed should be consuming a significant portion of their calories from supplemental foods after they are six months old; those who are not should be given an iron-fortified formula.

Reduced fat-content milk is not recommended during infancy.

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CARIES LESIONS AND FLUOROSIS

One of the problems in diagnosing white spot lesions is the difficulty in discriminating them from surfaces with light fluorosis, especially if the white spot lesion is small and has a glossy appearance. According to the classification of Thylstrup & Fejerskov all narrow or more pronounced white lines corresponding to the perikymata were considered to be dental fluorosis.

The white spot caries lesions, however, are located near the gingival margin, or sometimes at some distance, but parallel to the curve of the gingiva. Mostly a white spot lesion is a localized change in the enamel of the surface.

Groeneveld, A.: Longitudinal study of prevalence of enamel lesions in a fluoridated and non-fluoridated area. Community Dent Oral Epidemiol, 13: 159-163, June, 1985.

Abstracts

Waldman, B.H.: Update on pedodontics in a period of improving economics. J Dent Child, 52:337-340, September-October, 1985.

Available recent data on the practice of pedodontics is considered in terms of the general improving economics of dentistry. Despite the lack of limited information which would support improvements in the pedodontic sector, the number of pedodontists continues to increase.

Pedodontists, Economic conditions

Cipes, M.H. and Miraglia, M.: Pedodontists' attitudes toward parental presence during children's dental visits. J Dent Child, 52:342-343, September-October, 1985.

Connecticut pediatric dentistswere surveyed for their opinions on parental presence in the operatory during preschoolers' dental visits. Responses obtained from 51 of the 52 pedodontists in the state and from 9 pediatric dental residents showed considerable variation in provider acceptance of parental presence during treatment and some variation in acceptance of parental presence during examination. A striking bimodal response pattern reflected the respondents' strong views on the topic. It was found that pedodontists who were practicing longer were less likely to examine and treat their patients with the parent present. The greater acceptance of parental presence by younger practitioners may reflect either a changing philosophy of pedodontic practice or the effect of years of clinical experience on older practitioners' behavior.

Parental presence, Preschool children, Pedodontists' attitudes

Roeters, J. and Burgersdijk, R.: The necessity of general anaesthesia for the dental treatment of mentally handicapped patients: A follow-up study. J Dent Child, 52:344-346, September-October, 1985.

In the period 1968-1980, 221 mentally retarded patients living in three big institutes with a total of 1780 patients received restorative treatment under general anesthesia. From the records of the dental department of these institutes, it could be concluded that 192 of them could be treated on subsequent visits, in the dental chair. Only twenty-two patients needed a second treatment under general anesthesia and three required a third treatment. Finally, these patients also accepted dental treatment without the use of general anesthesia. Because of the great amount of work done under general anesthesia, it appears that the main reason for using a general anesthetic was to permit a relatively rapid completion of the patients' needs. Granted sufficient manpower and time, one may expect that the number of mentally handicapped patients who may require treatment under general anesthesia will decrease to about 4 percent of the total patient load.

Handicapped patients, General anesthesia

Siegal, M.D. and Degnan, E.T.: Variation among fluoride concentrations of water from domestic wells in a four county area. J Dent Child, 52:347-352, September-October, 1985.

Fluoridated water is the most cost-effective method for preventing dental caries. The fluoride concentrations of public water systems are generally known by health departments or water supply engineers. Approximately 15 percent of U.S.

residents, however, were not served by public water systems in 1980. Most private water supplies are domestic wells. Laboratory analysis is necessary to determine the fluoride concentration of a particular well. In this study, water samples from domestic wells in a four-county area of New Mexico were analyzed for fluoride, over a twenty-four month period. Of the 503 nonrandomly selected samples analyzed, thirty-three (6.6 percent) had less than 0.3 ppm, 372 (73.9 percent) had between 0.3 and 0.7 ppm and 98 (19.5 percent) had greater than 0.7 ppm of fluoride. The Council on Dental Therapeutics of the American Dental Association considers fluoride concentrations of greater than 0.7 ppm to be acceptable caries preventive levels in drinking water. Dietary fluoride supplements may be prescribed when fluoride concentrations are below this level. Variation in fluoride concentration was found at all well-depth intervals considered. Water from domestic wells, therefore, must be assayed for fluoride to help determine a child's fluoride supplementation needs.

Fluoride, Domestic wells, Fluoride supplements

Reid, J.S.: Patient assessment of the value of bleaching tetracycline stained teeth. J Dent Child, 52:353-355, September-October, 1985.

In a review of eighty-three patients who received bleaching treatment for tetracycline stained teeth, forty-three were satisfied with the result. The best results were obtained in patients with discoloration caused by a combination of colors. Good results were obtained in patients with yellow discoloration of teeth; twenty-seven of forty-five were satisfied with the result in this category. The poorest results were obtained in patients with grey discoloration of their teeth; only two of twenty-four were judged successful. Patients who were not satisfied with the result stated that either no change in the appearance of their teeth was seen or that only a temporary improvement occurred. The total number of teeth treated was approximately 500 and none of these teeth was demanged or became nonvital as a result of treatment.

Tetracycline stain, Bleaching

Stokes, A.N.: Internally reinforced porcelain crowns for immature teeth. J Dent Child, 53:356-358, September-October, 1985.

A colloidal gold-coated platinum matrix strengthens porcelain jacket crowns to the extent that crowns of a minimum thickness of 0.5mm can fulfill functional and esthetic requirements. Crowns of this type require minimal cavity preparation, often without need for local analgesia. Experience over a ten-year period supports the practicality and longevity of this technique.

Reinforced porcelain crowns, Immature teeth

Belanger, G.K. and Coke, J.M.: Idiopathic external root resorption of the entire permanent dentition. J Dent Child, 52:359-363, September-October, 1985.

Resorption of the external surfaces of roots is normally a physiologic process in the primary dentition, but is usually considered a pathologic process when it occurs in the permanent dentition. Idiopathic external root resorption is a term used when an exact etiology cannot be determined. Most root resorption involves single or several teeth. An unusual case is described in which all the permanent teeth showed progressive external root resorption without a determinable cause. The differential diagnosis and treatment options are discussed with emphasis on the potential benefits of using calcium hydroxide.

Idiopathic external root resorption, Permanent dentition, Calcium hydroxide

Houpt, M.T.; Sheskin, R.B.; Koeningsberg, S.R.: Assessing chloral hydrate dosage for young children. J Dent Child, 52:364-369, September-October, 1985.

This study was performed to investigate the effectiveness in young children of two oral doses of chloral hydrate supplemented with nitrous oxide: the standard dose (50 mg/kg) and a higher dose (75 mg/kg). Seventeen children, twenty-one to forty-six months (mean = 31 months), participated in the study. Successful sedation, as evidenced by lack of movements and/or crying which interfered with treatment, was found with 75 percent of high dose administration, compared with only 18 percent of low dose administration. Vital signs remained essentially unchanged throughout all treatments, with the exception of transitory elevation of the pulse rate when the mouth prop was inserted or local anesthesia was administered. The only adverse effect noted was vomiting, which occurred four times. it is concluded that the 75 mg/kg dosage of chloral hydrate supplemented by nitrous oxide analgesia seems superior to the recommended dose of 50 mg/kg, when young children are sedated for dental treatment.

Chloral hydrate, Nitrous oxide, Children

Continued on page 392

Folio, J.; Smilack, Z.H.; Roberts, M.W.: Clinical management of multiple maxillary anterior supernumerary teeth: Report of case. J Dent Child, 52:370-373, September-October, 1985.
Multiple maxillary anterior supernumerary teeth are an unusual occurrence with potential pathological and orthodontic complications. An innovative management of a case is described.
Supernumerary teeth

Groper, J.N.: A simplified treatment for correcting an ectopically erupting maxillary first permanent molar. J Dent Child, 52:374-376, September-October, 1985.
A simple technique is described for treating the ectopically erupted permanent molar. It consists of a molar band, and a soldered helical finger spring, whose free end engages the undercut of a bonded lingual button affixed to the occlusal surface of an ectopic molar.
Ectopic eruption, Helical finger spring

Trask, G.M.; Sheller, B.L.; Morton, T.H.: Mandibular buccal infected cyst in a six-year-old girl: Report of case. J Dent Child, 52:377-379, September-October, 1985.
The mandibular infected buccal cyst should be included in the differential diagnosis for children with painful swellings in the mandibular molar area. A clinical case is presented in which antibiotic treatment for a streptococcal infection of the throat masked clinical symptoms of an infected cyst.
Cyst, infected; Antibiotic treatment