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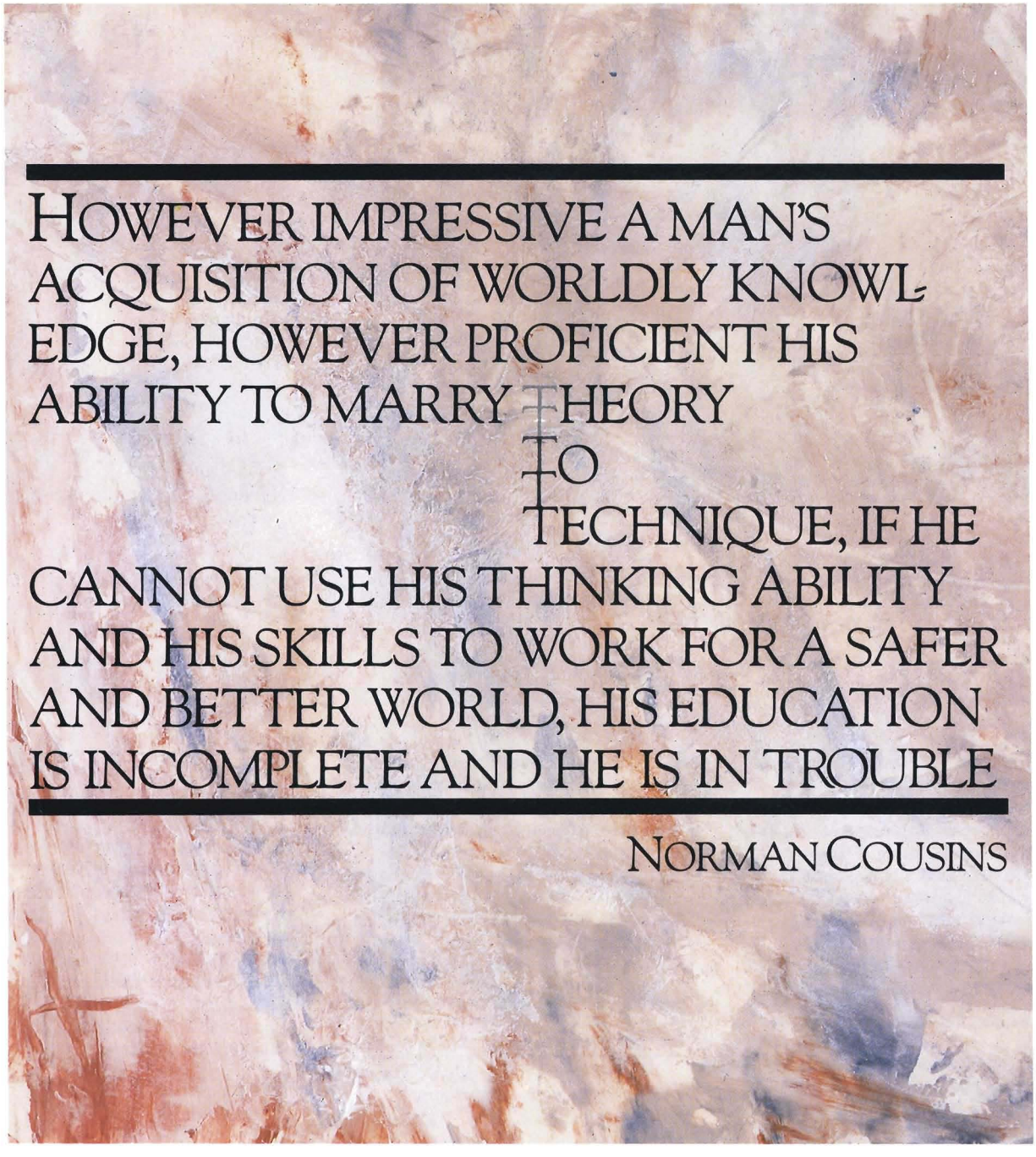
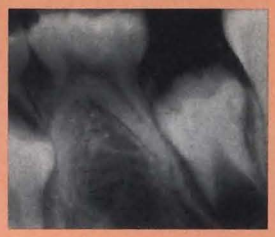


HUMAN HISTORY BECOMES MORE AND MORE A RACE BETWEEN EDUCATION AND CATASTROPHE.

—Herbert George Wells

60 YEARS OF SERVICE



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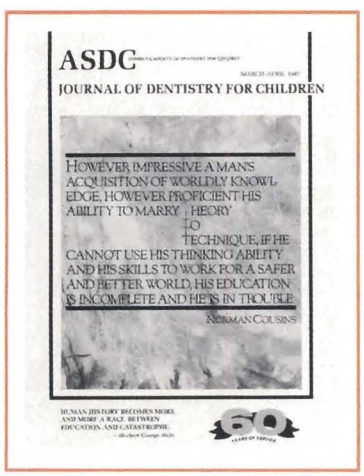
Volume 54 Number 2 March-April 1987



Throughout the ages, the definition of an educated person has been consistently the same, to the point that the words can be carved in stone without fear of contradiction.

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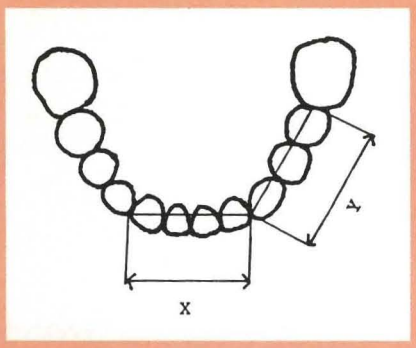

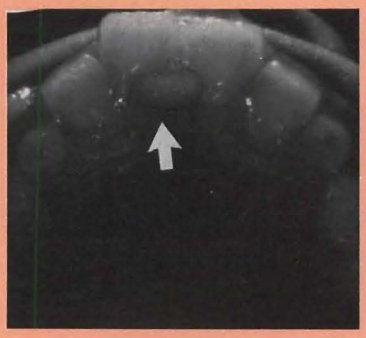

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For the busy reader

Insurance reimbursement for sealants in 1986: report of a survey—page 81

Lack of reimbursement for pit and fissure sealants by third-party payers is frequently cited as a major barrier to increased use by dental practitioners. An increase in insurance coverage for sealants since January, 1984 may facilitate practitioners' use of the procedure, ultimately improving the public's oral health.

Requests for reprints should be directed to Patricia H. Glasrud, MPH, Department of Dental Hygiene, 5-164 Malcolm Moos Health Sciences Tower, School of Dentistry, University of Minnesota, 515 Delaware Street Southeast, Minneapolis, MN 55455.

Changing patterns of dental disease in children and the use of dental services—page 89

By 1980, more than 106 million individuals from 8,000 communities nationwide were receiving adjusted fluoridated water. An additional 9.8 million people in 3,000 communities were using water with naturally occurring fluoride levels. A review is provided of the continuing need for, and use of, dental services by children since the first adjustment in a community's water supply 42 years ago.

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

Management of the refractory young child with chloral hydrate: dosage selection—page 93

Chloral hydrate is often selected for its wide range of safety, yet concerns are increasingly raised about its frequent failure to provide adequate levels of sedation while using the recommended hypnotic dosage. This paper discusses the implications of these weaknesses in a pedodontic context.

Requests for reprints should be directed to Dr. John E. Nathan, 183 South Bloomingdale Road, Bloomingdale, IL 60108.

Knowledge about systemic fluoride supplements among pediatric dentistry faculty and practitioners—page 101

As approximately 50 percent of the U.S. population does not have access to optimally fluoridated water, systemic fluoride supplements should be considered as an alternative. Faculty reported being very well informed about proper fluoride supplement protocol, whereas some practitioners were somewhat or well-informed.

Requests for reprints should be directed to Steven M. Levy, DDS, MPH, Assistant Professor, Department of Preventive and Community Dentistry, College of Dentistry, The University of Iowa, Iowa City, IA 52242.

Analgesics in pediatric dental surgery: relative efficacy of aluminum ibuprofen suspension and acetaminophen elixir—page 106

At one and two hours after administration, aluminum ibuprofen provided statistically superior analgesia, compared with acetaminophen and placebo.

Requests for reprints should be directed to Tim McGaw, DDS, MSc, Room 5084, Faculty of Dentistry, University of Alberta, Edmonton, Alberta, Canada T6G 2N8.

Validation of the children's oral health status index (COHSI)—page 110

The findings presented here provide support for the validity of the Children's Oral Health Status Index. The COHSI is a good predictor of dentists' ranking of the oral health of pairs of children when there are at least ten points difference between the scores.

Requests for reprints should be directed to Patricia P. Hagan, DDS, MS, Assistant Professor, Department of Pediatric Dentistry, West Virginia University School of Dentistry, Morgantown, West Virginia 26506.

A method of mixed dentition analysis in the mandible—page 114

There are many methods available for mixed dentition analysis. Presented here is a simple method of space analysis in the mandibular arch, using a modified fine-tipped electric digital caliper.

Requests for reprints should be directed to Dr. Wataru Motokawa, Associate Professor, Fukuoka Dental College, Department of Pedodontics, 700, Ta, Sawara-ku, Fukuoka, 814-01, Japan.

Do young children instinctively know what to eat?—page 119

This article reviews the food studies by pediatrician Clara Davis. In the 1920s and 1930s, she conducted pioneering studies and published the results in at least twelve papers on the selection of diets by infants and young children; limitations and misperceptions are addressed here.

Reprints are not available.

Mandibular second premolar erupting between the second primary molar and the first permanent molar: report of case—page 123

This article presents an unusual case of a nine-year-old boy with a mandibular left second premolar that appeared to be positioned between the mandibular left second primary molar and the left first permanent molar.

Requests for reprints should be directed to Mark E. Koonmen, DMD, MS, G-1122 South Linden Road, Flint, MI 48504.

Oral fibromas in children: reports of two cases—page 126

Two cases of fibromas of the oral cavity—benign soft tissue tumors, commonly seen with sessile or pedunculated bases—are presented.

Requests for reprints should be directed to Shahrbanoo Fadavi, DDS, MS, Assistant Professor, The University of Illinois at Chicago, Department of Pediatric Dentistry (M/C 850), College of Dentistry, 801 South Paulina Street, Box 6998, Chicago, IL 60680.

Orofacial manifestations of the Seckel syndrome—page 129

Requests for reprints should be directed to Dr. Ronald J. Jorgenson, Department of Pediatric Dentistry-Dental School, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, TX 78284.

Insurance reimbursement for sealants in 1986: report of a survey

Sealants

Patricia H. Glasrud, MPH
P. Jean Frazier, MPH, PhD
Alice M. Horowitz, MA

Lack of reimbursement for pit and fissure sealants by third-party payers is a frequently cited barrier to their increased use by dental practitioners.[1,2] Dentists who wish to provide patients with sealants are faced with a dilemma, if restorations, but not sealants, are included as a benefit on the family's dental insurance plan. Encouraging parents to accept this preventive measure may be problematic, not only for dentists, but also for families, when they must provide out-of-pocket payment.

Third-party payers, on the other hand, have described why they have been reluctant to include sealants on group dental plans. For example, purchasers (employers) may not be interested in long-term preventive measures; most carriers are not interested in adding benefits to a program which will make it more expensive to the purchaser; purchasers have limited dollars, and there is concern about the dental profession's ability to contain costs or utilization.[3-5]

Continued low use of sealants by practitioners prompted several national conferences to address barri-

P.H. Glasrud is Assistant Professor, Department of Dental Hygiene; P.J. Frazier is Associate Professor, Department of Health Ecology, Malcolm Moos Health Sciences Tower, School of Dentistry, University of Minnesota; A.M. Horowitz is Coordinator, Health Promotion and Science Transfer, Science Transfer and Research Analysis Branch, Epidemiology and Oral Disease Prevention Promotion, National Institute of Dental Research, National Institutes of Health, Bethesda, Maryland 20892.

ers and to stimulate practitioner and public awareness and adoption of this preventive procedure.[6-8] The American Dental Association held such a meeting in 1981, a major portion of which was devoted to third party carriers' role in use of sealants.[6] In December, 1983, the National Institutes of Health convened a Consensus Development Conference on Dental Sealants in the Prevention of Tooth Decay.[9] The consensus panel statement confirmed the safety, efficacy, and underutilization of sealants. The panel urged the development of guidelines for reimbursement that are acceptable to third-party payers.

Although most payments for dental services continue to be derived from private, direct sources, over 100 million Americans are estimated to have dental benefits today.[10,11] Third-party payers, however, only rarely have provided coverage for sealants. Results from a telephone survey of third-party payers conducted in August, 1983, indicated that the majority did not then include sealants as a benefit on group dental plans.[12] Since that time, extensive efforts have been made to promote the use of sealants through professional and public education. The purpose of this study was to provide an update on the extent of third-party reimbursement for sealants, in early 1986.

METHOD

Current mailing addresses for forty-seven Delta Dental Plans and forty-five commercial insurance companies known to write group dental plans were obtained from the American Dental Association. A St. Paul, Minnesota, Blue Cross/Blue Shield Association office provided a national membership list of ninety such companies. In January, 1986, a pretested fourteen-item questionnaire, cover letter and self-addressed, postage-paid return envelope were mailed to this universe of 182 third-party payers. Delta Dental Plan questionnaires were sent to identified individuals, such as the Executive Director, by name. Questionnaires to commercial companies and to Blue Cross/Blue Shield Associations were directed to "Group Dental Plans, Administrator." Telephone calls to mail nonrespondents to obtain information from those most knowledgeable about their company's dental benefits were begun in February and completed in March, 1986.

An adjusted response rate of 78.7 percent (140) was achieved after excluding four undeliverable questionnaires from the total number sent. Twenty of the 140 completed questionnaires were not usable: eight companies do not write group dental plans, six refused to provide information, and the only information furnished by the remaining six companies was that they do not currently provide sealant coverage. Of the 120 usable questionnaires, 28 percent were from Delta Dental respondents, 28 percent from commercial insurance company respondents and 44 percent from Blue Cross/Blue Shield respondents. These proportions are representative of the distribution of the three types of 182 companies to which the questionnaires were mailed.

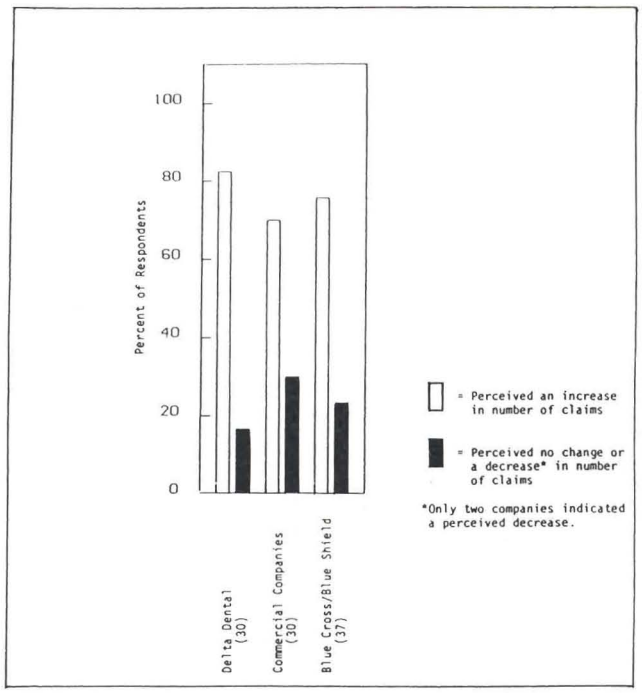

Figure 1. Perceived change in number of sealant claims by type of company, (N = 97). Question: "Over the past two years, claims submitted to your company for sealant reimbursement have (check one): Increased, Decreased, Remained the Same."

Nearly 63 percent (88) of respondents provided information by mail, with the remaining 37 percent (52) by telephone. Responses were obtained from Blue Cross/Blue Shield Associations in forty-seven states and the District of Columbia. Eighty-five respondents indicated that they functioned in an administrative or supervisory capacity.

RESULTS

A majority of respondents from each of the three types of third-party payers indicated a perceived increase in the number of claims submitted to their companies for sealant reimbursement over the past two years (Figure 1). Though not statistically significant, a greater proportion of Delta Dental respondents perceived an increase than did respondents from either of the other types of companies.

Seventy percent (84) of all third-party payer respondents indicated that their companies currently write

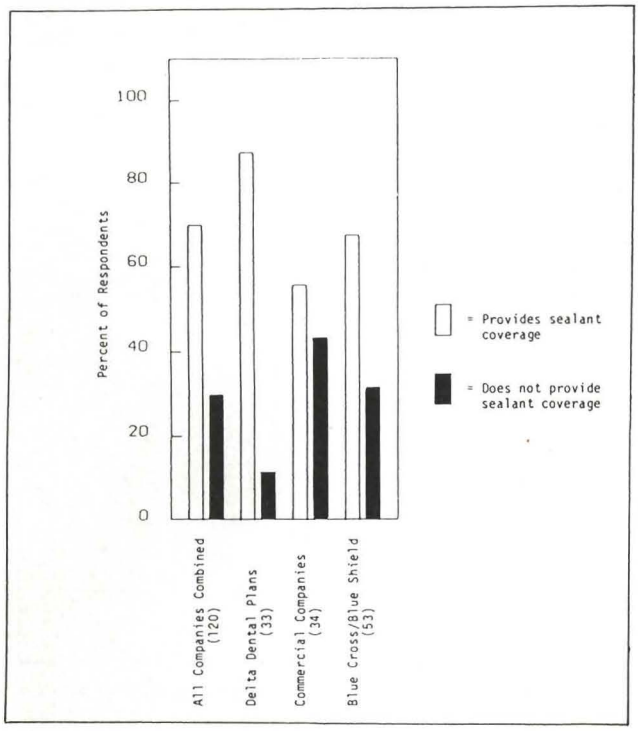

*Figure 2. Insurance reimbursement for sealants by type of company (1986). Question: "Do any of your group dental plans currently provide coverage for dental sealants?" (chi square = 8.36, 2 d.f., p = 0.15) *Four additional Delta Dental Plans and two additional Blue Cross/Blue Shield Associations indicated that they do not currently write plans which include sealant coverage. Because this was the only information obtained from these respondents, they were not included in any analyses.*

group dental plans that provide coverage for sealants (Figure 2). A significantly greater proportion of Delta Dental respondents than those from either commercial insurance companies or Blue Cross/Blue Shield Associations reported that they are providing sealant coverage (p = .015).

Reasons for excluding sealants

Respondents from eleven of the thirty-six companies that do not now include sealants as a benefit indicated that such coverage was under consideration. The thirty-six respondents were asked to give reasons why their companies do not presently include sealant coverage. Given a list of twelve possibilities, the most frequent reason checked was "lack of cost-effectiveness data relative to third-party payers" (Figure 3). The second most frequent reason given was "lack of specific guidelines for use of sealants." For the fourth category, respondents' "other" reasons included, for example, "no market demand," "is a cosmetic procedure," and "specifically excluded along with oral hygiene instructions and plaque control programs."

Extent of sealant coverage

Two items in the survey were designed to examine the actual extent of sealant coverage provided by the companies. First, all respondents (regardless of their status as providers or nonproviders of sealant coverage) were asked to estimate the number of groups for which their company currently writes dental plans (Figure 4). Although there was wide range of groups estimated (median = 400), there was no significant difference in number of groups among the types of companies. A greater proportion of Blue Cross/Blue Shield respondents (41 percent) estimated that they write plans for many groups (over 500), while a greater proportion of Delta Dental respondents (40 percent) estimated that they write plans for fewer groups (200 or less). Forty-five percent of commercial insurance companies estimated that their companies write dental plans for between 200 and 500 groups.

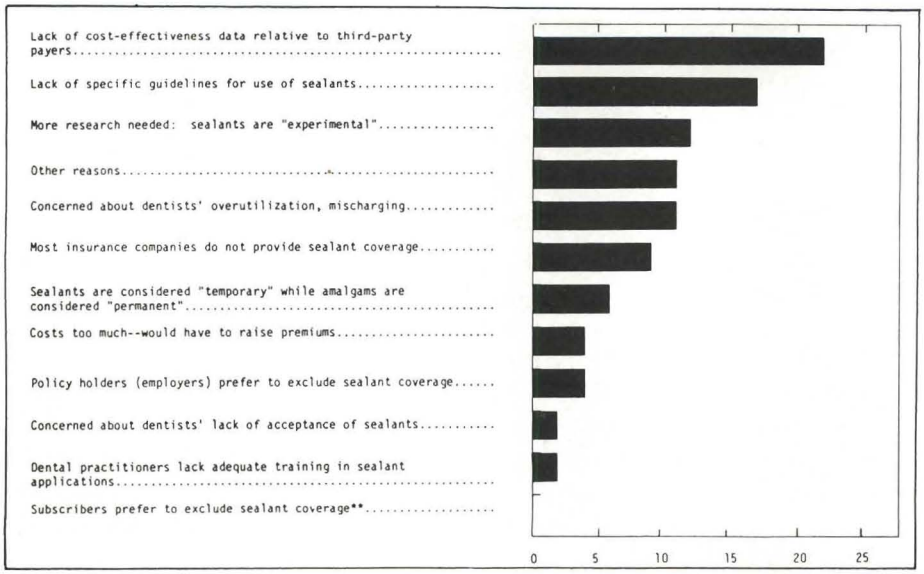

Figure 3. Insurance companies' reasons for not providing sealant coverage, (N = 32). *Multiple responses were allowed. Total number of responses = 95.* *No respondent checked this reason.*

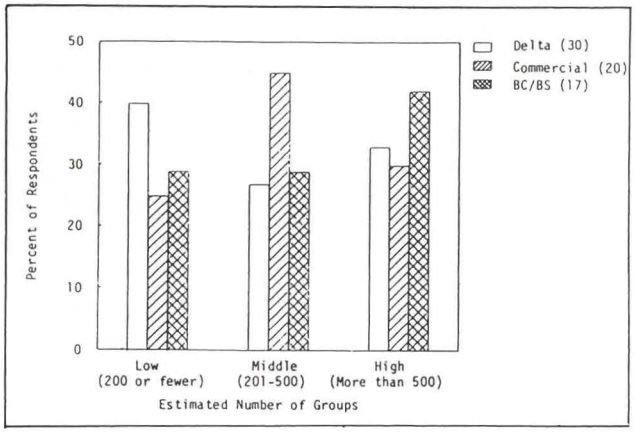

Figure 4. Estimated number of groups for which dental plans are written by type of company, (N = 67). Question: "For approximately how many groups (policy holders) does your company currently write dental plans?" N.S. (chi square = 2.56, 4 d.f., p = .6333).

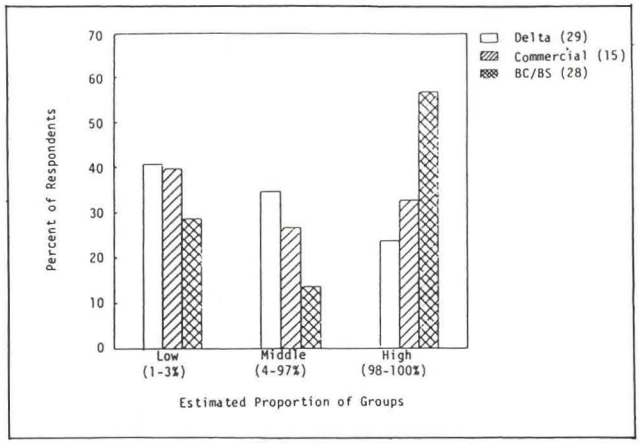

Figure 5. Estimated proportion of groups providing sealant reimbursement by type of company, (N = 72). Question: "Approximately what percent of policy holders (estimated in Question 2) currently have sealant coverage?" N.S. (chi square = 7.21, 4 d.f., p = .1251).

Second, respondents whose companies provide sealant coverage were asked to estimate the percent of their groups having such coverage (Figure 5). Altogether, three-fourths of these respondents estimated very low (1 percent to 3 percent) or very high (98 to 100 percent) proportions of groups having sealant coverage (median = 60 percent). Forty-seven percent of seventy-two respondents indicated that sealants were included as a benefit on 25 percent or fewer of their group dental plans. A greater proportion of Blue Cross/Blue Shield respondents estimated higher percentages covered than respondents from the other types of companies. No significant difference was observed, however, in estimated proportions of groups providing coverage according to type of third-party payer.

Dates of implementation

Participants from companies that provide sealant coverage were asked the month and year when such coverage was first implemented on any of their group dental plans. Dates ranged from January, 1976 through January, 1986 (Figure 6), with the majority first implementing coverage since January, 1984. Although a greater proportion of the commercial insurance companies were early implementors (before December, 1983), there were no significant differences in when sealants were included as a benefit, according to type of company.

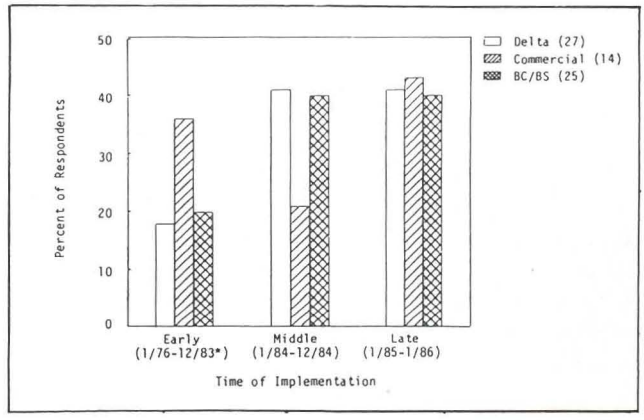

*Figure 6. Time of implementation of sealant coverage by type of company, (N = 66). Question: "Approximately how long has coverage been available on your group dental plans?" *No respondent reported implementing coverage between 9/83 and 12/83. N.S. (chi square = 2.44, 4 d.f., p = .6552).*

Criteria for reimbursement

Seventy respondents (85 percent) indicated that their companies base reimbursement for sealants on conditions related to patient age and type of tooth sealed. A majority of respondents from each type of company indicated the application of such criteria before payment is made. Although a smaller proportion of Blue Cross/

Table ☐ Type of tooth and patient age criteria (N = 70).

Type of tooth	Number of respondents indicating coverage by type of tooth	Mean minimum patient age limit	Mean maximum patient age limit
Primary (Unspecified by type)	15	1.0 year (1)	13.9 years (9)
Permanent			
Incisors/canines	15	6.0 years (5)	15.6 years (12)
Premolars	31	8.8 years (5)	15.4 years (27)
First molars	68	5.8 years (17)	14.7 years (62)
Second molars	65	8.7 years (16)	15.3 years (60)
Third molars	34	8.3 years (4)	15.4 years (29)

Blue Shield respondents reported that criteria are applied, there was no significant difference in whether such criteria are applied according to type of third-party payer ($p = .1411$).

Participants from companies that apply criteria were asked to check each type of tooth for which their company would provide reimbursement. They also were asked to indicate the patient age range for each type of tooth checked as reimbursable. A majority of respondents indicated that payment would be made for permanent first and second molars rather than for other types of teeth listed (Table). More respondents provided information about upper rather than lower patient-age limits.

An open-ended question asked what other conditions were applied before payment for sealants is made. Thirty-eight respondents listed such other conditions. Most of these conditions were related to the absence of caries or restorations on teeth to be sealed. One respondent indicated a reduced allowance for subsequent amalgam restorations in teeth that were previously treated with sealants. Analysis by type of company revealed that significantly more Delta Dental Plans apply such additional criteria before reimbursement is made ($p = .01$).

Reimbursement levels and replacement criteria

Sixty respondents indicated that reimbursement for sealants is made on a per tooth basis. Maximum dollar amounts allowed per tooth ranged from $2.00 to $25.00, with a mean of $16.40 ($N = 32$). While eight respondents reported that reimbursement was on a per quadrant basis, only three said what the maximum allowance was. These amounts ranged from $15.00 to $40.00 per quadrant. Eight remaining respondents indicated that sealants are reimbursed on either a per tooth or per quadrant basis, but provided no dollar amounts.

Approximately 45 percent (thirty-one) of respondents reported that a deductible was not applied before reimbursement was made, as compared with 23 percent (sixteen) who reported such application. Nearly 32 percent (twenty-two) indicated that application of a deductible was dependent upon specific group dental plans.

Approximately 63 percent (forty-seven) of respondents reported that replacement of sealants would be reimbursed. Forty-six percent of Delta Dental respondents, as compared with 94 percent and 60 percent of commercial company and Blue Cross/Blue Shield respondents, respectively, indicated that such replacements would be a covered expense. Respondents from thirty-one companies indicated that time-limit criteria were applied to reimbursements for replacements. The time limit most frequently mentioned was one replacement during a three- year interval.

Topical fluoride coverage

A series of questions related to reimbursement for the topical application of fluoride was included for comparison because:

- ☐ Topical fluoride, like sealant, is a primary preventive procedure.
- ☐ Optimal benefits of a dental caries prevention program may be expected, with the combined use of fluorides and sealants.

A majority of respondents (113) indicated that their group plans provide reimbursement for the topical application of fluoride. Ninety-nine percent (107) reported that criteria such as patient age limits, are applied before reimbursements are made. The mean maximum patient age limit for topical fluoride reimbursement was eighteen years, ($N = 96$).

Significantly more Blue Cross/Blue Shield respondents than those from either of the other types of payers provide coverage for topical fluorides twice per year, rather than once per year ($p = .01$). Fifteen respondents included specific information about additional criteria

for payment for topical fluoride, such as "must accompany a prophylaxis" and "dependent child only." There was no significant difference in the frequencies of application allowed for payment, between companies that provide sealant coverage and those that do not.

DISCUSSION

Early in 1986, a majority of insurance companies provided coverage for the use of sealants on group dental plans. Although there were methodological and sample differences, a similar study of third-party payment for sealants in August, 1983, revealed that a majority of payers at that time were not providing reimbursement.[12] There are undoubtedly multiple, interrelated explanations for this increase in the number of companies that include sealants as a benefit.

Of interest are specific findings in the present study with respect to the National Institutes of Health Consensus Development Conference on sealants held in December, 1983. A unique, stated objective of these NIH conferences is the dissemination of information on specific health technologies to health care providers and to the public, with the ultimate goal of improving the public's health. Subsequently, this conference received widespread coverage not only in professional publications, but also in the public media. It is notable, therefore, that 77 percent (fifty-one) of respondents implemented coverage after December, 1983, and that a majority saw an increase in the number of claims for sealants, over the past two years. A related finding from a series of cross-sectional studies of Minnesota private general practices, from 1980 through 1984, showed substantial increases in both the proportion of dentists applying and number of patients receiving sealants, during 1984.[13]

Reasons for excluding sealants

Several reasons for not providing sealant reimbursement were similar in both the 1983 and 1986 studies, but the proportions were different.[12] It should be noted that the 1983 questionnaire used an open-ended item to gather this particular information, while the 1986 question on this topic was a checklist of twelve possible reasons for noncoverage. A greater proportion of the responses in 1983 was related to the belief that "sealants are experimental." The NIH consensus panel statement may have been influential in removing doubt about the safety and effectiveness of sealants, thereby helping to dispel the notion of sealants' "experimental" status. Conversely, a greater proportion of responses in the present study was related to the cost-effectiveness of sealants relative to third-party payers.

Development of reimbursement guidelines

Recognizing that availability of third-party payment might enhance the adoption and utilization rates of sealants, the 1983 NIH consensus panel recommended that "(an) effort should be undertaken to prepare guidelines for the use of sealants that are acceptable to third-party payers".[9] Lack of such guidelines has been cited by insurance company respondents in the present study as an obstacle to increased coverage for sealants.

Encouragingly, 85 percent of respondents who included sealants as a benefit also reported the use of some type of criteria for reimbursement. Results show, however, that there is a tremendous variation in currently used criteria for reimbursement; regarding, for instance, patient age-limits and types of teeth to be sealed. Although the optimal time for sealant application is as soon after tooth eruption as possible, none of the respondents specifically mentioned this as a condition for reimbursement.

Increased attention to reimbursement guidelines has resulted in the development of more specific application and reimbursement criteria for use in both private and public health settings.[14-17] Various groups involved in developing these criteria used different approaches, e.g. optimal caries prevention for the greatest number of people, as compared with relatively short-term cost-effectiveness for insurance companies.[16,17] Clearly, these recently generated guidelines may appear contradictory, but such divergence is indicative of the evolving process of formulating criteria.

Third-party payers have concerns about possible over-utilization of sealants, if the procedure were included as a benefit on group dental plans.[3-5] Although payers perhaps have similar concerns regarding topical fluoride application, nearly all respondents reported providing coverage for this preventive procedure. Further, most companies apply topical fluoride reimbursement criteria, such as maximum patient age-limits or number of applications reimbursed per year. Given that maximum caries preventive benefits can be derived from the combined use of fluorides and sealants, perhaps contingent reimbursement criteria could be developed for topical fluorides, sealants and subsequent restorations. Criteria for reimbursement for topical fluoride could be made more stringent; for example, based on patient need, such as caries history and fluoride ingestion, as well as

type of fluoride product and application procedure used.

Reimbursement availability and level of use of sealants

Availability of third-party payment likely is a factor involved in the process of gaining greater use of sealants in dental practice. National surveys of dentists in 1974 and 1982 indicated relatively low levels of use by dentists in private practice.[18,19] A third national survey of dentists in 1984-85 documented an increase in the use of sealants, although many practitioners still reported using sealants only infrequently.[20] Respondents in the 1984- 85 study who were not then using sealants cited three factors that would influence their decision to try sealants, or try them again: additional research findings (29 percent), patient requests (27 percent), and availability of insurance coverage (16 percent). Among respondents then using sealants, 53 percent reported insurance coverage as an influence on their use of sealants. Respondents in the 1984-85 study estimated that only 12 percent of their patients' policies covered sealants at that time. A significant association was found between percentage of the respondents' patients with insurance coverage and the respondents' use of sealants.

Although only a few dentists responding in the 1984-85 study reported having Medicaid reimbursement available for sealants, its availability also was positively associated with the level of use of sealants.[20] A survey of state dental directors in August, 1984 reported that Medicaid paid for sealants in seven states. In October, 1985, a survey of state and territorial dental directors reported that Medicaid programs in at least fourteen states then paid for sealants (Personal communications, N. Shory, 12 November, 1985; A. Moore, 31 January, 1986). While there appears to be an increase in Medicaid reimbursement for sealants, as in the private insurance industry, broader coverage may be required to stimulate and maintain higher levels of use by dental care providers.

Public awareness, insurance and sealant use

Patient/parent knowledge and demand also are factors affecting the use of sealants. While little is known about the public's knowledge of sealants, even less is known about the potential influence of consumer knowledge on increasing demand for third-party coverage of sealants, or on effective demand for sealants at dental offices. Some evidence suggests consumers are becoming aware of sealants and that this awareness may influence their use by practitioners. Telephone data collected during November, 1984 showed that 47 percent (381) of Minnesota adult participants had heard of sealants.[22] Seventy percent of those who were aware of sealants had first heard of them within the previous six to eight months (Spring 1984), most frequently on television or radio programs. Thus, a majority had learned of sealants shortly after the well-publicized NIH consensus development conference.

Based on such mass media exposure, the consumer is at least equipped to ask questions of dental care providers. In the 1984-85 national survey of dentists, "patient requests" was the second greatest reported influence on dentists' decision to use sealants.[20] The level of sealant use was greater among dentists whose patients had previous knowledge of sealants. Results of the Minnesota consumer survey suggest that visibility obtained through the mass media, and generated by the NIH conference, could have stimulated such public awareness.[22] This, in turn, could have prompted dentists' greater use of sealants, as reported in the 1984- 85 survey.[20] Greater consumer awareness of their own access to third-party reimbursement for sealants, through private insurers or through Medicaid, could further enhance the likelihood that sealants will be used in dental practice.

Delegation to auxiliaries

No information is available on the extent to which the type of operator (dentist or auxiliary) performing the treatment may influence cost-effectiveness to insurers. Existing evidence, however, does suggest that while dental hygienists are generally knowledgeable about sealants, their ability to use sealants is heavily dependent on the dentist-employer's knowledge of sealants, as well as on provisions of state dental practice acts and related legislative actions.[23] Lack of employer acceptance of sealants, and nondelegation of the procedure were the most frequently cited reasons given by dental hygienists in a July, 1983, two-state study (Minnesota and Wisconsin) and in a January, 1985, study in Virginia.[24,25] Cost- efficiency to the insurance industry may be influenced not only by the dentist's willingness to use sealants as part of the primary preventive services offered in his practice, but also by the dentist's willingness to delegate the procedure to a dental hygienist or assistant. State practice acts in over half the states allow placement by dental hygienists. Reported fees for sealants charged by dentists in the 1984-85 national study

were lower for respondents in states permitting delegation of the procedure to an auxiliary and for those who delegated placement to auxiliaries.[20]

CONCLUSIONS

In early 1986, a majority of third-party payer respondents reported providing sealant coverage on "any group dental plans." This finding represents an increase in the proportion of insurance companies providing such coverage since 1983. Results suggest further study in the following areas:

- ☐ The actual extent to which patients have sealants paid for by a third-party remains unknown. Furthermore, little is known about the influence of the presence or absence of coverage for sealants in dental plans on whether: a) dentists advise parents or patients to have sealants applied, b) parents accept dentists' advice to apply (or not apply) sealants, and c) parents request application of sealants for their children.
- ☐ The NIH sealant consensus development conference may have stimulated activity in the dental insurance industry, the dental profession, and the public leading to increased coverage of sealants. Whether this reported increase will plateau, decline or increase remains to be seen. Periodic monitoring of third-party payer policies regarding coverage could document such changes.
- ☐ Existing reimbursement criteria used by insurance companies are not uniform among companies. Future studies could document whether more consistent guidelines are developed. Such investigations should be useful to third-party payers in their efforts to determine which criteria contribute most to the cost-effectiveness of sealants for their companies.

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Changing patterns of dental disease in children and the use of dental services

Disease patterns

H. Barry Waldman, DDS, MPH, PhD

RESULTS OF FLUORIDATION AND OTHER PREVENTION PROGRAMS

The adjustment of the fluoride content of community water supplies as a method to prevent tooth decay began in January, 1945, in Grand Rapids, MI. By 1980, over 106 million individuals in more than 8,000 communities throughout the nation were receiving adjusted fluoridated water (Figure 1). An additional 9.8 million people in 3,000 communities were using water with naturally occurring fluoride levels of 0.7 parts per million or higher. In 1985, 61 percent of the U.S. population drinking from public water supplies received fluoridated water.[1] Thus, forty years after the first water system was fluoridated more than a half of the individuals living in the United States "have access to water with a dentally significant concentration of fluoride."[2]

In addition, millions of youngsters are involved in fluoride rinse programs; receive topical applications of fluoride; consume fluoride supplements in their vitamins; and brush with fluoridated tooth paste. And further, sealants, acid etching technics and increased public knowledge and understanding of prevention (e.g. well over 90 percent of the adult public is aware of the

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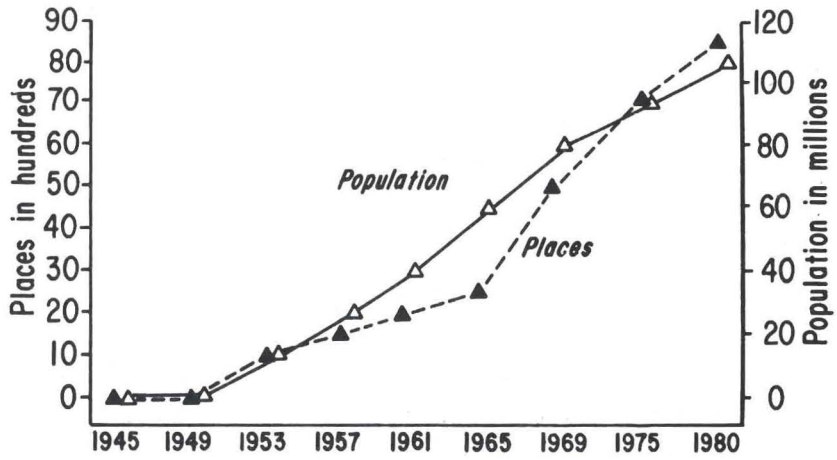


The line indicated by the open triangle represents the population. The line indicated by the solid triangle represents the places.

Figure 1. Places and population served by adjusted fluoridation 1945-1980.[1]

need to brush and floss teeth and to visit a dentist regularly) have added greatly to programs to prevent and/or limit the consequences of dental disease.[3]

The substantial decrease in the prevalence of dental caries (in each age level between five years and seventeen years) has been reported repeatedly in lay and professional publications. For example, between 1971/73 and 1979/80 the average decay-missing-filled surface rate (DMFS) for all U.S. children between five years and seventeen years decreased from 7.06 to 4.77.[4]

There have been numbers of reports forecasting eventual variations in the need and demand for dental services in middle age and older population groups as a result of this dramatic decrease in the rates of decay in children.[5] But how has the substantial decrease in dental caries affected treatment needs and demand for services by children at the present time?

NEED FOR DENTAL SERVICES

The results from the 1979/1980 National Dental Caries Prevalence Survey indicate that during the 1970s, demand for dental services by children between five years and seventeen years (as measured in terms of filled teeth) did not decline.[6] Rather, the ratio of filled teeth to total caries experience increased and there is now half as much untreated dental caries in children as there was in the early 1970s.

Yet, dental treatment needs still exist. In 1979- 1980, almost a quarter (24 percent) of white children (ages five to seventeen) and a third of nonwhite children required restorations in their permanent dentitions; even greater percentages (30 percent and 40 percent, respectively) required restorative services for their primary dentitions. In addition, extractions, crowns, replacements and pulpal treatment were required (Table 1). (It should be noted that because of the examination criteria used in the national study, all findings are apt to be conservative when compared with those that would be expected from routine dental examinations with radiographs.)[6] And further, treatment needs (in terms of actual numerical requirements per child) are greater for residents of non-standard metropolitan statistical areas (Table 2).

DEMAND FOR DENTAL TREATMENT

There is, however, the inevitable question, "How does adjusting levels of fluoride in drinking water and other measures to prevent dental disease affect dental practice; particularly in dental offices providing services for children?"

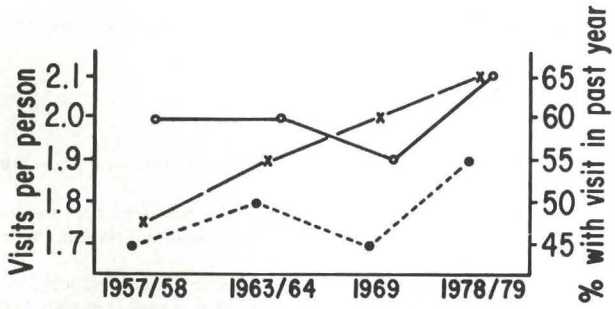
Table 1 ☐ Percent of children needing treatment in the primary and permanent dentitions by race: 1979-1980.[6]

	Primary dentition		Permanent dentition	
	Whites	Blacks & all others	Whites	Blacks & all others
Restorations	30%	40%	24%	33%
Extractions	6	8	1	4
Crowns	5	7	2	5
Replacements			2	6
Pulpal treatment			1	4

Table 2 ☐ Dental treatment needs per 100 children by residence: 1979-1980.[6]

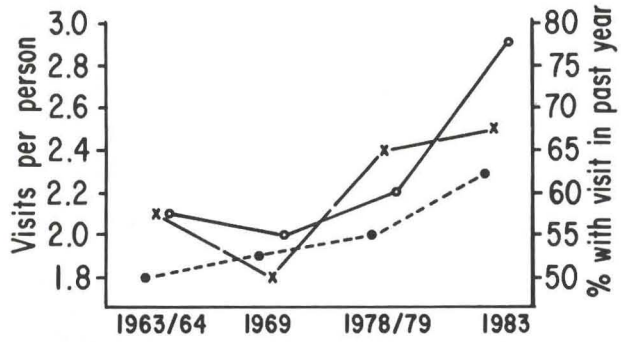
	SMSA*	Non-SMSA	Total U.S.
Primary dentition (Ages 5-9)			
Restorations	112.2	154.9	124.4
Extractions	9.2	18.6	11.9
Crowns	6.5	10.7	7.7
Permanent dentition (Ages 5-17)			
Restorations	66.6	81.3	70.8
Extractions	1.9	3.8	2.4
Replacements	3.5	6.1	4.3
Crowns	2.5	3.6	2.8
Pulpal treatment	1.7	3.0	2.1

*Standard Metropolitan Statistical Area



The line indicated by the solid dot represents the annual number of visits per person by males. The line indicated by the open circle represents the annual number of visits per person by females. The line indicated by the x represents the combined male and female percent with a visit in the past year.

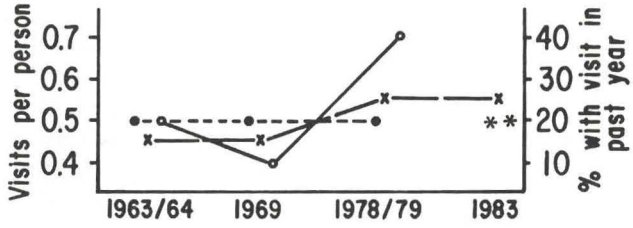
Figure 2. Annual number of dental visits per person by gender and percent of population groups with a dental visit in the past year by children 5 through 14 years of age: 1957/58 through 1978/79.[10-15]



The line indicated by the solid dot represents the annual number of visits per person by males. The line indicated by the open circle represents the annual number of visits per person by females. The line indicated by the x represents the combined male and female percent with a visit in the past year.

Figure 3. Annual number of dental visits per person by gender and percent of population group with a dental visit in the past year by children 6 through 16 years of age: 1963/64 through 1983. [10-13, 16]

In the early 1970s, Douglas *et al* reported that the magnitude of restorative care does not decrease in a community with a lower caries rate.[7] These investigators reported that the number of restorations placed in one year by the average dentist practicing in a fluoridated community was similar to that placed by the average dentist in a nonfluoridated community. Similarly, Dunning observed that the introduction of fluoride in a community does not necessarily induce a diminution in the demand for dental treatment in that community.[8] Rather, he states that the introduction of water fluoridation actually may facilitate an extension of dental care to a much larger proportion of the population than previously received it, and may result in the delivery of more complete maintenance care. In one school based fluoride mouthrinsing program it was noted that, in addition to a decrease in the level of caries and increase in the relative magnitude of restorative care, there was a complete elimination of emergency dental care associated with the extraction of permanent teeth, because of caries.[9]

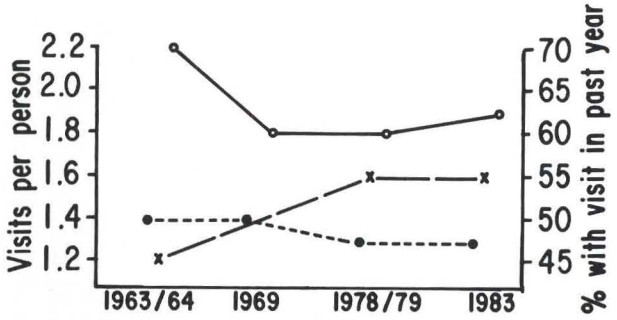


The line indicated by the solid dot represents the annual number of visits per person by males. The line indicated by the open circle represents the annual number of visits per person by females. The line indicated by the x represents the combined male and female percent with a visit in the past year.
*1983 annual number of visits per person data combined for males and females.

Figure 4. Annual number of dental visits per person by gender and percent of population group with a dental visit in the past year by children under 6 years of age: 1963/64 through 1983.[10-13, 17]

On a national basis, there is increasing evidence that the efforts to prevent dental disease (at least for children) has not resulted in a decrease in the demand for dental treatment. For example, between 1957/58 and 1978/79 both male and female children between five and fourteen years of age reported both general increases in annual dental visit rates and percents of the population with dental visits (Figure 2). Comparable increases between 1963/64 and 1983 were reported for children between six and sixteen years (Figure 3). (Different age presentations in federal reports require variations in historical reviews.) In addition, between 1963/64 and 1983, children under six years of age generally maintained constant annual dental visit patterns (Figure 4).

Finally, between the mid 1960s and the mid 1980s, while young adult males (between seventeen and twenty- four years) reported no major changes in visit-per-person patterns, young adult females reported some decrease in the number of annual visits. There was a general increase for the overall population, however, in



The line indicated by the solid dot represents the annual number of visits per person by males. The line indicated by the open circle represents the annual number of visits per person by females. The line indicated by the x represents the combined male and female percent with a visit in the past year.

Figure 5. Annual number of dental visits per person by gender and percent of population group with a dental visit in the past year by young adults 17 through 24 years of age: 1963/64 through 1983.[10-13, 16]

the percentage of individuals with a dental visit in the past year (Figure 5).

OVERVIEW

The observation in the early 1970s, that the introduction of fluoride in a community does not induce an overall diminution in the demand for dental services (at least for children), has been borne out through the mid 1980s. Dental needs still remain in each successive age-group of youngster and successive studies document continuing increases in the use of dental services by children. The substantial decreases in dental caries have affected and surely will continue to affect, however, the character of dental practices and the spectrum and emphasis of dental services.

It is evident that a combination of the following conditions has provided dental practitioners who serve the younger population with the unique opportunity to preserve the dentition of more patients and provide complete maintenance care, while eliminating the historic task of salvaging the remains of the ravages of dental decay:

- ☐ The increase in actual numerical size of the under-eighteen-year-old population through the 1980s and 1990s.[18]
- ☐ The general population's growing awareness of the need for, and value of, programs for prevention of all diseases.
- ☐ Increasing third party coverage of dental expenses.
- ☐ The population's overwhelming awareness of the need for a regular dental checkup.[3]

Providing dental services for the younger population has changed indeed; but available information continues to document a continuing and growing demand for services by this segment of our community.

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Management of the refractory young child with chloral hydrate: dosage selection

Behavior

John E. Nathan, DDS, M Dent Sc

Despite the widespread use of chloral hydrate, there is little agreement among pediatric dentists regarding its therapeutic dosage for management of very uncooperative young children. Often selected for its wide range of safety, increasing concern has been raised with respect to its frequent failure to provide adequate levels of sedation, when using the manufacturer's recommended hypnotic dosage. To date, few studies have been conducted in an attempt to establish a therapeutic dosage range of chloral hydrate (alone or in combinations) for management of the refractory young child needing extensive treatment. While some pediatric dental texts have advocated dosages exceeding manufacturer's recommendations, none has offered controlled data to substantiate claims of safety and efficacy.

Several patient and dentist factors contribute toward a declining selection of more potent and predictable modalities, such as general anesthesia or parenteral sedation in the management of refractory children. These include increased public concern regarding the appropriateness and safety of sedation and general anesthesia by dentists, prohibitive costs associated with treatment performed in the hospital, anesthetic risks, increased liability costs, and the need for extensive armamentariums in an office setting.

This paper has two objectives. The first will focus on a discussion of the problematic issues associated with the use of chloral hydrate and will include a detailed analysis

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of the studies which have appeared in the literature. The second aim will be to discuss the implications of the weaknesses in our understanding of this agent in a pedodontic context. Several considerations regarding the design of future research to circumvent these difficulties will be discussed.

PATIENT AND DRUG CONSIDERATIONS IN ORAL PEDIATRIC DENTAL SEDATION

Patient considerations

An immediate objective of the pediatric dentist is to accomplish treatment in the least stressful manner possible. For many young children below the age of reason, neurologically handicapped and lacking in cooperative ability, conventional communication and nonpharmacologic approaches may be inadequate or even inappropriate. The selection of a management strategy must take into account factors such as safety, feasibility, patient and parent acceptance, risk and cost considerations. The oral route of administration offers distinct advantages with respect to patient acceptance and diminished risk, when compared to more potent parenteral routes. Limitations include variable absorption and no opportunity for titration. Despite disadvantages, its safety record and practicality maintain the oral route as an attractive initial alternative to a general anesthetic or parenteral technique.

Parent considerations

Preparation of the parent regarding the sedation visit and adequate informed consent are essential. It is imperative the parent clearly understands the rationale by which the modality suggested has been selected, the NPO instructions, onset, treatment, and recovery expectations.

While some practitioners prefer to administer medications upon arrival in the office, others permit parental home administration (less threatening environment) 30-45 minutes before the appointment time. This decision is generally based upon anticipated parental compliance and patient considerations. All oral instructions should be reinforced in written form.

Parents must be apprised of the long duration of onset, action and recovery. To minimize or prevent alarm, it would be helpful to identify potential sources of alarms

- ☐ Occasional agitation or disorientation while the drug is being absorbed (not uncommon).
- ☐ Sedation adequate to permit treatment may last 1-1 1/2 hours, after which drug effects will dissipate slowly over the next several hours. Although easily arousable when spoken to or by physical stimulation, many children may be seen to return to a somnolent state, during the recovery period. Discharge from the dental office, however, should not occur until the patient is stable, awake and ambulatory.

Drug considerations

Critical to the successful use of pedodontic oral sedation, is recognition that the child is not a "small adult", when selecting drugs or dosages.[1] Pharmacokinetic factors that reflect differences in surface area, organ size, cardiac rate and output, basal metabolic rate, distribution and glomerular filtration support the contention that children often require greater doses per body weight than adults.[2] As such, it is acknowledged that earlier dosage rules established for children, (e.g. Young's Clark's, Fried's, Cowling), representing small fractions of adult dosages based on age and weight, are of limited value. Unfortunately, dosages for sedative- hypnotics, on the basis of surface area, have not been presented.

Further, it must be understood that manufacturer's dosage recommendations for sedative-hypnotics are calculated to provide sedation for an essentially cooperative individual and can, at best, be expected to serve as minimum baseline starting dosage to overcome highly resistive child behaviors. Musselman *et al* suggested that additional factors such as physical activity level, emotional status, degree of cooperation, stomach contents, and time of day likely contribute to the need to surpass baseline dosages.[2]

If there appears to be some mystique about oral dosage selection for children, it is probably in large part a skill acquired from years of experience witnessing children's reactions to oral sedation. On the basis of over twenty-five years, Kopel suggested dosages in excess of manufacturer's recommendations, yet consistent with current pedodontic textbook recommendations.[3,4]

The initial assessment of patient response and clinical judgment to alter dosages above or below manufacturer's recommendations are of critical importance.

An important concept regarding pedodontic oral sedative-hypnotics is the differentiation between paradoxical excitement and overdosage. The novice is likely to misinterpret agitation of the child as a sign of overdosage either during or shortly after the latent period. This is a

common phenomenon observed before drug absorption is maximal and an adequate level of sedation is achieved. Under circumstances where agitation persists, underdosage, rather than overdosage is usually the correct assessment. Also characteristic of a slight underdosage is a child who may become somnolent during the latent period, yet becomes fully aroused and unmanageable upon the introduction of noxious stimulation (insertion of a mouth prop, injection, clamp placement, or cavity preparation). This state generally persists until distribution and dissipation of the drug effects occur. Often it is necessary to terminate the procedure and make adjustments in either dosages or modality for the next visit. Occasionally, additional drug(s) can be administered and treatment resumed following an additional 15-45 minute latency, if patient and office schedules permit. Alternatively, the use of a titrable agent such as N_2O may be added to achieve adequate sedation and avoid postponement. This is not easily accomplished, however, since a degree of patient compliance is required for this technique to be applied.

DEPTH OF SEDATION: CONSCIOUS SEDATION OR DEEP SEDATION

The response to increased public concern regarding the appropriateness and safety of sedation in the dental office has been substantial both within and outside the profession. On state and federal levels and through increased initiatives by dental specialty organizations, guidelines and legislation have been proposed for the use of conscious sedation, deep sedation and general anesthesia.[5,6] Inherent in the safe utilization of sedative modalities is appropriate dentist training and familiarity with drugs and techniques, proper monitoring of vital functions, ability to recognize when health is compromised, and the proper availability and use of emergency drugs and equipment.

Continuous monitoring and assessment of the depth of sedation of the patient receiving hypnotic dosages of chloral hydrate is essential. An expectation commonly associated with this agent is an onset of somnolence. Although it could be argued that this level of depressed consciousness does not differ from the unmedicated child patient who falls asleep during treatment, the induction of somnolence precludes classification of the depth of sedation as falling within the realm of conscious sedation. Although believed to be easily arousable by physical or voice stimulation, by definition, classification when accompanied by somnolence, most appropriately should be considered "deep sedation" (controlled state of depressed consciousness which may be accompanied by a partial loss of protective reflexes, including inability to respond purposefully to voice command). Interpretations regarding minimum precautions, monitoring requirements, etc. may vary, therefore, according to individual state regulations.

Table 1 ☐ Chloral hydrate (manufacturer's recommendations).[7]

Orally:	Sedative dose: 25 mg/kg Hypnotic dose: 50 mg/kg
Rectally:	Hypnotic dose
Maximum single dose:	1000 mg.
Toxicity:	10 grams (one death reported with 4 grams)

Table 2 ☐ Chloral hydrate (pediatric dental texts recommendations).

Oral	Rectal	Source
25-50 mg/kg (for children > 60 lb less for sedation	Same	McDonald & Avery[8] (1984)
50-70 mg/kg	Same	Trapp, L.[9] (1982) (in Stewart *et al*)
500 mg (2-3 yr; 25-30 lb) 750 mg (3-4 yr; 30-35 lb) 850 mg (4-5 yr; 35-40 lb) 1000 mg (5-10 yr; 40-65 lb)	60-900 mg	Malamed[10] (in Braham & Morris) (1980)
500 - 700 mg (2-4 yr) 750 - 900 mg (4-7 yr) 1000 - 1500 mg (> 7)	Same	Sim[11] (in Wright, G.) (1975)

CHLORAL HYDRATE IN PEDODONTIC PRACTICE

Tables 1 and 2 list the manufacturer's and pedodontic text dosage recommendations for chloral hydrate. The ensuing section reviews the pedodontic trials which attempted to assess the efficacy and safety of various dosage schedules. Tables 3 and 4 summarize the pedodontic and medical trials. It should be noted that the medical trials make use of higher doses of chloral hydrate, and none represents a controlled investigation.[24-28]

Czarnecki and Binns premedicated 100 "difficult-to-manage" children (majority under nine years of age) in a span of 422 visits, with chloral hydrate using dosages of 500 mg for children up to six years and 1000 mg for those over six.[12] Excellent and good results were reported in 21 percent and 60 percent respectively; treatment was completed on another 17 percent, although not without difficulty while only 2 percent were unmanageable. The high frequency of success (81 percent), which differs markedly from the later findings of Smith and Evans *et al*, who examined similar dosages, strongly questions the extent to which subjects were difficult to manage without drugs.[13,14]

Table 3 ☐ Pedodontic trials using chloral hydrate alone or in combination.

Drug dosage ranges and experimental conditions	Therapeutic success	N =	Adverse reactions reported	Source
50 mg/kg + 50% N_2O vs. 75 mg/kg + 40% N_2O (2 Hr. NPO)	18% 75%	17 17	vomiting 4/34	Houpt *et al*[23] (1985)
50 or 70 mg/kg + 25 mg hydroxyzine ± 20-30 mg meperidine ± 10-50% N_2O (min. 6 Hr. NPO)	83% (meperdine) 43% (w/o meperdine)	63 79	vomiting 4/142	Nathan and West[22] (1985)
75 mg/kg + 50% N_2O vs. 50 mg/kg + 25 mg promethazine + 50% N_2O	79% 90%	21 21	45% vomiting 14% vomiting	Houpt *et al*[20] (1984)
75 mg/kg + 50% N_2O vs. 50 mg/kg + 25 mg promethazine + 50% N_2O vs. 50 mg/kg + 50% N_2O	72% 89%	19 19	48% vomiting 28% vomiting	Koenigsberg *et al*[19] (1984)
60 mg/kg + 40% N_2O vs. 40 mg/kg + 40% N_2O vs. 20 mg/kg + 50% N_2O vs. Placebo (3 Hr NPO)	79% 27% 40% 46%	15 15 15 15	4/15 (27%) airway —— obstr. —— ——	Moore, *et al*[21] (1984)
75 mg/kg + 40-50% N_2O vs. 50 mg/kg + 40-50% N_2O	65% 6%	17 17	4/34 vomiting	Sheskin *et al*[18] (1983)
40 mg/kg vs. Placebo (30 min. latency) no NPO restrict.)	No stat diff	21 21	no episodes of vom.; one 219 lb. pt. rec'd 3,984 mg without problem	Barr *et al*[17] (1977)
1000 mg + 50-200 mg hydroxyzine vs. 1500 mg + 50-200 mg hydroxyzine	62% 56%	29 9	——	Tobias *et al*[16] (1975)
15 grains vs. 7.5 grains + 25 mg promethazine	60% 68%	58 pts. 142 visits	10% vomiting	Robbins[15] (1967)
500 mg < 6 yrs. 1000 mg > 6 yrs.	81% Overall	100 pts. 422 visits	—	Czarnecki and Binns[12] (1963)

Evans *et al* acknowledged the need to study pedodontic premedication agents under controlled conditions.[14] Using rating scales to score patient manageability and emotionality quantitatively, they compared 12 and 15 mg/lb doses of chloral hydrate under blind conditions with a placebo. An occlusal restoration was placed, on each of two visits, in seventy-five children (3-8 years of age) who "appeared apprehensive and difficult" to manage. The authors reported surprise that no significant differences were found at that dosage and attributed the failure to find drug effects, to a failure of drug action. The fact that parents were instructed to feed children thirty minutes prior to drug administration and treatment commenced following only a thirty-minute latent period likely minimized drug absorption. Despite these factors, the low dosage and probable low levels of pretreatment anxiety, this study was among the first to draw attention to the need to evaluate oral premedication agents, more objectively.

Conducted in a private practice setting, Robbins compared the responses of fifty-eight children (22 mos - 6 years of age) over a span of 142 visits to placebo, 15 grains chloral hydrate, and 7.5 grains of chloral hydrate plus 25 mg promethazine.[15] The author indicated that subjects

Table 4 ☐ Medical trials involving chloral hydrate.

Drug dosage ranges and experimental conditions	Therapeutic success	N =	Adverse reactions reported	Source
80 mg/kg oral C.H.	85%	231	1 episode of respiratory distress associated with excess secretions & enlarged tonsilar & adenoid tissues	Thompson, *et al*[28] (1982)
50 mg/kg for < 4 wks. 100 mg/kg for > 4 wks.	98%	300	15% nausea/vomit 5% excitement	Judisch *et al*[27] (1980)
75 mg/kg	——	No data presented	——	Houser *et al*[26] (1975)
50-100 mg/kg rectal 500 mg p.o. (1-2 yrs.) 750-1000 mg (> 2 yrs.)	——	No data presented	——	Davis[25] (1973)
25 mg/ (month of age)	90%	No data		Carabelle[24] (1961)

demonstrated strongly apprehensive behavior during an initial visit for examination and radiographs. Statistically significant differences were reported for both drug conditions compared to the placebo, with less nausea/vomiting resulting from the combination using promethazine. Of importance was the observation that the addition of an antiemetic enabled using half the chloral hydrate dose without reducing therapeutic success. This benefit was later amplified in studies of Houpt and Koenigsberg described below.

Tobias *et al* assessed the effectiveness of a chloral hydrate-hydroxyzine combination on thirty-nine previously unmanageable children (ranging from 1.75-10.5 years of age; mean 3.9 years).[16] Subjects received either 1000 or 1500 mg chloral hydrate, and 50 mg hydroxyzine one hour before appointments. In addition, some subjects received up to 150 mg (in 50 mg divided doses) of hydroxyzine starting the day, evening and/or morning before the appointment doses. Two three-year-old subjects received two additional 1000 mg doses of chloral hydrate upon rising and in the morning before the preoperative combination. Fifty-one percent of the cases were reported as effective, 13 percent were semieffective and 28 percent showed fair-to-poor results. The arbitrary selection (on the basis of age) of chloral hydrate dosages and a failure to utilize a specific mg/kg dosage no doubt minimized meaningful assessment of the efficacy of this regimen. No attempts were made to examine the potentiating effects of the multiple dosage administrations of hydroxyzine of chloral hydrate.

Barr *et al* subjectively assessed the responses of twenty-one patients, ranging in age from one to seventeen years, using cross-over blind conditions across two visits.[17] Subjects received a placebo at one visit and 40 mg/kg chloral hydrate for the other visit. No statistically significant differences were found at this dosage, and the authors concluded that chloral hydrate is not recommended for the very young, the mentally retarded, or the emotionally disturbed pediatric dental patient. No description was made of the behavioral selection criteria and the authors acknowledged that several subjects manifested improved behavior throughout a series of visits. On the basis of the high incidence of positive behavior from the placebo, one must question whether subjects were sufficiently difficult to warrant medication at the outset. Other design limitations included small sample size, wide distribution of age, inclusion of neurologically normal and handicapped patients, low chloral hydrate dosage, no definitive NPO instructions, and an insufficient latency period (30 minutes).

Smith evaluated the behavioral (Frankl Scale) and kinesic/vocalization responses of fourteen neurologically handicapped patients, ranging in age from four to sixteen years (mean: 10 years) in two dental visits.[13] Using a cross-over and blind conditions, subjects received chloral hydrate or a placebo. Dosages of chloral hydrate ranged from approximately 400 mg to 1500 mg. Children weighing 5-10 kg received 75 mg/kg with dosage decreasing to 30 mg/kg for subjects weighing up to 50 kg. No differences between placebo and chloral hydrate were found for either behavior or kinesics. Despite the appropriate use of the blind cross-over, design flaws which included small sample size, wide distribution of age, and variable dosage no doubt minimized the opportunity to detect group differences.

Acknowledging the frequent failure rate, when following the manufacturer's recommended dose of chloral hydrate, Sheskin *et al*, in a two visit cross-over design, compared the effectiveness of 50 mg/kg with a 75 mg/kg dose on seventeen children (18-46 mos.).[18] Successful sedation as evidenced by a lack of movement and/or crying which interfered with treatment was found in 6 percent and 65 percent of the visits with the low and high doses, respectively. Four episodes of vomiting were reported. Had N_2O in concentrations of 40 - 50 percent not been administered to all subjects, interpretations with respect to the effectiveness of the oral medications alone may have been enhanced. In view of the wide individual variation among children as well as adults with respect to therapeutic concentrations of N_2O, it is conceivable that some children may have shown agitation (stage II) by N_2O alone. On the other hand, considerable differences were reported in the control of interfering behaviors between the high and low doses with a relatively low incidence of vomiting. The behavioral selection criteria were not defined other than to indicate that subjects were nonexperienced and required at least two premedication visits. The fact that such low success rates were achieved, particularly with the 50 mg/kg dose, however, strongly suggests subjects were severely anxious to warrant medication. The impact of N_2O nevertheless confounds this issue. Houpt *et al* (1985), described later, amplifies on this design.

In preliminary presentations, Koenigsberg *et al* and Houpt *et al*, adding a few more subjects, compared the effectiveness and safety of chloral hydrate with and without promethazine.[19,20] Using a cross over design and blind conditions in two visits, they rated the behavioral (degree of sleep, crying, and body movements) and physiologic responses (blood pressure, pulse and respiratory rates, and pupil size) before, during, and after dental treatment of twenty-one children, (15-45 mos;

mean 32 mos.). Subjects received randomly 75 mg/kg chloral hydrate or 50 mg/kg chloral hydrate plus 25 mg promethazine. All subjects received 50 percent N_2O and were restrained in a papoose board® with head holder. While Koenigsberg *et al* reported an incidence of nausea/vomiting of 48 percent and 28 percent respectively (in 19 subjects), Houpt *et al* reported 45 percent and 14 percent (in twenty-one patients) receiving the chloral hydrate without and with promethazine, respectively.[19,20] The increase in nausea/vomiting of subjects receiving 75 mg/kg chloral hydrate differs markedly from those receiving the identical regimen in Sheskin's study.

Successful sedations (lack of crying and/or interrupting movements) were found in 90 percent of the cases using the antiemetic compared to 79 percent with the high dose chloral hydrate without the antiemetic.

On the basis of these data, it would appear that the addition of 25 mg promethazine dramatically increased the success rate of the 50 mg/kg dosage of chloral hydrate from 6 percent to 90 percent; while success of the 75 mg/kg dose supplemented with 50 percent N_2O in this study (72 percent) did not differ greatly from Sheskin's findings (65 percent).

In view of the upsetting nature of chloral hydrate on the gastrointestinal functions and the high level of N_2O administered, it was not surprising to observe a 48 percent incidence of vomiting. The authors acknowledged that both factors may have contributed to the high incidence of vomiting and agree that future study should reduce or eliminate the confounding nature of N_2O. As a result, the increased success achieved by adding 25 mg of promethazine was not easily addressed.

Noteworthy, however, were the use and description of rating scales for the assessment of patient alertness, movement, quality of crying, and overall behavior. The use of pupillary size as a fine index of depth of sedation and the noncontinuous monitoring of vital signs, however, seem inadequate from the perspective of being able to differentiate depth of sedation, particularly in the somnolent patient. Greater opportunity for comparison may have been possible had promethazine been administered with both chloral hydrate dosages.

Moore *et al* compared the responses of sixty children, aged two to five years, considered uncooperative, under blind conditions for one dental visit.[21] Subjects received either a placebo, 20 mg/kg, 40 mg/kg, or 60 mg/kg chloral hydrate, with and without 40 percent N_2O. Using a Frankl rating system, statistically significant improvements were observed only for subjects receiving 60 mg/kg chloral hydrate compared to placebo (without N_2O-O_2). It was particularly interesting to note that positive behaviors among the placebo group ranged from 46-67 percent when rated across all aspects of a visit, particularly during the injection with N_2O. This finding strongly suggests their behavioral selection criteria included a large percentage of nonanxious subjects, or at least subjects who were highly responsive to standard nonpharmacologic management approaches. Similar high percentages of positive behaviors (40 percent and 27 percent) observed with the 20 mg/kg and 40 mg/kg groups, respectively, during injections with N_2O, confound the ability to draw conclusions regarding the safety (or lack of) of using 60 mg/kg dosage with 40 percent N_2O.

These authors reported airway obstruction in four of fifteen subjects for the 60 mg/kg group, when 40 percent N_2O was administered. It should not be surprising to find this dosage to be too high, if used for nonanxious or minimally anxious subjects. It seems warranted that further study utilizing adequate behavioral selection criteria upon which to evaluate the efficacy and safety of various dosages of chloral hydrate should be made.

Nathan and West retrospectively compared the efficacy and safety of a chloral hydrate-hydroxyzine combination with and without low doses of oral meperidine on 135 unmanageable (requiring harsh physical restraint) patients, ages eighteen to sixty months (mean: 34 mos.).[22] Treated over a span of 142 visits, subjects received either 50 or 70 mg/kg doses of chloral hydrate with 25 mg hydroxyzine with and without 20-30 mg meperidine. Success of sedations were defined on the basis of the ability to complete treatment and the extent to which physical restraint was needed to overcome persistent interfering behaviors.

Although treatment objectives were completed in 71 percent and 97 percent of the nonmeperidine and meperidine visits, rigid restraint was needed in 57 percent and 17 percent of these cases, respectively. Successful sedations (no need for persistent application of restraints) occurred, therefore, in 43 percent and 83 percent of the cases involving nonmeperidine and meperidine, respectively. N_2O (in concentrations ranging from 10- 50 percent) was used only after premedications were judged inadequate to produce adequate levels of sedation. No significant improvements in success were attributable to either the higher dose of chloral hydrate or the addition of N_2O. Limitations of this preliminary study included the lack of control conditions and relatively small sample size ($N = 8$ and 9) of those receiving the high dose of chloral hydrate with meperidine, with and without N_2O, respectively. En-

hanced success by the addition of low doses of meperidine, while enabling significant reduction of chloral hydrate dosage warrants further study.

Houpt *et al*, using an identical design and assessment criteria to their earlier study, compared the effectiveness of 50 mg/kg vs 75 mg/kg chloral hydrate on seventeen children (21-46 mos., mean 31 mos.)[23] All subjects received N_2O in concentrations 40 - 50 percent and the papoose board without the head restraint. All parents were instructed to feed children a light meal consisting of a small glass of milk and bowl of cereal at least two hours before the appointment. While the impact of this feeding on drug absorption is unclear, the incidence of nausea was reduced to four instances.

Overall, 82 percent of the low dose administrations were rated as bad or very bad, while 75 percent of the high dose administrations were rated good or very good. The authors concluded that 75 mg/kg + 40 percent N_2O provided significantly better sedation than 50 mg/kg chloral hydrate + 50 percent N_2O. They also conceded that N_2O likely had a confounding effect and suggested future studies be done without N_2O.

SUMMARY AND IMPLICATIONS FOR FUTURE RESEARCH

Considerable study of the use of chloral hydrate in pediatric dentistry was undertaken. Consistent with observations of Duncan *et al*, wide variation in dosage selection exists among pedodontic practitioners.[29] Of the clinical trials conducted within pedodontic and medical fields, rarely are dosage recommendations and claims of clinical success based upon substantive controlled data.

On the basis of these studies, several conclusions emerge which should serve as focus for future study.

- ☐ Despite widespread use, no criteria have been established to clarify effective and safe dosage guidelines for management of the severely resistive young child.
- ☐ Explanations to account for the range of success/failure reported with chloral hydrate dosages (alone or in combinations) appear multifactorial in nature. Deficiencies in research design include:
  - ☐ Inadequate subject selection criteria. Ample demonstration of adequate levels of pretreatment anxiety is needed to assure the ability to detect differences attributable to a drug. Inclusion of minimally anxious subjects sensitive to standard behavior management techniques further obscures the opportunity to differentiate effects of experience and adaptation when multiple visit studies are conducted.
  - ☐ Inadequate NPO enforcement and allowance for latent periods. Need exists to control factors that affect drug absorption by the oral route. An adequate period (4-6 hours) of fasting or restriction of foods and nonclear liquids as well as allowance for a sufficient latent period can be expected to facilitate drug absorption. Other pertinent variables which include "first pass" metabolism, and anxiety itself which limits gastrointestinal motility, need to be factored into dosage assessment.
  - ☐ Inadequate sample size.
  - ☐ Lack of blind conditions.
  - ☐ Avoidance of confounding drug(s).
  - ☐ Demonstrated validity of behavioral assessment scales/ratings.
  - ☐ Need for continuous measurement/monitoring/recording of vital physiologic functions during operative and recovery periods.
  - ☐ No assessment of recovery.

Despite a dearth of studies involving chloral hydrate in children, controlled data are needed to clarify its efficacy and criteria for dosage selection. Additional research appears warranted to guide the most effective use of this sedative agent as an alternative to general anesthesia or parenteral sedation.

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In the article by Barbakow *et al*, published in the January-February 1987 issue, the graphs in Tables 2 and 3 were transposed. They should appear as shown below. We are sorry for any inconvenience to the readers.

Figure 2. Profiles of the enamel fluoride concentrations and the depths of etch (cumulative) of the specimens water-washed for 10 sec after each brushing plus an additional 24 h after the last brushing with dentifrices containing either amine fluorides 297 & 242 (Elmex®); nicomethanol hydrofluoride; sodium fluoride (Crest®); or water.

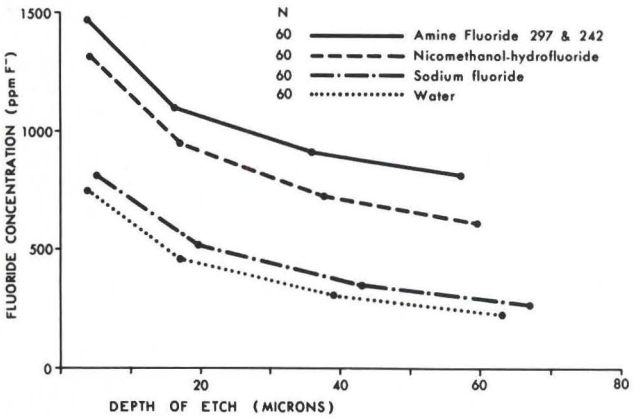
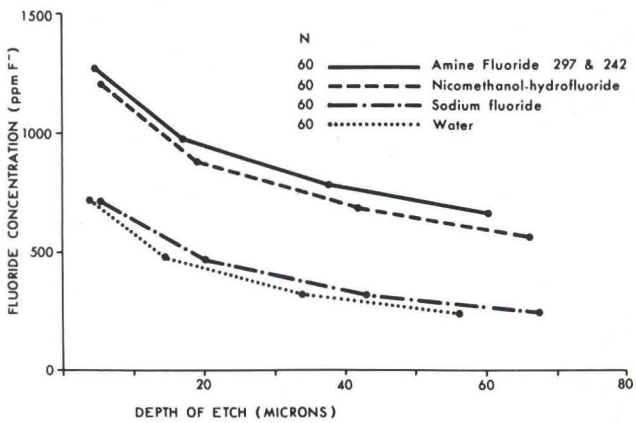


Figure 3. Profiles of the enamel fluoride concentrations and the depths of etch (cumulative) of the specimens water-washed for 10 sec after each brushing plus an additional 50 h after the last brushing with dentifrices containing either amine fluorides 297 & 242 (Elmex®); nicomethanol hydrofluoride; sodium fluoride (Crest®); or water.



Knowledge about systemic fluoride supplements among pediatric dentistry faculty and practitioners

Clinic

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Community water fluoridation has been recognized as the most efficient and cost-effective method for providing the recommended levels of systemic fluoride necessary for the prevention of dental caries.[1,2] Almost half of the population of the United States, however, does not have access to optimally fluoridated water.[3] Fluoride tablets and drops are effective and safe measures for reducing dental caries in children who do not have access to optimally fluoridated water.[4-7] They have been advocated, particularly for use in nonfluoridated areas, especially in private-practice settings.[8,9] Before prescribing these supplements, however, proper fluoride histories and assays of the major sources of drinking water for each patient must be obtained, in order to determine the proper dosage and to avoid dental fluorosis.

Previous studies have shown that most dentists and physicians in the United States prescribed fluoride supplements, but the numbers of water samples submitted for fluoride assay have been small in comparison with the numbers of births in nonfluoridated areas.[10-15] Thus, many providers prescribe fluoride supplements without obtaining prior specific knowledge, by assay, of the pa-

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tient's water fluoride content. In addition, some providers have been shown to be unaware of the recommended dosage regimen and contraindications such as optimally fluoridated water. Pediatric dentists in North Carolina conducted a significant proportion of the total water fluoride assay activity, despite their relatively small numbers.[14] Overall, 33 percent of pediatric dentists were found to be assaying during the study period.[14]

Dental researchers have been shown to select fluoride as the key factor in dental caries prevention, while dentists and the public emphasized oral hygiene most, followed by diet and professional dental care.[16] Researchers may more fully appreciate the practicality of fluoride as a preventive measure that "does not require the public to be skilled in oral hygiene techniques."[16] Practitioners may focus more on the theory that a clean tooth will not decay and may overemphasize oral hygiene procedures.[13,16,17]

Reported here are results of a 1984 survey of North Carolina pediatric dentistry faculty and private practitioners. Levels and sources of knowledge about fluoride supplements and factors considered in evaluating fluoride supplement need were investigated. Faculty members were expected to be more knowledgeable about and thorough in their evaluations of patients' needs for fluoride supplementation.

METHODS AND MATERIALS

Licensure renewal files of the North Carolina State Board of Dental Examiners provided listings and addresses for the forty-five dentists in private practice who listed a primary specialty of pediatric dentistry. The nine pediatric dentistry faculty and two pediatric dentistry fellows at the University of North Carolina School of Dentistry constituted the faculty group. A two-page survey instrument used both open-ended and structured questions about knowledge and protocol of systemic fluoride supplements (see Appendix). A follow-up mailing was sent to all nonrespondents three weeks after the initial mailing and both telephone follow-up and a third mailing were used after a similar interval. All faculty responded, as did all forty-two of the private practitioners for whom current addresses were available.

RESULTS

The distributions of years since dental school were similar for the private pediatric dentists and the faculty; 33 percent to 45 percent of each group graduated less than ten years ago and 14 percent to 18 percent graduated twenty-six or more years ago.

As expected, private pediatric dentists were much more likely than the faculty to be treating large numbers of child patients. Ninety-five percent of private practitioners treated twenty-one or more children per week, while only 36 percent of the faculty did. Similar percentages of the patients of the faculty and private practice groups received optimally fluoridated drinking water. Twenty-seven percent of the faculty and 33 percent of the private practitioners reported that a majority of their patients did not receive optimally fluoridated water.

Almost all pediatric dentists prescribed systemic fluoride supplements; all faculty and 93 percent of private practitioners prescribed supplements. Table 1 shows the factors considered in determining the need for fluoride supplementation and the appropriate dosage. (This was an open-ended question with multiple responses from most practitioners). A majority of the faculty reported considering fluoridated home-water, recommended dosage guidelines, and water-fluoride assay results. Most private pediatric dentists listed fluoridated home water as a consideration, but only 47 percent listed water fluoride assay results and only 24 percent listed dosage guidelines. Other sources of fluoridated water, such as school and daycare, were considered by 36

Table 1 ☐ Factors considered in fluoride supplement determinations.*

Factor	Percentage of faculty listing factor (n = 11)	Percentage of private practitioners listing factor (n = 42)
Fluoridated home water	55	71
Country/well water	9	5
Other water fluoridated (e.g., daycare, school)	36	26
Patient age	36	47
Water fluoride assay results	100	47
Dosage schedule/guidelines	55	24
Caries activity	18	7
Patient weight	0	3
Motivation of patient and/or parent	0	5
Other	0	26

*This was an open-ended question and many practitioners listed several factors, so percentages do not sum to 100%.

Table 2 ☐ Percentage distribution of how well informed pediatric dentists felt about fluoride supplementation.

	Percentage of dentists who felt			
	Very well informed	Well informed	Somewhat informed	Not well informed
Faculty (n = 11)	91	9	0	0
Private practitioners (n = 42)	63	32	5	0

percent of the faculty and 26 percent of the private dentists.

Table 2 shows the percentage distribution of how well-informed pediatric dentists felt they were about current practices in fluoride supplementation. Only one faculty member felt less than very well informed, while 5 percent of private pediatric dentists felt only somewhat informed and 32 percent felt well informed.

Table 3 shows the amounts of knowledge about fluoride supplementation learned from various sources. A majority of the faculty learned a great deal from their residency training, continuing education and meetings, and professional journals. Private pediatric dentists learned the most from their residencies and dental schools, but less from continuing education courses and professional journals and meetings.

Similar percentages of faculty (73 percent) and private practitioners (62 percent) had been asked by medical personnel for information or advice concerning systemic fluoride supplements. Eighty-two percent of the faculty and 64 percent of the private pediatric practitioners thought that a program in which dentists would advise medical personnel about fluoride supplements would be helpful. Approximately 90 percent of each group was willing to participate actively in such a program.

DISCUSSION

Faculty and fellows of pediatric dentistry were more likely than private pediatric dentists to consider several of the pertinent factors in fluoride supplement need and dosage determinations. Faculty were more than twice as likely to mention both water fluoride assay results and dosage schedule guidelines. These are essential considerations in supplement determinations, in largely rural states such as North Carolina. Fairly high percentages of practitioners, however, also considered these factors. Because of the open-ended nature of this question, the percentages of persons who actually considered these factors may be underestimated.

Faculty reported they had learned less about fluoride supplements from dental school than did the practitioners. Both groups reported that they learned much about fluoride supplements from their residencies. Thirteen percent of the private dentists reported that the residency was not applicable, perhaps because they were never formally trained in pediatric dentistry residencies, despite self-reporting (in licensure renewal data) that their primary specialty was pediatric dentistry. Faculty reported learning more from continuing education courses and professional journals than did private dentists.

The majority of both groups had been asked to provide information about supplements to medical personnel. The overwhelming majority were willing to help with an educational program for medical personnel about fluoride supplements. Smaller majorities felt that such a program would be useful. It was not possible to determine whether this was because of feelings that the physicians were already well informed or because of

Table 3 ☐ Percentage of pediatric dentists who learned from these sources about fluoride supplements.

	Percentage who learned									
	A great deal		A moderate amount		A small amount		Little or nothing		Not applicable	
	F	P	F	P	F	P	F	P	F	P
Dental school	10	48	30	21	20	26	40	5	0	0
Pediatric dentistry residency	60	67	20	18	10	0	10	3	0	13
Continuing education meetings	50	28	0	30	20	23	20	18	10	3
Professional journals	50	15	40	50	10	23	0	13	0	0
Dental reference books	11	11	33	27	33	27	22	35	0	0
Mail advertising	0	3	0	3	33	35	67	49	0	11
Pharmaceutical representatives	0	0	0	19	11	27	78	49	11	5
State board of health fluoride guidelines*	—	11	—	14	—	28	—	33	—	14
Other	0	30	0	20	0	0	0	30	0	20

F = Faculty (n = 11) P = Private practitioners (n = 42)
*Not included in the questionnaire for the faculty.

dentists' feelings that physicians likely would not be receptive to such a program. The willingness of almost all pediatric dentists to participate in such a program is encouraging and would be critical to the success of any such efforts.

Overall, pediatric dentists in private practice were less likely than faculty to be very well informed about and to consider appropriate factors in water fluoride assay and fluoride supplementation. Nevertheless, the responses of the private practitioners were generally positive. The differences between the dental researchers and practitioners were not as great as those found in other studies comparing the knowledge and practices of prevention of dental disease. This may be due, at least in part, to the training in, and emphasis on research to which residents in pediatric dentistry are typically exposed. In all likelihood, faculty and practitioners of pediatric dentistry have had more similar training than the majority of dental practitioners and researchers.

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Portions of this paper were presented at the 113th Annual Meeting of the American Public Health Association in Washington, D.C. in November 1985. This research was initiated while Dr. Levy was Dental Public Health Resident with the North Carolina Dental Health Section.

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APPENDIX IS PRINTED ON FACING PAGE

QUESTIONNAIRE

Please circle the correct response or explain in the space provided.

1. Do you currently treat patients? YES NO
2. Do you currently treat children under age 13? YES NO
   IF YOUR ANSWER TO QUESTION #1 or #2 IS "NO" YOU NEED ANSWER NO MORE QUESTIONS.
   PLEASE RETURN THE QUESTIONNAIRE IN THE ENCLOSED ENVELOPE.
3. Of the following types of auxiliaries, how many of each do you employ in your office?
   Hygientists _____ Assistants _____ Other _____
4. How many years has it been since you graduated from dental school?
   less than 5 6-10 11-15 16-20 21-25 26-30 more than 30
5. How many child patients under age 13 do you see in an average week?
   less than 5 6-10 11-15 16-20 more than 20
6. Do you prescribe systemic fluoride supplements? YES NO
7. What factors and guidelines do you consider and what steps do you take in determining if a child needs a fluoride supplement, and if so, the correct dose?
8. What percentage of your child patients:
   a. Live in communities with optimally fluoridated water?
      none 1-25% 25-50% 51-75% 76-100% Unknown
   b. Appear for their first dental visit already having fluoride supplementation (either separately or in vitamin combination) from their physician?
      none 1-25% 26-50% 51-75% 76-100% Unknown
   c. Do you prescribe fluoride supplements for?
      none 1-25% 26-50% 51-75% 76-100% Unknown
9. What factors caused you **not** to prescribe fluoride supplements for the balance of the children who do **not drink fluoridated water or receive fluoride supplements from their** physician?
10. If some of your patients are drinking optimally fluoridated water, is it mostly:
    Naturally occurring Adjusted Unknown
11. Of the total time spent in your practice concerning water fluoride analysis and fluoride supplements, what percentage is spent by the:

_____Dentist	EXAMPLE:	40 Dentist
_____Hygienist		50 Hygienist
_____Assistant		10 Assistant
_____Other		0 Other
_____TOTAL		100% TOTAL

12. Have you been asked by medical personnel to advise them regarding the proper use of fluoride supplements? YES NO
    If "YES" by what types of medical personnel? How many times per year? How recently?
13. Do you think that a program involving dentists advising medical personnel about fluoride supplements would be helpful (in your area)? YES NO
14. Would you be willing to actively participate? YES NO
15. How much did you learn about fluoride supplements from each of the following sources? (Please check the most appropriate response for each source.)

	A GREAT DEAL	A MODERATE AMOUNT	A SMALL AMOUNT	LITTLE OR NOTHING	NOT APPLICABLE
Dental School	_____	_____	_____	_____	_____
Residency	_____	_____	_____	_____	_____
Continuing Education/ Meetings	_____	_____	_____	_____	_____
Professional Journals	_____	_____	_____	_____	_____
Dental Reference Books	_____	_____	_____	_____	_____
Mail Advertising	_____	_____	_____	_____	_____
Pharmaceutical Representatives	_____	_____	_____	_____	_____
State Board of Health Published Fluoride Guidelines	_____	_____	_____	_____	_____
Other (Specify)	_____	_____	_____	_____	_____

16. How well informed do you feel that you are regarding current practices in fluoride supplementation?
    Very Well Informed Well Informed Somewhat Informed Not Well Informed
17. Do you have any comments you wish to make about the use of fluoride supplements or water samples for fluoride assay? (Plese use other side, if necesary.)

Analgesics in pediatric dental surgery: relative efficacy of aluminum ibuprofen suspension and acetaminophen elixir

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Ibuprofen (Motrin[a]) is a propionic acid derivative with antiinflammatory, analgesic and antipyretic properties. The analgesic activity of ibuprofen has been demonstrated in the treatment of pain produced by dental surgery. Using this model, ibuprofen has been shown to be three to five times as potent as aspirin with considerably less potential for gastrointestinal irritation and inhibition of platelet function.[1,2]

The formulation of the tablet denies these benefits to patients unable to swallow sizeable tablets. To solve this problem, a suspension of aluminum ibuprofen, consisting of the bis-ibuprofen salt of aluminum hydroxide, was formulated. In the gastrointestinal tract, the aluminum moiety disassociates to form insoluble aluminum salts, thus yielding free ibuprofen to be absorbed. Pharmacokinetic studies have shown a suspension of aluminum ibuprofen to be bioequivalent to Motrin tablets.[3]

Acetaminophen elixir is a popular analgesic/antipyretic agent for use in pediatric populations. Acetaminophen has been shown to be comparable to aspirin in relief of dental pain.[4]

The purpose of this study was to compare the analgesic properties, safety, and tolerance of a single dose of aluminum ibuprofen suspension, acetaminophen elixir and placebo, when used for relief of postextraction pain in children.

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MATERIALS AND METHODS

Outpatients, ages seven to sixteen years, requiring extraction of at least one permanent tooth were enrolled in the study. Minimum weight for inclusion in the study was eighteen kilograms. The study was reviewed and approved by the Ethics Committee of the Faculty of Dentistry and written, informed parental consent was obtained prior to participation. Upon entry to the study, age, sex, height, weight, race, dental diagnosis and proposed procedure were recorded.

Exclusion criteria for the study included the following: those already taking analgesics, aspirin or other nonsteroidal antiinflammatory drugs; those who previously exhibited hypersensitivity to Motrin or acetaminophen or individuals with the syndrome of nasal polyps, angioedema and bronchospastic reactivity to aspirin or other nonsteroidal antiinflammatory agents; those with a history of peptic ulceration, gastrointestinal bleeding, fluid retention and edema, intrinsic or acquired coagulation defects, cardiac decompensation, hypertension or patients with known impaired hepatic, hematologic and/or renal functions.

The study was of a double blind design in which all medication bottles were dispensed in coded identical-looking sealed boxes. Patients were randomly assigned to one of three medication groups. Group I received 200

All study medications were provided by the Upjohn Company of Canada.

[a] Motrin (Upjohn Pharmaceuticals)

mg (2.5 ml) of aluminum ibuprofen in suspension. Group II received 240 mg (10 ml) or 360 mg (15 ml) of acetaminophen elixir according to age (240 mg for seven-to-eight-year-old children, 360 mg for eight-to-sixteen-year-old children). Group III received placebo (10 ml of cherry-flavored suspension).

Parents were instructed to administer medication, when the child's postoperative pain was assessed as having reached a moderate or severe level. The study design and the analgesic factors recorded were similar to previous outpatient trials of pain relief following dental surgery.[1,5,6] Pain was rated as: 1, none; 2, mild; 3, moderate; and 4, severe. Pain was rated at zero, one- half, one, two, three and four hours after taking the study medication. In addition to pain intensity, the degree of pain relief at each time interval was recorded as either: 1, complete; 2, a lot; 3, some; 4, little; 5, none.

Pain-intensity-difference scores (PID) were derived by subtracting the patient's assessment of their pain level at each time-interval after medication from the intensity at the time of administration. Summed effects (calculated by totalling the scores for four hours) and peak effects were calculated for both PID and pain relief.

At the end of the four-hour-assessment period, the overall global rating of the study medication was recorded as: 1, excellent; 2, good; 3, fair; 4, poor; and 5, discontinued.

Categorical patient data were analyzed for differences between treatment groups by means of the Chi-square test. Continuous variables were analyzed by the one-way analysis of variance test. For the nonparametric analysis, the Kruskal-Wallis one-way analysis of variance was also used. If an overall significant difference occurred with the analysis of variance test, then pair-wise comparisons of ordered categorical variables. (e.g. pain intensity, pain relief, overall global rating) were performed by Scheffe multiple comparisons. Correlations were done by a Spearman rank order test. The level of significance used was 0.05.

RESULTS

Of the 150 patients entering the study, twenty-one did not develop a moderate or severe degree of pain requiring an analgesic, and were, therefore, excluded from the study. An additional six patients were excluded for reasons of noncompliance with the accurate recording and return of home records. The dropouts were approximately evenly distributed between groups. No significant differences were measured between the three groups for sex, age, race, height, weight, or initial pain severity (Table 1). This established that the groups were similar at base-line.

The dental surgical procedures performed ranged from extraction of a single erupted permanent tooth to the surgical removal of multiple unerupted or impacted teeth. No significant differences existed in the distribution of dental procedures performed in the three treatment groups (Table 2).

Table 3 presents the mean scores for the various mea-

Table 1 ☐ Distribution of patient characteristics within medication groups.

	Motrin	Acetaminophen	Placebo
Patient number	41	43	39
Age			
8-13 years	17	9	15
14-16 years	24	34	24
Sex			
Male	12	18	17
Female	29	25	22
Race			
White	37	39	37
Black	1	1	0
Other	3	3	1
Height (mean centimeters)			
Male	155.4	166.4	160.4
Female	154.0	154.8	156.5
Weight (mean kilograms)			
Male	51.6	50.0	50.2
Female	51.8	50.0	50.2
Initial pain			
Moderate	32	36	28
Severe	9	7	11

Table 2 ☐ Distribution of dental procedures within medication groups.

	Motrin	Acetaminophen	Placebo
Single erupted tooth	4	4	3
Multiple erupted teeth	10	11	11
Single unerupted tooth	5	6	8
Multiple unerupted teeth	22	22	17

Table 3 ☐ Mean values for pain intensity, pain relief and global rating of drug efficacy.

	Motrin	Acetaminophen	Placebo
Pain intensity			
0 hr.	3.22	3.16	3.28
½ hr.	2.80	2.70	2.97
1 hr.	2.20	2.35	2.74
2 hr.	2.12	2.30	2.49
3 hr.	1.82	2.14	2.18
4 hr.	1.78	1.95	2.21
Pain relief			
½ hr.	3.76	3.67	4.13
1 hr.	2.78	3.05	3.67
2 hr.	2.54	2.91	3.31
3 hr.	2.10	2.44	2.69
4 hr.	2.02	2.23	2.58
Global rating	2.27	2.72	3.20

sures of analgesia. A time effect curve for pain intensity is presented in the Figure showing that aluminum ibuprofen was the most efficacious treatment over the four-hour-evaluation period.

The Kruskal-Wallis test demonstrated significant treatment effects ($p < 0.05$) for one-hour and two-hour scores for differences in pain intensity and pain relief, as well as total pain relief and overall global rating.

A pair-wise comparison of pain intensity and pain relief at one and two hours found aluminum ibuprofen to be superior to both acetaminophen and placebo ($p < 0.05$), with no significant difference between acetaminophen and placebo. At one-half, three and four hours, no significant differences were measured between treatment groups for these two factors; but a trend in favor of aluminum ibuprofen was found.

Pair-wise comparisons of total pain relief scores and overall global rating showed aluminum ibuprofen to be superior to both acetaminophen and placebo ($p < 0.05$). Comparison of total pain intensity differences showed a trend toward a superior efficacy of aluminum ibuprofen, but the differences were not statistically significant ($p = 0.058$). No significant differences were measured between acetaminophen and placebo for these three variables.

Side effects did not occur with sufficient frequency to allow any meaningful statistical analysis. Only four adverse reactions were recorded: one case of mild stomach upset in a patient receiving aluminum ibuprofen, one case of dizziness in a patient receiving acetaminophen, and dizziness and drowsiness reported in two patients receiving placebo.

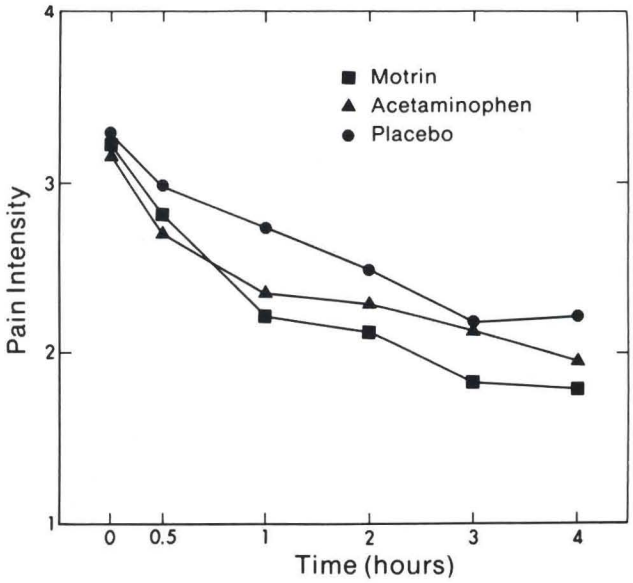

Figure. Time effect curve for pain intensity by medication.

DISCUSSION

Analgesic efficacy of aluminum ibuprofen was found to be superior to acetaminophen or placebo in the relief of postextraction pain in this pediatric population. The postoperative pain associated with dental surgery is invariably associated with inflammation and edema. Consequently, aluminum ibuprofen's superior analgesic efficacy in this study may be due in part to its antiinflammatory properties, properties not shared by acetaminophen.

Concern has been expressed regarding the accuracy and consistency of young children's verbal descriptions of their pain experience.[1] In the only previously reported study of aluminum ibuprofen as an analgesic for relief of postextraction pain in children, the patient population ranged in age from five to twelve years, in contrast to the mean patient age of 14.4 years in the present study.[6] In the present study, a significant correlation ($p < 0.05$) was found between the patient's assessment of pain relief at each time interval and the corresponding pain intensity difference, independently recorded factors estimating the degree of analgesia. Thus, in this older patient population, a consistency is seen in the children's interpretations and recordings of their pain experiences.

A difficulty encountered in the earlier study by Moore *et al* was that, because of the younger mean age of their patient population, many of the dental surgical procedures involved the relatively atraumatic removal of resorbing primary teeth.[6] As a result, only 33 percent of patients required a postoperative analgesic, resulting in a modest sample size. Fewer than 10 percent of the children in the medication or placebo groups, furthermore, reported any pain by four hours, rendering the separation of active and placebo analgesics difficult at these latter time intervals.

In the present study, all dental surgical procedures involved the removal of permanent teeth, primarily for orthodontic purposes, and 65 percent of cases involved the removal of one or more unerupted or impacted permanent teeth. Incidence of moderate to severe pain and a requirement for analgesics was found in 86 percent of enrolled cases.

At one and two hours postmedication, the analgesic action of aluminum ibuprofen was significantly superior to both acetaminophen and placebo. By three and four hours postmedication, inflammation and edema would

be expected to contribute increasingly to patient discomfort. Aluminum ibuprofen, with its antiinflammatory effect, continued to demonstrate the greatest analgesic efficacy at these time intervals. There were no statistically significant differences, however, between groups at three and four hours. Given the rather high mean weight (51.8 kgs) in the present pediatric study, it may be that dosing was suboptimal.

The optimal pediatric dose of ibuprofen, in either tablet or suspension formulation, has not yet been determined. The 200 mg dosage of aluminum ibuprofen employed in the present study is one-half of the dosage recommended for relief of moderately severe pain in adults and yet 70 percent of the children weighed in excess of 45 kgs. When the data for patients weighing less than 45 kgs were reanalyzed separately, a trend was observed showing aluminum ibuprofen to be superior to other study medications at all time intervals. Statistically significant differences could not be demonstrated, however, presumably due in large measure to the smaller sample sizes in this weight category. Further pediatric studies are clearly indicated to determine ideal dosage schedules.

Superior analgesic properties of aluminum ibuprofen in this study were not at the expense of any significant adverse effects. Certainly, long-time experience with ibuprofen tablets has been associated with an impressive safety record.[2] In spite of the reported bioequivalence of aluminum ibuprofen and the ibuprofen tablets, however, the fact that the former preparation is a salt of aluminum hydroxide raises toxicology considerations. Although many toxicology textbooks state that aluminum is not absorbed in the gastrointestinal tract there is increasing evidence that aluminum may not only be absorbed, but may also be toxic, particularly in patients with renal failure.[7-10] Evidence has been presented that aluminum may be neurotoxic and it has been implicated in Alzheimer's disease.[2,11]

The assistance of Drs. O. Korol, M. Mickleborough, C. Robinson, T. Stevenson and M. Strelioff and their respective office staffs is gratefully acknowledged.

Extensive *in vivo* evaluations of possible aluminum absorption from aluminum ibuprofen suspension formulations have been performed by means of atomic absorption spectrophotometry.[12] Serum levels of aluminum were below the level of assay sensitivity (0.010 ppm) for the majority of samples. No differences were seen between levels detected after administration of aluminum ibuprofen suspension and the other non-aluminum containing dosage forms. It was concluded, therefore, that no aluminum absorption occurred following the administration of aluminum ibuprofen suspension.

In conclusion, aluminum ibuprofen suspension was found superior to both acetaminophen elixir and placebo in the relief of postextraction discomfort in a pediatric population. Optimal dose schedules remain to be determined.

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Validation of the children's oral health status index (COHSI)

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As health services in the United States grow more costly and complex, it becomes increasingly important to develop meaningful barometers of the effectiveness of the health care system. In the general health field there have been considerable interest and some effort toward developing a composite health status index.[1] Surprisingly, until recently there has been little effort in dental research toward development of a composite oral health status index. The organization, delivery and evaluation of dental services are coming under increasing scrutiny as private, public and governmental agencies demand improved cost containment and quality assurance in their dental service programs. As a result, the development of an integrated, comprehensive measure of children's oral health status is beginning to receive attention.

Traditionally, the assessment of the oral health status of children has been described in terms of separate indices such as the def, DMF, Gingival Index (GI), and the Orthodontic Treatment Priority Index.[2-5] Each of these epidemiologically based indices indicates the status of a distinct aspect of the oral health picture. None of these indices, however, independently provides a summarization of the diverse elements which together depict overall oral health status.

Recently Koch, Gershen and Marcus developed the Children's Oral Health Status Index (COHSI) as an integrated, comprehensive measure of oral health status of pediatric populations.[6] This index was designed for the direct appraisal of four easily measured components of children's oral health: decayed teeth, missing teeth, tooth position, and occlusion. The index summarizes these diverse elements into a single number which provides an indication of overall oral health status.

The advantage of this composite index is that it not only provides an overall oral health picture, but is quickly and easily used. It would facilitate comparisons of oral health among child populations and permit assessment of changes in the overall oral health of a population over a period of time. Thus, the COHS Index would be a convenient, comprehensive tool for the planning and evaluation of community clinics, school dental programs and other dental health service programs. Additionally the index would facilitate survey and health services research.

Development of the COHSI was an extension of research conducted by Nikias and coworkers, and Marcus and coworkers in developing indices of oral health status for adults.[7-11] In the development of the oral health

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indices, Marcus employed a paired preference methodology. The underlying assumption in this approach to index development was that while dentists may disagree as to what constitutes an appropriate treatment plan for a given patient, they tend to agree on what constitutes good oral health.[6,9,12]

In development of any new health status index, validity studies are necessary to establish that the index is measuring what it purports to measure, which in this case for the COHSI is the oral health of children. Recently, at the UCLA dental clinic, a paired-preference experiment was conducted to study the predictive or criterion validity of the COHSI.[6] The experiment was designed to demonstrate the ability of the index to predict dentists' decisions regarding the oral health status of children. The results at UCLA supported the validity of the index, since there was a high percentage agreement between the dentists' decisions and the index's predictions. The authors expressed concern, however, that the study had been conducted on a population of children who were uniformly in very good oral health, as reflected by a narrow range of COHSI scores. COHSI scores can range from -51 to a perfect score of 100, but only varied between 85 and 100, with a mean of 95, in the UCLA study.

The purpose of the present study was to validate further the COHSI, using a sample of children with diverse oral health. This trial was designed to determine the percent agreement among oral health rankings derived from dentists' clinical impressions and rankings generated by the COHSI.

METHODS

Twenty-one children, nine males and twelve females, ranging in age from four to nearly eighteen years old, participated in the study. These children were selected from a group of 239 children participating in another aspect of the study which correlated COHSI with other indices and assessed the longitudinal stability of the index.[13,14] The COHSI scores of all children had been determined previously by a single examiner calibrated in the use of the index.

Subjects were selected for participation in this study to ensure diversity of oral health status, as represented by a wide range in index scores. With 100 representing perfect oral health, COHSI scores for the subjects ranged from 60 to 100. Although the numerically worst possible case would have a score of -51.4, the chances of encountering such a child in actual practice are extremely remote. To obtain such a negative score, the child would have to be in the permanent dentition with twenty-four missing teeth and the remaining teeth carious and malpositioned. Additionally, a complex, severe malocclusion would also be apparent.[6] In the present study, we found that children who were selected for the study due to their significant dental problems still obtained COHSI scores above 60, considerably higher than anything approaching the theoretically lowest score.

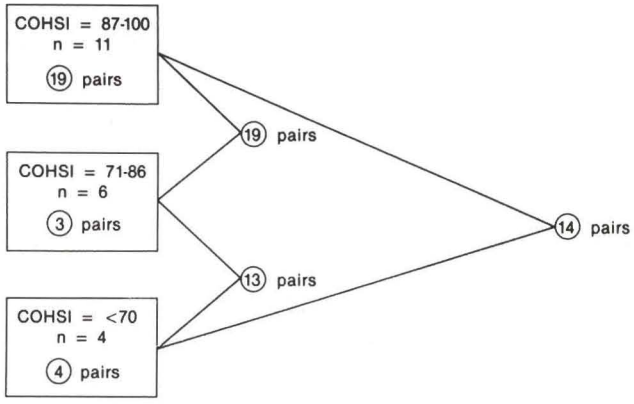

Figure. Distribution of sample by COHSI score and study design of pairings of children.

Four children had "low" COHSI scores of less than 70, six had "moderate" index scores between 71 and 86 and eleven had "high" scores between 87 and 100. Four children had primary dentitions, eight had mixed dentitions and nine had permanent dentitions. Prior to pairings, the sample was grouped by COHSI score and by dentition type. These twenty-one children were paired in seventy-two different combinations: twenty-six pairs of children with similar index scores, thirty-two pairs with moderately divergent index scores, and fourteen pairs with widely divergent scores (Figure).

One professor of pediatric dentistry, one pediatric dental resident and one dental resident pursuing a master's degree in public health dentistry participated as judges. Each of the seventy-two pairs were examined independently by each of the judges. For every pair, each judge was asked to use his or her own professional criteria to select the child in better oral health, assuming neither patient would receive any dental treatment during the next five years.

The pairs were seated in adjacent dental chairs for visual and tactile dental examinations. No radiographs were made available to the examiners during the study. Examiners did not discuss their decisions with one an-

other at anytime during the project. Each examiner proceeded through the experiment in a different sequence to control for any ordering effect. To assess intrarater reliability, 8 percent of the pairs were randomly chosen and recycled over the course of the study.

RESULTS

Percent agreement of the COHSI with the examiner's selection of which child in each pair was in better oral health is expected to provide an indication of the index's validity. Overall, the COHSI's agreement with the examiners choices was 72 percent (Table). For pairs having similar COHSI scores (average of five COHSI points difference) in the low, moderate or high score range, the COHSI's choice of which child was in better oral health concurred with the examiners' choices 56 percent of the time or less. If successive samples of random decisions were to be made, the average rate of COHSI agreement with judges would be 50 percent. Thus, when pairs had similar scores, the predictive ability of the COHSI beyond chance was minimal. As the COHSI scores of the pairs became moderately divergent (average of 13 points difference), however, percent agreement increased from 64 to 86 percent. The ability of the index to predict judges' choices jumped to 95 percent when the index scores of the pairs became widely divergent (average of 30 points difference). When examiner agreement was determined by the consensus of two or more examiners, the index concurred with the judges 100 percent of the time for the pairs having widely divergent scores. Overall, percent agreements of COHSI with the individual examiners agreed quite closely with those with the examiners' consensus (Table 1). Clearly, as COHSI scores of the pairs became more divergent, the ability of the index to predict examiners' choices improved.

Preferences of the individual examiners were similarly predictable by the index scores. The index agreed with the pediatric and public health dentists' choices 74 percent of the time. The index predicted the pediatric resident's decision 68 percent of the time. For only eight of the seventy-two pairs (11 percent) did all three judges disagree with the index predictions.

Overall interexaminer agreement regarding decisions for all pairs of children was 74 percent. Interexaminer agreement for each pair of examiners was similar, ranging from 68 to 79 percent. The highest interexaminer agreement occurred between the two dental residents who had recently graduated from the same dental school. The pediatric dentist and the pediatric resident had the lowest interexaminer agreement.

Table ☐ Percent agreement of COHSI with examiner predictions for pairs with similar, moderately divergent and widely divergent oral health status scores.

Type of pairings*	Range of COHSI scores of pairs	Number of pairs	Percent agreement of index with individual examiners	Percent agreement of index with a consensus (majority) of examiners
S	60 - 70	4	42	50
S	71 - 86	3	56	67
S	87 - 100	19	49	47
M	60 - 70 and 71 - 86	13	64	69
M	71 - 86 and 87 - 100	19	86	89
W	60 - 70 and 87 - 100	14	95	100
Total	All pairs	72	72	74

*Note: S = pairs were composed of children with similar COHSI scores
M = pairs were composed of children with moderately divergent COHSI scores
W = pairs were composed of children with widely divergent COHSI scores

Both interexaminer agreement and index agreement with the examiners were similar across dentition types (permanent, mixed or primary). There was 75 percent index agreement with the examiners within dentition types, and 70 percent agreement across dentition types. When at least one child in a pair was in the primary dentition, the percent agreement was somewhat lower (61 percent) than in pairs where neither child was in primary dentition (77 percent). The majority of pairs including primary dentitions had similar index scores, however, while dyads without primary dentitions more often displayed divergent scores. Thus, dentition type by itself does not appear to be an important factor in determining percent agreement. Intrarater reliability was 100 percent as the judges agreed with their original choices in each of the 8 percent of recycled pairs.

DISCUSSION

The ability of the Children's Oral Health Status Index to predict dentists' decisions regarding the oral health of children gives an indication of the validity of the index. The overall 72 percent agreement between the index and the examiners' choices found in this study is similar to the 76 percent agreement found by Koch, Gershen and Marcus using similar methods.[6] Nearly half of the seventy-two pairs had ten or less points difference in their index scores, while the other half of the pairs

consisted of children with greater than ten index points difference between them. The preferences of the judges were anticipated to be difficult to predict via the index, when the COHSI scores of the children were similar and were expected to be far easier to predict, when scores differed by more than ten points. This, in fact, was the case. The judges concurred with the index's predictions only 56 percent of the time in pairs with ten or less points difference in scores. When there were more than ten points difference in scores, however, judges agreed with the index 84 percent of the time. Thus, the predictive validity of the index appears to be good, when scores differ by ten or more index points. The index does not discriminate as well when fewer than ten points separate individuals' scores. The index would seem appropriate for use, therefore, when significant variation in the status of oral health of a population is suspected.

Results indicate that overall interexaminer agreement was good. The three examiners had similar backgrounds, however, because of their affiliation with the same school of dentistry. The highest interexaminer agreement occurred between the two examiners who had recently graduated from the same dental school. Further investigation of the validity of the index using examiners from various geographical regions and with diverse education and experience is warranted, therefore, before the index is widely adopted.

Greater conformity among the pediatric dentists might have been expected. Similar trends among specialists were noted in the paired preference experiments conducted by Gershen and others during index development.[12] Differences in emphasis in specialty training programs may account for the disagreements between specialists.

Investigating the disagreements that the index's predictions had with the examiners revealed a tendency for the judges to view restored teeth more negatively than sound teeth. The index, however, considers a restored tooth to be quantitatively identical to a healthy, unrestored tooth. The examiners also demonstrated a tendency to factor obvious unesthetic dental problems (such as decayed or missing primary maxillary anterior teeth) into their decisions to a greater extend than does the index.

CONCLUSIONS

The findings presented here provide support for the validity of the Children's Oral Health Status Index. The COHSI is a good predictor of dentist's rankings of the oral health of pairs of children, when there are at least ten points difference between the scores. Further efforts to validate the index using examiners from dissimilar backgrounds and training would be needed, however, before the index is used on a large-scale basis.

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A method of mixed dentition analysis in the mandible

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It is important to know how to determine space availability accurately by measuring arch length and predicting with reasonable accuracy the sizes of the unerupted teeth in the early mixed dentition. In particular, estimation of the mesiodistal dimensions of the unerupted canines and premolars in the early mixed dentition is a necessary and important diagnostic aid in space management.

Numerous methods have been proposed to accomplish it. The two major approaches to this problem are the various radiographic methods and estimations made from the mesiodistal dimensions of erupted permanent incisors.[1-11]

Although numerous methods are available, they require radiographs, the use of tables, or the memorization of formulas. Thus, we have investigated a clinical method that is less time-consuming than those proposed by other authors. We found that the measurement between the distal surfaces of the mandibular permanent lateral incisors is approximately equal to that of the combined widths of the mandibular permanent canine and first and second premolars. In this article, our method will be referred to as the Interlateral Incisor Width (I.L.I.W.) Analysis.

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The purpose of the present study is to examine and compare the accuracy of the Ono, Moyers, Ballard and Wylie, and our mixed dentition analysis in the mandibular arch.[6,8,9]

LITERATURE REVIEW

Regarding the radiograph methods, Nance first pointed out the similarity of the permanent canine and first and second premolars as seen in charts of average tooth sizes.[1] To determine the variability of the leeway space, he measured the unerupted canine and premolars on the radiograph.

Hixon and Oldfather could predict the widths of unerupted mandibular canine and premolars from the sum of the mesiodistal dimensions of the central and lateral incisors and the images of the first and second premolar from long cone radiographs ($r = 0.88$).[2]

Huckaba described the necessity to compensate for these factors, if an accurate reading is to be made, since direct measurements of images taken from the film will be somewhat greater than measurements of the actual teeth.[3] He developed the procedure on the basis that the degree of magnification on a given film is approximately the same for a primary tooth as for its permanent successor. The actual size of the unerupted permanent tooth can be calculated within close practical limits.

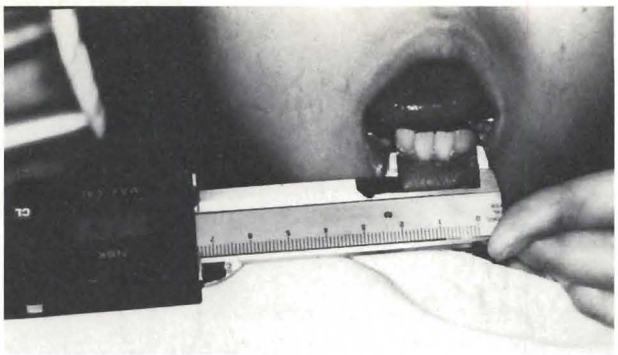

Figure 1. Measuring the diameter of the teeth with a modified fine-tipped electric digital caliper.

Figure 2. Handheld computer, measure interface and caliper.

Sim proposed a simpler analysis for both maxillary and mandibular arches in the mixed dentition.[4] Since the width of the first premolar is very nearly the average width of the canine and second premolar (as shown in Moorrees' chart), he proposed simply to multiply the radiographic width of only the first premolar to obtain the width of the three teeth combined.[12]

Smith *et al* further developed a method to use a prediction table based on the regression equation, which is referred to as the Tri-4 analysis.[5]

Regarding the statistical methods, Ballard and Wylie were so concerned about the variability of x-ray films that they devised a scheme for estimating the width of the mandibular permanent canines and premolars on the basis of the combined widths of the four mandibular permanent incisors.[6] They developed the following formula, despite a low coefficient of correlation ($r = 0.64$): $X = 9.41 + 0.52Y$. X is equal to the sum of the mesiodistal dimensions of the permanent canine and premolars, while Y is equal to the sum of the mesiodistal diameters of the mandibular permanent incisors. They came to the conclusion that their method had only 2.6 percent error (0.6mm) as compared to a 10.5 percent error (2.2 mm) when using only the radiographs. They also indicated that good radiographs should be used and suggested their method as an adjunct to Nance's method.

Ono presented the correlation between the permanent incisors and permanent canine and premolars in both arches as well as the correlation between the mandibular permanent incisors and maxillary permanent canine and premolars in a group of Japanese children.[8] He also developed a regression equation to predict the width of the unerupted permanent canine and premolars.

Moyers developed the use of a probability chart for predicting the widths of both maxillary and mandibular unerupted canines and premolars from the sum of the mesiodistal dimensions of the mandibular permanent incisors.[9] He recommended using the 75 percent level of probability to protect on the crowded side.

Tanaka and Johnston found by linear regression equations that the mesiodistal dimensions of the canine and premolars could be predicted at the 75 percent level of confidence by adding 10.5 mm to half the width of the mandibular incisors, which were measured in millimeters.[10] The width of the maxillary canine and premolars could be predicted by adding 11.0 mm to half the width in millimeters of the mandibular incisors.

Hamano estimated a sum of the mesiodistal dimensions of permanent canine and premolars with use of multiple regression analysis in Japanese children.[11] He concluded that according to coefficients of determination, an estimating method using a multiple regression analysis elevated predictability approximately 14 to 16 percent compared with the previous methods by simple regression analysis.

MATERIALS AND METHODS

The data were collected by measuring the teeth of 119 Japanese children (sixty-two females and fifty-seven males) ranging in age from thirteen to seventeen years with an average of fifteen years. They were selected during dental screenings at junior high schools and high schools in Fukuoka.

To be included in the study, the children had to meet the following requirements:

- ☐ The mandibular permanent canine and first and second premolars were present.
- ☐ The four mandibular permanent incisors, canines, and premolars were present and were neither crowded nor spaced.
- ☐ None of these teeth had interproximal restorations, nor was there any evidence of interproximal stripping.

All measurements were taken with a modified fine-tipped electric caliper to allow measurements to be taken in the mouth. The measurements were:

- ☐ The sum of the mesiodistal dimensions of the four mandibular incisors.
- ☐ The distance between the distal surfaces of the mandibular permanent lateral incisors.
- ☐ The mesiodistal dimension of the mandibular canine and the first and second premolars of one side.

All measurements were carried out by one of the authors according to the method of Hixon and Oldfather and recorded in the Handheld Computer by connecting it to the caliper through the Measure Interface (Figures 1,2).[2] Two independent measurements were recorded for each tooth. If the two agreed within 0.1 mm, the

average of the two was used. If disagreement exceeded 0.1 mm, two more independent measurements were taken and the four averaged.

Predicted values for the sum of the mesiodistal dimensions of the mandibular permanent canine and first and second premolars were calculated for the I.L.I.W. (Figure 3), Ono, Moyers at the 75 percent probability level and Ballard and Wylie analyses. In the statistical analysis, Pearson's product-moment correlation coefficient of the sum of the mesiodistal dimensions of the erupted permanent mandibular canine and first and second premolars with their predicted values obtained by the I.L.I.W., Ono, Moyers and Ballard and Wylie was used.

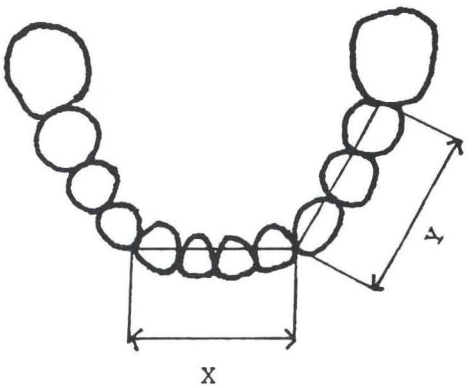

Figure 3. I.L.I.W. Analysis X = Y.
X: Measurement between the distal surfaces of $\overline{2|2}$
Y: Measurement of the combined widths of $\overline{345}$

RESULTS

Correlation coefficients for the sum of the actual mesiodistal width of the permanent canine and premolars with their predicted values obtained by each of the four analyses revealed r = 0.63 for I.L.I.W., r = 0.55 for Ono, r = 0.57 for Moyers and r = 0.55 for Ballard and Wylie analyses (Table 1). It can be seen that all analyses used had a low correlation. Of the methods being tested, our I.L.I.W. analysis achieved the best correlation of r = 0.63. Table 2 indicates a discrepancy between the predicted and actual dimensions of the mandibular permanent canine and first and second premolars. This indicates the smaller discrepancy in Ballard and Wylie, Moyers and I.L.I.W. analyses than in Ono analysis. The scatter diagrams show the line of regression of actual size of mandibular permanent canine and premolars based on predicted values in all analyses (Figures 4-7).

DISCUSSION

There are two main approaches to determining the size of unerupted permanent teeth: radiographic and statistical.

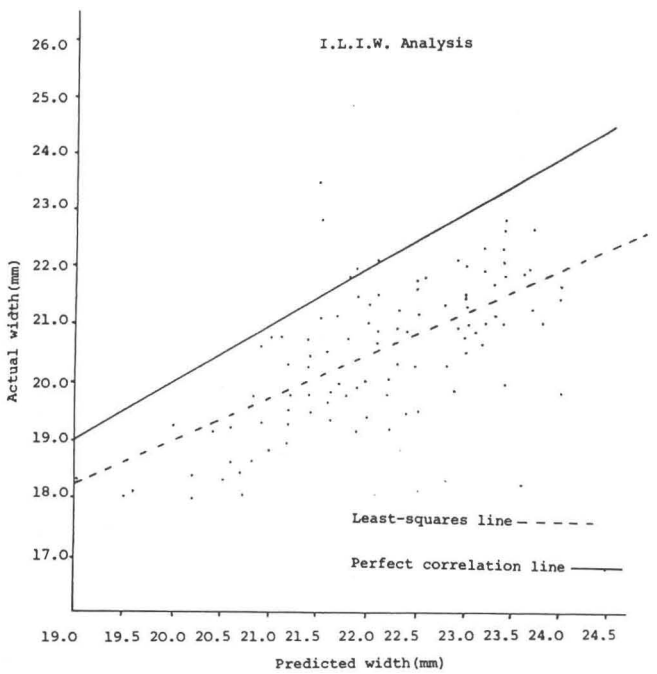

Figure 4. I.L.I.W. Analysis.

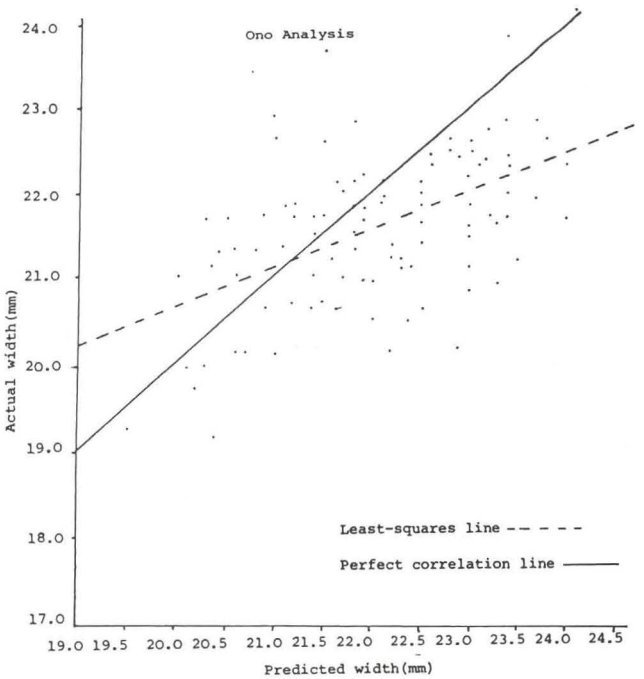

Figure 5. Ono Analysis.

Table 1 ☐ Correlation values of analysis methods.

Analysis method	Coefficient of correlation (r)
I.L.I.W. (Interlateral Incisor Width)	.63
Ono	.55
Moyers	.57
Ballard & Wylie	.55

Table 2 ☐ Discrepancy between predicted and actual widths of canine and premolars.

Analysis method	0.5 mm or less	0.6 mm-1.0 mm	1.1 mm or greater
I.L.I.W.	44%	27%	29%
Ono	42%	23%	35%
Moyers	47%	23%	30%
Ballard & Wylie	44%	31%	25%

Several studies have been undertaken to compare the accuracy of various methods of estimating the size of unerupted permanent canines and premolars.

Zilberman *et al*, checked the accuracy of predicting the mesiodistal dimensions of unerupted permanent canines and premolars, from radiographs as well as from already erupted permanent teeth, in a group of Israeli children.[13] They found the direct measurement of the permanent canine and premolars from radiographs offered greater accuracy than the method proposed by Moyers. Their study also indicated that the combination method developed by Hixon and Oldfather was comparable in accuracy to the strictly radiograph measurement technique.

Kaplan *et al* compared the accuracy of the Hixon and Oldfather, Moyers, and Tanaka and Johnston mixed dentition analyses.[14] They concluded that the Hixon and Oldfather analysis was the most accurate of the three methods for predicting the size of the unerupted permanent canines and premolars.

Smith *et al*, checked the accuracy of the analysis based on Moyers' tables, Hixon and Oldfather's combination procedure, and the Tri-4 analysis.[5] They concluded that the Tri-4 analysis appeared to be simpler and a more accurate method of mixed dentition analysis than those in common use.

White concluded in the comparison of these methods that the radiographic method was as accurate and more universal in its application than others.[15]

As mentioned before, they indicated that the predicted values from measurements of radiographs were closer to the actual width of the permanent canine and premolars.[5,13-16]

On the other hand, there was only fair correlation for the mesiodistal dimensions of the four mandibular permanent incisors as a basis for predicting the widths of permanent canines and premolars.[2,10,12,13] Correlations between the mandibular permanent incisors and the

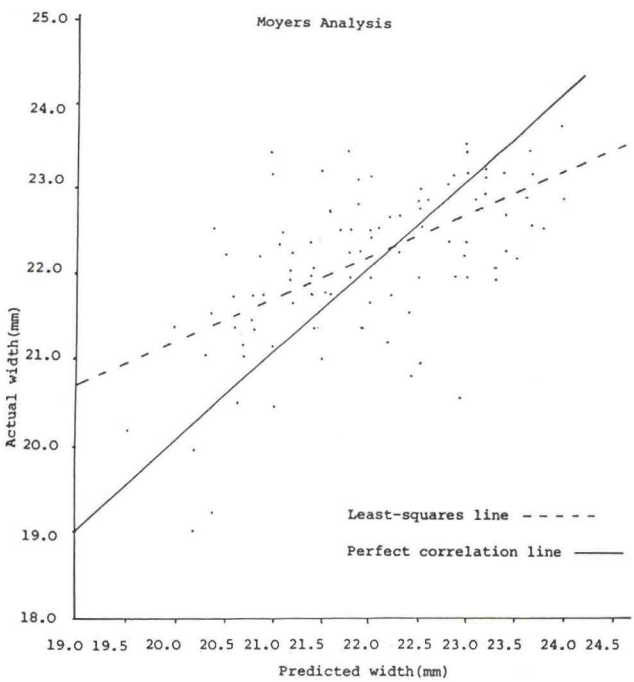

Figure 6. Moyers Analysis.

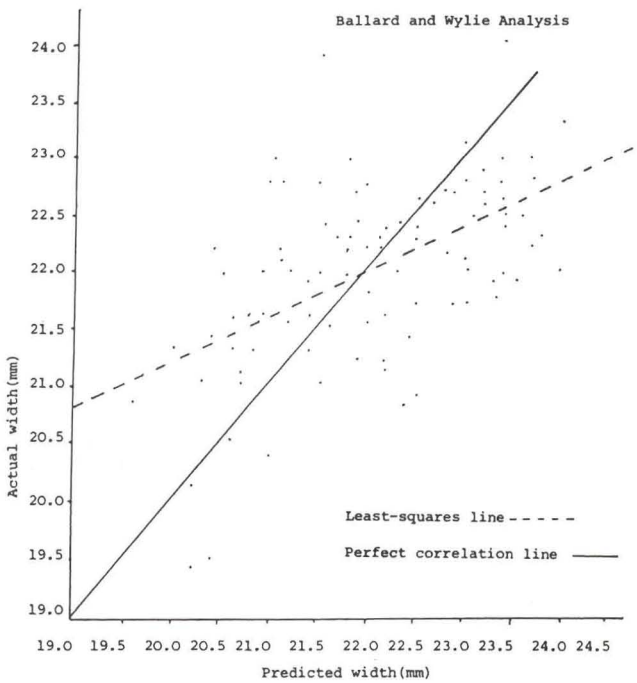

Figure 7. Ballard and Wylie Analysis.

permanent canines and premolars were found to be relatively low. Ballard and Wylie found r = 0.64; Hixon and Oldfather, r = 0.69; Bolton, r = 0.65; and Tanaka and Johnston, r = 0.625.[2,6,7,10]

In the present study, we compared four methods that did not require radiographs. As a result, the correlations between the mandibular permanent incisors and permanent canines and premolars were relatively low, compared with those of earlier investigations. This difference may be attributed to racial variability. Of these methods, our analysis was found to be the most accurate method. In addition, it was simpler and quicker, because it enables us to estimate the mesiodistal dimension of the unerupted permanent canines and premolars by measuring the distance between the distal surfaces of the mandibular permanent lateral incisors in the patient's mouth with a modified, fine-tipped, electrical, digital caliper.

SUMMARY AND CONCLUSIONS

We developed a method of space analysis based on the fact that the measurement between the distal surfaces of the mandibular permanent lateral incisors was approximately equal to that of the combined widths of the mandibular permanent canine and premolars. This method is referred to as Interlateral Incisor Width (I.L.I.W.) Analysis. One hundred and nineteen Japanese children, without malocclusion, were selected for the study. Various measurements of teeth were taken in their mouths with a modified, fine-tipped, electrical, digital caliper and recorded in a Handheld Computer by connecting it to the caliper. Statistical analyses were conducted to compare the accuracy of the I.L.I.W., Ono, Moyers, and Ballard and Wylie analyses in the mandibular arch. The summary of the results were:

- ☐ Correlation coefficients for the sum of the actual mesiodistal dimensions of the canine and premolars with their predicted values obtained by each of the four analyses revealed r = 0.63 for I.L.I.W., r = 0.55 for Ono, r = 0.57 for Moyers, and r - 0.55 for Ballard and Wylie. Our I.L.I.W. method presented the best correlation of the four analyses, although each indicated a relatively low correlation. This method does appear to be clinically valid, since it is simple enough to enable the practitioner to estimate the combined dimension of the unerupted canine and premolars by measurement, in the mouth, of the distance between the distal surfaces of both mandibular permanent lateral incisors, instead of on study casts.
- ☐ It is recommended that a radiographic method be used in conjunction with our method to obtain a more accurate estimate. Consequently it is concluded that our I.L.I.W. method of space analysis, when used with a radiographical method, appears to be as appropriate as those in common use.

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Nutrition

Do young children instinctively know what to eat?

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THE STUDIES OF CLARA DAVIS REVISITED

In the 1920s and 1930s, the pediatrician Clara Davis conducted pioneering studies, now considered classic, and published at least twelve papers on the selection of diets by infants and young children.[1-4] The results of her research have been widely interpreted by health professionals to mean that given a wide variety of choices, children will instinctively select and consume a well-balanced diet. Such a broad conclusion was not drawn by Davis, nor can it be concluded from her research or from any other investigation. Yet, this supposition is frequently stated as fact in medical textbooks and echoed by clinicians.[5-8] The misinterpretation of Davis' results may lead to an overly relaxed attitude toward poor food habits and contribute to the development of nutritional problems in children. This article reviews Davis' studies, addresses their limitations and some common misperceptions about their results, and examines her findings in the light of current scientific knowledge.

INFANT FEEDING IN THE EARLY 20TH CENTURY

In contrast to the present-day recommendation that solid foods be introduced into an infant's diet between

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the ages of four and six months, most infants during the first quarter of this century were not given solid food until they were nearly a year old.[9,10] It was commonly believed that the transition from the suckling diet to one embracing food eaten by adults should be made gradually, over a period of three or four years.[1] In 1909 Jacobi gave advice typical of the time: "Before children are two years of age no vegetables in any quantity should be given to them.[11] Small quantities may be given later on; they will be acceptable and readily digested." The prevailing belief was that the early introduction of vegetables, fruits, and meat would cause ill health and "digestive troubles."

Disagreement with these feeding practices motivated Davis' research. Davis described the infant-feeding practices as "a prescription of diet by limitation, a practice that in the case of adults is generally reserved for the ill, the thin or the obese."[1] It was her hypothesis that infants could tolerate and should receive a wide variety of solid foods during the first years of life. The primary purpose of her research was to test this hypothesis.

REVIEW OF DAVIS' RESEARCH

Davis' research focused on identifying the foods that infants would, in the absence of adult intervention, select to eat, and determining whether the foods and amounts selected would be adequate to maintain growth and digestive health. The first study, published in 1928, provided the most detailed description of food selection, consumption, and infant health.[1] It involved three infants between seven and nine months old; two were in the study for six months and the third for one year. In 1939, Davis reported in much less detail the results of a study involving twelve more children over a period ranging from six months to four and a half years.[2]

The research protocol was the same for both studies. The infants, who were orphans living in a hospital, had been only breast-fed before the start of the experiment. They were allowed to select foods at each meal for the duration of the study. Only fresh unprocessed foods were used, unseasoned and prepared as simply as possible. No mixed dishes, food combinations (i.e. breads, soups, or custard), sugars, syrups, or sweetened foods were included. Oatmeal, wheat, beef, bone marrow, eggs, and vegetables in both raw and cooked forms were served. Table 1 lists the specific foods offered.

Infants were offered ten foods and two types of milk at each meal, and the items were rotated so that the entire list of foods was served daily. At meal time, a tray was placed in front of the infant, with a nurse present solely as an observer. Each food portion was weighed on a gram balance scale before being served, and the uneaten remains were weighed after the meal was completed. The results of the experiment with three infants provided specific and detailed tabular data on the amounts of foods consumed, as well as on weight and height changes.

From the beginning of the study, Davis found that the three infants selected a combination of foods in quantities sufficient for growth. In fact, after six months on the self-selected diets, gains in weight were disproportionately higher than gains in height for two of the three infants.[12] Definite preferences, which changed over time, emerged, and each infant went on "food jags." Of the thirty-four foods offered, 90 percent of the energy intake for all three infants was derived from fourteen foods. Of these, nine were preferred by all three infants (bone marrow, milk, eggs, banana, apples, oranges, cornmeal, whole wheat, and oatmeal). Bone marrow was the largest single source of calories (27 percent) for one infant, whereas milk provided the bulk of calories for the other two (19 and 39 percent). All three infants shared a low preference for all ten vegetables, as well as for pineapple, peaches, liver, kidney, ocean fish, and sea salt. These foods constituted less than 10 percent of the total energy intake. Davis observed that the infants ate much more fruit, meat, eggs, and fat than pediatricians typically advised (or that children were ever allowed to eat) and much less cereal and spinach, which were commonly recommended.

Davis noted that all three children were in good health as judged by growth, weight, bone development, appearance, and vigor. She concluded from her study that "with natural foodstuffs, young children could choose their diets and thrive without adult direction as to just what and how much of these foods they should eat."[4]

NUTRIENT INTAKE OF INFANTS

On the basis of Davis' data, we calculated the nutrient intakes for the three infants, using DAS, a nutrient-analysis program, and additional food-composition data supplied by the Nutrition Coordinating Center in Minneapolis and the Department of Animal Science at the University of Minnesota.[13] The 1980 recommended dietary allowances (RDAs) for infants 0.5 to one year of age were used. Table 2 shows the average intake of nutrients as a percentage of the RDA for each of the three infants. With the exception of iron, the foods consumed equaled or exceeded the RDA for the nutrients examined. Milk

Table 1 ☐ Foods offered in Davis' experiment.

1. Meats (muscle cuts): beef, lamb, chicken.
2. Glandular organs: liver, kidney, brains, sweetbreads (thymus).
3. Seafood: ocean fish (haddock).
4. Cereals: whole wheat (unprocessed), oatmeal (Scotch), barley (whole grain), cornmeal (yellow), rye (Ry-Krisp).
5. Bone products: bone marrow (beef and veal), bone jelly (soluble bone substances).
6. Eggs.
7. Milks: grade A raw milk, grade A raw whole lactic milk.
8. Fruits: apples, oranges, bananas, peaches, pineapples.
9. Vegetables: lettuce, cabbage, spinach, cauliflower, peas, beets, carrots, turnips, potatoes, tomatoes.
10. Incidentals: sea salt (Seisal).

Table 2 ☐ Average intake of nutrients as a percentage of the RDA during 173 days of self-selected diets in three infants.

Nutrient	Infant		
	1	2	3
	% 1980 RDA*		
Energy	146	135	113
Protein	426	329	346
Vitamin A	441	349	305
Vitamin C	289	744	179
Thiamin	180	214	184
Riboflavin	383	350	350
Niacin	180	150	125
Vitamin B_6	287	330	158
Folacin	479	574	341
Vitamin B_{12}	1346	747	576
Calcium	131	139	179
Phosphorus	358	275	314
Magnesium	335	445	285
Iron	100	74	89
Zinc	188	136	168
	% of total meal		
Protein	25	17	23
Fat	37	21	38
Carbohydrate	38	62	39

*For infants 0.5 to 1 year old.

intake, although it accounted for 19 to 39 percent of the total calories, supplied at least 75 percent of the RDA for half the nutrients listed in Table 2.

MISPERCEPTION OF DAVIS' DATA

Davis' work was instrumental in changing infant-feeding practices. The results of her research demonstrated that infants could digest the foods eaten by adults (especially meats) and grow normally. We have repeatedly observed, however, that the misinterpretation of her results has led to the propagation of myths about infant nutrition. The most prevalent myth is that infants and children have the innate ability to select for themselves a balanced, nutritious diet. But Davis' experiment involved what she herself called an "artificial environment," in that only nutritious and unsweetened foods were offered. She referred to the types of food offered as the "trick" in her experiment.[2] "Self-selection," she concluded, "can have no, or but doubtful, value if the diet must be selected from inferior foods."[2]

An important question not addressed by Davis' research is what foods infants would have selected given the availability of desserts, ice cream, pastries, candy, and other less nutritious food (a study, incidentally, that Davis planned but was unable to do because of the Great Depression). To date, such a definitive study has not been done, but existing data provide a basis for speculation about what children's food choices would be if they were given access to highly palatable foods.

Food selection is determined by complex and interacting cultural, sensory, environmental, genetic, and social variables. Although relatively little is known about the formation of preferences, it is clear that food preferences are a major determinant of food selection.[14] A large body of evidence supports the existence of an innate preference for sweet-tasting substances in human infants, and a preference for sweetness persists throughout childhood.[15-19] Birch found that the two dimensions most influential in determining food acceptability in young children are sweetness and familiarity.[20] On the basis of Davis' admission of an artificial environment, Birch's study, and our clinical experience, we speculate that children would select sweet foods over nonsweet, more nutritious foods if allowed free choice.

Davis suggested that her data provided evidence for "the existence of some innate, automatic mechanism...that regulates appetite" and that this regulatory mechanism was responsible for the nutritional adequacy of the young children's diets.[2] Birch has argued, however, that it is the ability to learn that is innate — i.e., the ability to learn about the consequences of eating particular foods through a conditional association between food cues and the physiologic consequences of eating those foods. Furthermore, Rolls and colleagues demonstrated that food intake in humans increases as the variety of foods offered at a meal increases.[21,22] The provision of an assortment of nutritious foods, therefore, rather than an innate ability to select needed foods, may have been responsible for the dietary adequacy observed.

Davis was careful to point out that the mechanism that regulates appetite, energy intake, and body weight was operative only for the "primitive diet" based on natural foods, and not for processed foods, such as sugar.[1] It has long been observed that animals fed standard laboratory rations will not overeat and will not become obese even when food is abundant. Sclafani and Springer, however, demonstrated that obesity could easily be produced in the laboratory by giving rats of normal weight ad libitum access to a highly palatable "supermarket diet" of chocolate chip cookies, marshmallows, condensed milk, milk chocolate, salami, peanut butter, cheese, and bananas.[23,24] The rats overate the supermarket foods, gaining 269 percent more weight than controls fed only laboratory rations. Free access to high-calorie, low-nutrient foods may also encourage the development of obesity in children.

MANAGING THE DIETS OF YOUNG CHILDREN

Obesity, dietary deficiencies and excesses, dental caries, and iron deficiency have been identified as major

nutritional problems among young children in the United States.[25-29] Each of these problems is related to the amount and type of food made available to young children and consumed by them. Of particular interest currently are the potential effects of dietary patterns established early in childhood on the later development of heart disease, hypertension, and cancer. We believe that giving young children free access to highly preferred but nutritionally weak foods will encourage the development of nutritional problems during childhood and beyond. To set healthy dietary patterns and ensure a balanced diet, one should limit the diet of young children to a variety of fresh or frozen vegetables and legumes; dairy products; fresh and unsweetened fruits and fruit juices; breads, pastas, rice, cereals, and other grain products; and lean meats. The environment in which the food is offered is important. Foods should not be used to reward or punish certain kinds of behavior, nor should children be coaxed to eat everything that is served. Children should not be expected to like every food tasted or to eat the amount served to them. Deciding how much food to consume should be the prerogative of the child. Sweets and other foods serving primarily as a source of calories need not be excluded from a young child's diet, but they should be limited to amounts that will not interfere with the child's consumption of basic foods during meals.

CONCLUSION

Davis noted that the primary conclusions arising from her research were that (1) young children should be offered only foods that have the highest nutritional values, and (2) young childrens' appetites are a reliable guide to the amount of food that should be consumed.[4] Davis warned about the misuse of the term "self-selection" or the phrase "allowing the child to choose its own food," since it implied taking the control of the child's diet out of the parents' hands.[4]

Although the studies of Clara Davis have enriched our knowledge of infant nutrition in many ways, it is indeed intriguing that the results she did not report and the conclusions she did not draw are those most often credited to her research. Clarification of the misconceptions about that research should set the stage for definitive research on food selection by young children.

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Mandibular second premolar erupting between the second primary molar and the first permanent molar: report of case

Case reports

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Transposition of teeth may be defined as an interchange in position by neighboring teeth, according to Beunviaje.[1] Transposition occurs most frequently in the maxilla, and usually involves the permanent canines and lateral incisors or permanent canines and first premolars. At the age of four and a half years, the developing canine is positioned above the first premolar which, in turn, is above the first primary molar. Because of its high position, the maxillary canine may migrate too far mesially and become transposed with a maxillary lateral incisor. Conversely, if it migrates too far distally it may become transposed with a maxillary first premolar. Transposition of teeth has been reported to occur with equal frequency in both sexes, and may be seen either unilaterally or bilaterally, with the left side of the arch most commonly affected.[3] Rates of occurrence of all transpositions have been described to be approximately 0.03 to 0.1 percent.[1-3] In an impressive number of cases of transposed teeth, additional dental anomalies occur. In a clinical study conducted by Jarvinin, all of 13,712 children with transposed teeth had other dental problems, including such conditions as hypodontia, overretained primary teeth, and peg-shaped lateral incisors.[2]

Suggested etiologic mechanisms for transposition of teeth include: movement of developing teeth within the jaws before their eruption; overretained primary teeth, leading to deflection in the eruption of the permanent

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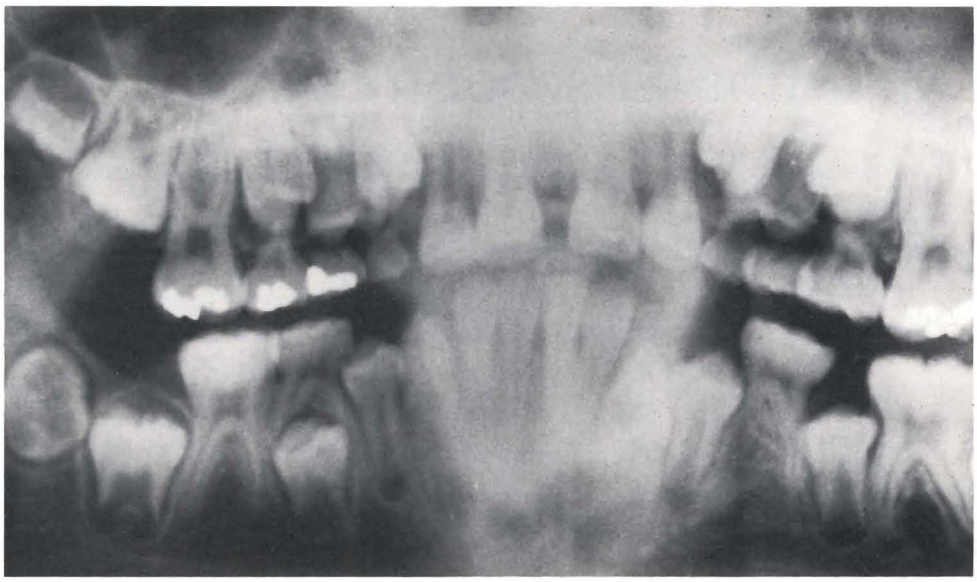

Figure 1. Panorex radiograph showing the transposed position of the mandibular second premolar.

successors; premature loss of primary teeth; trauma to the jaws; and transposition of the anlagen of teeth during odontogenesis.[5-7] Jarvinin speculated, "The contemporaneous occurrence of the transposition of teeth and the hypodontic patterns and missing or peg-shaped teeth...leads one to consider the association of the tooth transposition with the primary heritable dental disturbance which causes the congenital absence of teeth."[2] Ruprecht, however, feels that transpositions occur sporadically and most likely occur randomly.[3] Other authors argue that because of the infrequency of occurrence of the condition, determining an etiological mechanism for transposition of teeth is not possible.[7]

Ectopic eruption of teeth refers to a condition in which a tooth or teeth erupt, or attempt to erupt, into an abnormal position within the arch. This ectopic position of eruption has been speculated to be the result of varied conditions such as inadequate arch-length, excessive tooth-mass, and a variety of local factors, such as posterior positioning of the maxilla relative to the cranial base, abnormal angulation of the erupting first molars, and delayed calcification of some affected first permanent molars.[8,9] The incidence of ectopic eruption of teeth has been reported to be approximately 2 percent to 3 percent, as compared to the 0.03 percent to 0.1 percent for transpositions.[10,11] Ectopic eruption may occur in more than one quadrant, and is more common in the maxilla.[8]

CASE REPORT

A nine-year-old black male patient presented to the pediatric dental office for routine care. His medical history was noncontributory. He had not previously been seen by a dentist.

During radiographic examination, it was observed that the left mandibular second premolar was erupting between the mandibular left second primary molar and the left first permanent molar (Figures 1,2). There appeared to be no radiographic evidence of resorption or ankylosis of the distal root of the primary molar. The mesial root of the second primary molar, however, did appear to be ankylosed, although the tooth did not appear to be submerged clinically, as is common with ankylosed teeth. In addition, the mesial root appeared to be resorbed ectopically by the underlying first premolar. No evidence of a tooth bud was noted radiographically between the roots of the primary molar.

Clinically, the left mandibular second premolar seemed to be centered on the mandibular alveolar bone between the primary molar and the first permanent molar. Although the second premolar had penetrated the alveolar crest, there apparently was not adequate space available for it to erupt completely into occlusion. Functionally, the left mandibular first permanent molar was in a Class 2 molar relationship with the left maxillary first permanent molar, possibly due to the fact that it had been displaced distally by the transposed second premolar. The patient's occlusion on the right side showed a Class 1 molar relationship.

DISCUSSION

This case represents what we feel to be a unique condition, to the best of our knowledge, not previously reported. The condition reported appears not to be true transposition, because there is not an actual interchange of positions among any of the involved teeth. Yet, the second premolar is in a transposed position relative to where it is expected to be. We also feel that this case

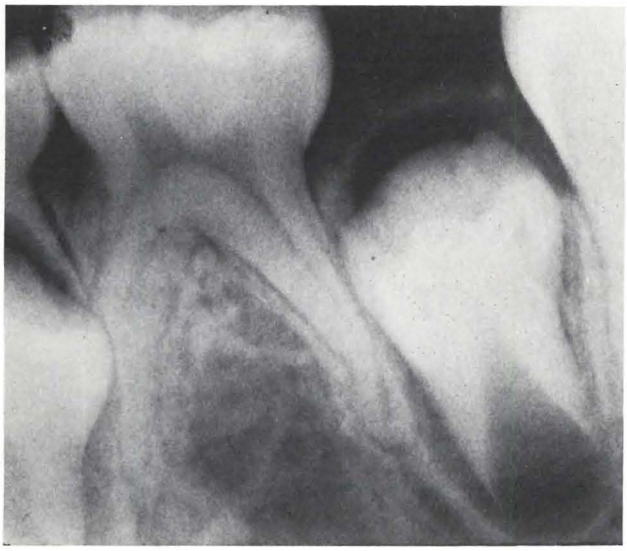

Figure 2. Intraoral radiograph showing the transposed position of the mandibular second premolar.

does not represent a true ectopic eruption, because of the fact that the second premolar apparently did not develop in, or erupt from, the intraradicular area of the second primary molar. Yet, the second premolar appears to have erupted into an abnormal or ectopic position, distal to the unresorbed first primary molar.

This condition may represent the result of displacement of the anlagen of the second mandibular premolar from its normal position between the roots of the second primary molar, to a more distal position. Another possible mechanism for such a condition is that the premolar seen radiographically and clinically is a supernumerary tooth, and that the second premolar is agenic. A case demonstrating this possibility has been reported by Winter as "pseudotransposition". In Winter's case, a supernumerary premolar erupted between the maxillary first and second permanent molars.[12] This condition actually represented a third premolar rather than a transposition of teeth.

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OTODENTAL SYNDROME

A young lady presented with a supplemental maxillary premolar tooth. Investigation revealed this to be fused to the maxillary second permanent molar tooth, the maxillary first molars having been extracted previously. Fusion of premolar and molar teeth is a feature of globodontia, the dental manifestation of Otodental syndrome. If this is such a case, the supplemental premolar must have been transposed with the first permanent molar.

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Oral fibromas in children: reports of two cases

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Fibroma of the oral cavity is a benign soft tissue tumor which is commonly seen with a sessile or pedunculated base. Its consistency varies from soft to firm and its size ranges from a few millimeters to a centimeter or more in diameter.[1] It may become whitened because of overlying hyperkeratosis caused by trauma.

Fibromas occur infrequently in the first and second decade of life and are found primarily on the palate, tongue, cheek and lip.[2] The etiology is generally considered to be caused by chronic irritation.

Histologically, fibromas consist predominately of dense collagen with areas of hyalinization and a paucity of blood vessels. Inflammatory cells, if present, are minimal and the entire lesion is covered by stratified squamous epithelium that may show parakeratosis or hyperparakeratosis.[3] Weathers and Callihan reported a type of fibroma, the giant cell fibroma, that appeared much more frequently in the first two decades of life.[4] The consistent diagnostic feature of these lesions was the presence of large stellate and multinucleated giant fibroblasts. Surgical removal is indicated. Recurrence is rare, if the source of irritation is removed.

CLINICAL REPORTS

Case 1

A two-year-old black male, with a palatal tissue growth adjunctive to his maxillary central incisors, presented to the Pediatric Dentistry clinic, University of Illinois at Chicago. His medical history was noncontributory and all of his vaccinations were current. The chief complaints were the presence of a tissue growth and labial displacement of the maxillary right central incisor (Figure 1). According to the child's mother, the mass was asymptomatic, but growing slowly. She also mentioned a history of trauma due to a fall three months ago with bleeding in the region of the maxillary central incisors and pain lasting for about two days.

On intraoral examination, a relatively large, firm, reddish mass, approximately 1 cm x 1 cm x 1 cm was seen attached by a narrow pedicle on the palate to the right of the midline. Some degree of tenderness to palpation was noticed. The maxillary right central incisor was positioned labially. It was not possible to determine whether the tumor had forced the tooth labially or whether the tooth was displaced first by trauma, followed by growth of the lesion from the traumatized periodontal ligament. There were no indications of discoloration and mobility of the maxillary central incisors. Tongue, tonsils, soft palate and the rest of the hard palate, cheek and lips appeared to be within normal limits. There was no regional lymphadenopathy and the face was symmetric. The child had a normal temperature, was alert and active without signs of malaise.

Radiographic examination revealed widening of the periodontal ligament of both maxillary central incisors. The trabeculation of bone seemed within normal limits, except for the area distal to the maxillary right central incisor, which was relatively radiolucent (Figure 2). There were no other significant changes present.

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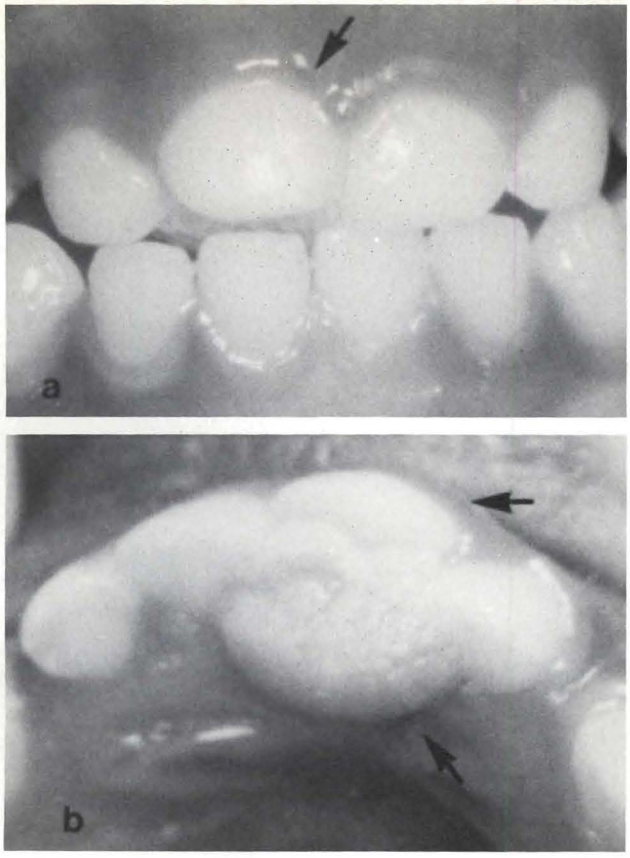

Figure 1. A fibroma of the palate has forced the maxillary right incisor labially in a two-year-old: (a) teeth in occlusion, (b) occlusal view.

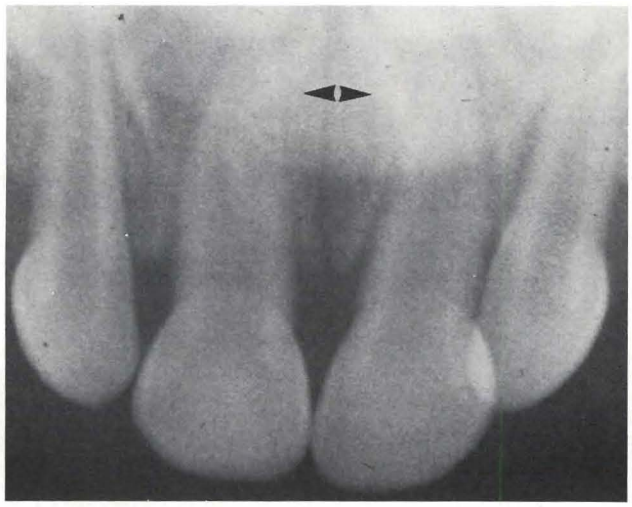

Figure 2. Periapical radiograph of maxillary central incisors showing widening of the periodontal ligaments.

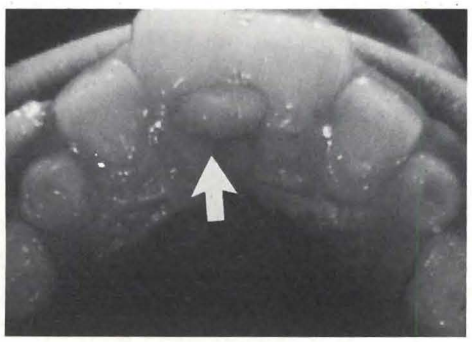

Figure 3. Giant cell fibroma of incisive papilla, in an eleven-year-old male (clinical view).

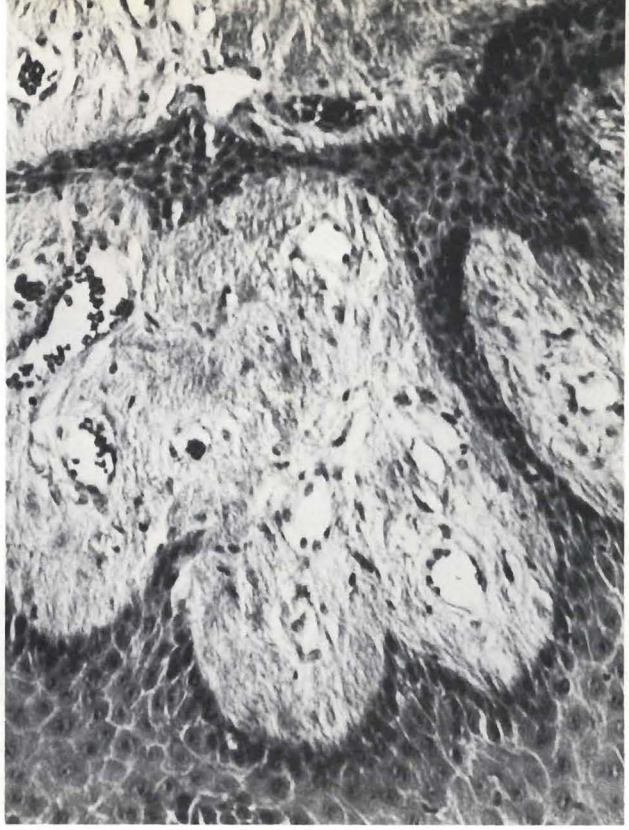

Figure 4. Photomicrograph, demonstrating a fibroma lined by stratified squamous epithelium: magnification X 100.

The lesion was excised under local anesthesia, using 4 ml of Xylocaine with epinephrine 1:100,000. The maxillary right central incisor was extracted, because it was attached to the tumor. The alveolar socket was thoroughly curetted. The bleeding was controlled and a suture (3-0 black silk) was placed. The tumor and tooth were sent for biopsy. The child tolerated the procedure very well.

Case 2

An eleven-year-old male presented for routine dental care. Oral evaluation showed a tumorous lesion (0.8 cm x 0.5 cm x 0.5 cm) related to the incisive papilla (Figure 3). The lesion was asymptomatic and not inflamed; and the patient, although aware of the lesion, was not concerned and had not brought it to the attention of the parents. Medical history was noncontributory, and all other findings were within normal limits. No history of trauma could be elicited from the child. A periapical radiograph of the region revealed no hard tissue changes. Patient was referred to an oral surgeon for biopsy and excision. The biopsy of the lesion supported a diagnosis of giant cell fibroma of the incisive papilla. Patient is scheduled for routine follow-up.

DISCUSSION

The pathology report of these two cases had the following similar characteristics. The specimens, covered by parakeratinized stratified squamous epithelium, showed elongation of their epithelial ridges. The underlying fibrous connective tissue was somewhat vascular and quite cellular (Figure 4). Pockets of chronic inflam-

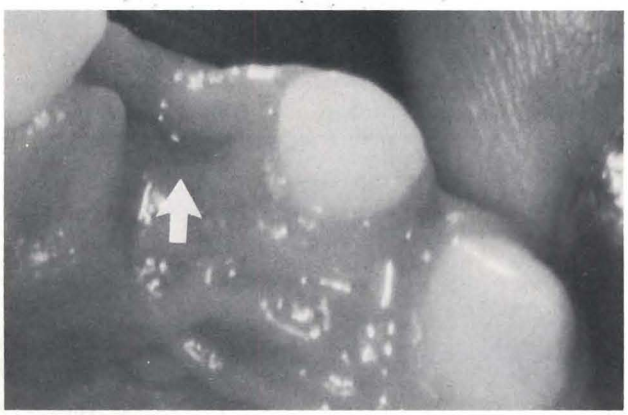

Figure 5. Clinical view of case 1, three years after surgery. Mirror image.

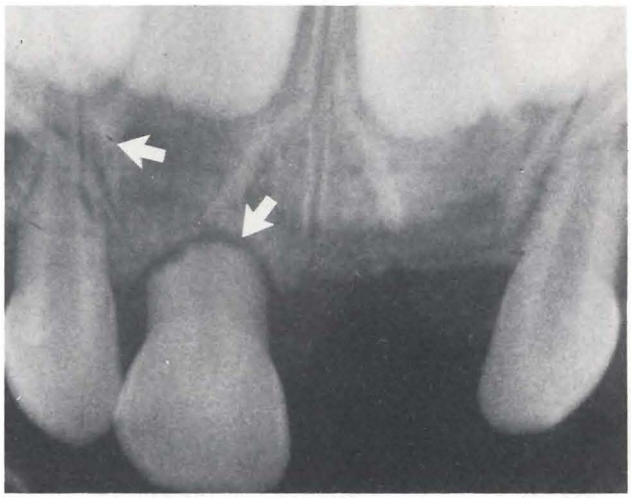

Figure 6. Periapical radiograph of case 1, three years after surgery, indicating atypical root resorption of maxillary left incisors (viewed from the lingual).

matory cells and hyalinized connective tissue were observed. The prominent histological feature of case 2 was the presence of numerous large multinucleated giant fibroblasts. The stellate cells had large vesicular nuclei that contained prominent nucleoli.

The characteristics of case 2 were very similar to the series reported by Weathers and Callihan, in 1974, and Houston, in 1982. Houston reported that the giant cell fibroma represented 4.7 percent of all biopsied fibrous lesions and 1.0 percent of total accessions in his biopsy service.[5] Patients in his study range from two years to eighty-four years of age.

Generally, when a tooth is subjected to trauma, the resultant inflammatory reaction is acute or transient. At times, depending on the velocity of the projectile and direction of the injury, the response is more likely to be a low-grade, inflammatory one. Within the tooth, the chronic inflammatory response is likely to lead to eventual pulpal necrosis, internal or external root resorption, discoloration of the tooth and partial or complete calcification (calcific metamorphosis) of the canal. The supporting periodontal fibers may respond by partial or complete degeneration, leading to mobility, tenderness, osteitis or ankylosis.[6-10]

Regular clinical and radiographic recall examinations were conducted periodically at six-month intervals for a period of three years for case 1. No sign of recurrence of the tumor nor symptoms of pain or discomfort were observed (Figure 5). Radiographs revealed progressive root resorption of the primary maxillary left central incisor (Figure 6). This finding is consistent with the history of a traumatized tooth and with the observation that the resorption changes reflected traumatic resorption.

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Orofacial manifestations of the Seckel syndrome

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Seckel syndrome is a rare autosomal recessive disorder originally described by Virchow in 1892 and more precisely defined by Seckel in 1960.[1,2] Fifty-four cases have been described in the literature to date.[2-25] Though rare, Seckel's birdheaded dwarfism is easily diagnosed by its unique facial configuration. In Table I the salient features of the syndrome are summarized: a characteristic facial appearance with micrognathia and prominent nose, severe staturoponderal retardation, microcephaly and mental retardation.

The purpose of this paper is to present a case of Seckel syndrome with emphasis on intraoral manifestations of the syndrome.

CASE REPORT

History

The propositus was a twenty-two-month-old white male born at term to a G_3P_3 healthy woman. His parents were first cousins. Except for a maternal uncle with infantile paralysis of unknown etiology, there were no acknowledged cases of birth defects in the family.

The boy's mother smoked one pack of cigarettes a day throughout the pregnancy, but otherwise denied exposure to infectious diseases, drugs, or teratogens. At six months, she first noted fetal movement and suffered from renal colic. At eight months' gestation, there was decrease in fetal movement and the fetus was determined to be in transverse position. He was delivered by caesarian section at nine months, weighing 1500 g (-5 S.D.) and measuring 39 cm in length (-8 S.D.). He required no special treatment after birth, but soon be-

Table ☐ Review of fifty-four cases (22M, 32F) of Seckel syndrome.

	Yes	No	No mention	Current case
Consanguinity	6	22	26	Yes
Normal gestation	35	5	14	Yes
Mental retardation	39	4	11	Yes
Delayed bone age	11	3	40	Yes
Low implantation of ears	13	0	31	Yes
Micrognathia	31	0	23	Yes
High palate	9	4	41	Yes
Cleft palate	4	5	45	No
Prominent nose	32	0	22	Yes
Hypodontia	3	2	49	Yes

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gan to show developmental delay. At three months, he could raise his head. At six months, his bone age was that of a newborn. By one year of age, he could sit and say a few words, such as "Dadda" and Mamma"; but could not crawl. His parents had perceived him to be bright, but were concerned about his diminutive height and inability to walk at eighteen months.

Physical examination

At age eighteen months, he measured 55 cm in length (-8 S.D.). His face was distinguished by a prominent nose and micrognathia (Figure 1). His ears were apparently low set and one lacked an earlobe. The palate was highly arched and the teeth were small; all primary teeth had erupted. He was permitted to sleep with a nippled bottle of milk, which likely explained the rampant caries, the anterior open bite and the diastema between his maxillary central incisors.

He had a pectus carinatum and eleven ribs, but no detectable cardiac problem. He had bilateral cryptorchidism with both testes palpable in the inguinal canals. Testicular size was proportional to body size, but small for this age, measuring 1 cm in length. He had bilateral radial hypoplasia, short fingers, and simian creases on both palms.

At age twenty months, he developed a fever of unknown origin that preceded a hemiparalysis of the right arm and leg. Movement in these extremities returned slowly, but an electroencephalogram indicated a pronounced diffuse organization of the cerebral electrical activity. No other laboratory tests were performed on this boy, with the exception of a chromosome analysis, which was predictably normal.

DISCUSSION

Seckel syndrome is characterized by dwarfism (adult height is less than 120 cm), microcephaly (head circumference in adults ranges from 39-42 cm; in neonates, less than 27 cm), a characteristic facial appearance, and a number of congenital malformations.

The child reported here was small at birth (39 cm in length - the mean of 54 cases in the literature was 35.34 cm, ranging from 18 to 46.5 cm). His birth weight was 1,500 g (the mean of reviewed cases was 1,499 g, ranging from 450 to 2,500 g). He was microcephalic and had other congenital malformations, shown in the Table.

Several characteristics of the oral cavity and craniofacies were unexpected, in light of the literature on the syndrome. The eruption of the teeth in the case

Figure. Case of Seckel syndrome showing the typical facial configuration.

reported here, for example, was considered precocious, an observation not previously reported. In the literature, seven cases reported normal dental age and four reported delayed dental age.[2,6] The pronounced micrognathia in the current case, however, was expected, since thirty- one of fifty-four cases in the literature had micrognathia and associated facial features, giving the appearance of a bird-like face. Generalized microdontia as seen in this case was reported in only four cases in the literature.[6,11] Enamel hypoplasia was reported in seven cases, but was not seen in our case.[2,3,11,15,18] This patient did demonstrate significant decay of the teeth, with some discoloration; these features along with the open bite and diastema were attributed to nursing bottle caries. Also present was a high palate, as was the case in nine other cases described elsewhere.[2,3,11,12,19] Finally, the maxillary lateral incisors were not seen on radiographs. The finding of hypodontia was previously described, in three cases.[2]

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ADOLESCENT DEPRESSION, ALCOHOL AND DRUG ABUSE

The distinction between primary and secondary depression offers a means of clarifying the nature of the relationship between alcohol/drug abuse and depression in adolescents. According to this distinction, primary depression is defined as depression occurring in a patient whose previous psychiatric history is negative, or positive only for pre-existing mania or depression. Secondary depression is defined as a depressive episode in a patient who has a pre-existing, diagnosable psychiatric disorder (for example, alcoholism and/or drug abuse in this study). The key to the classification is the chronology of the onset of the disorders. In our sample, 79 percent of both alcohol and drug abusers had another primary psychiatric disorder anteceding the alcohol or drug abuse. While others have identified specific psychosocial or personality attributes antecedent to drug abuse among adolecents, we believe this study is the first to document the association and sequence of psychiatric disorders, alcohol and drug abuse, rigorously defined and ascertained in a normal adolescent population.

Deykin, E.Y. *et al:*
Adolescent depression,
alcohol and drug abuse.
Am J Pub. Health, 77: 178-182, February, 1987

Abstracts

Sawyer, Danny R.; Nwoku, Algumba L.; Rotimi, V.O.; Hagen, James C.: Comparison of oral microflora between well-nourished and malnourished Nigerian children. J Dent Child, 53:439-443, November-December, 1986.

Microbial flora of well-nourished Nigerian children showed a wide spectrum of facultative flora, whereas anaerobic microbes were rarely isolated in these same children. In contrast, anaerobic microflora (especially *Bacteroides, Actinomyces*, and spirochetes) were usually, if not always, found in the malnourished children. An improved diet can reverse the tendency toward a shift in microbial flora to one of oral diseases, according to this study.

Diet, Oral health, Anaerobic microflora

Trowell, Hugh and Burkitt, Denis: Physiological role of dietary fiber: a ten-year review. J Dent Child, 53:444-447, November-December, 1986.

It is now accepted that dietary fiber is an important constituent of the diet. There is growing evidence that the low-fiber Western diets and the low consumption of whole grain products are important factors in several common diseases of the large bowel.

High-fiber diets, Health

Bimstein, Enrique; Bystrom, Eric B.; Ligh, Randy Q.: Undetected errors in cavity preparations from a preclinical course and their possible clinical implications. J Dent Child, 53:448-451, November-December, 1986.

A post-course evaluation of accepted class II cavity preparations from a pre-clinical pediatric dentistry course revealed previously undetected errors, in significant levels, in fifteen cavity criteria. Visual acuity, estimation of size, unspecified methods of observing, and incomplete operational definitions were considered to be main factors affecting students' performances and their instructors evalutions. Undetected errors would have led to failure of the restorations under clinical conditions.

Class II cavity preparations, Clinical evaluation

Bayardo, Ruben, E.: Anterior space maintainer and regainer. J Dent Child, 53:452-455, November-December, 1986.

Controversy exists concerning the space management of the anterior portion of the child's mouth. An appliance is described that applies simple orthodontic principles and devices to maintain arch symmetry and spacing of anterior teeth. It can also be used as a space regainer.

Direct-bonding, Space maintainer, Orthodontics

Ranalli, Dennis N.; Elliott, Margaret A.; Zullo, Thomas G.: Comparative analysis of ectopic eruption of maxillary permanent first molars in children with clefts. J Dent Child, 53:433-435, November-December, 1986.

A retrospective review of dental records at the University of Pittsburgh Cleft Palate Center was undertaken to determine the prevalence of ectopic eruption of maxillary permanent first molars in children with clefts, by cleft type. The percentage of cases was higher in children with clefts than in noncleft samples, but no statistically significant relationships were found for ectopic eruption by specific cleft type.

Oral clefts, Ectopic eruption, First molars

Barbakow, F.; Sener, B.; Lutz, F.; Imfeld, T.: Fluoride retention by human enamel after [in vitro] application of nicomethanol hydrofluoride. J Dent Child, 54:9-14, January-February, 1987.

Four groups of enamel specimens were brushed for ten weeks with dentifrices containing either nicomethanol hydrofluoride; a combination of amine fluorides 294 and 242; NaF; or distilled water. After brushing, the specimens

were washed, and after dividing them into subgroups, it could be determined that the fluoride "on and in the enamel" was significantly increased in the specimens brushed with the nicomethanol hydrofluoride dentifrice compared to that recorded for the NaF-brushed specimens.

Fluoride; Enamel

Hattab, F.N.: [In vitro] fluoride uptake by lased and unlased ground human enamel. J Dent Child, 54:15-17, January-February, 1987.

Under this experimental design, ground enamel was used, which is known to contain a low and consistent fluoride concentration, providing a background against which small amounts of acquired fluoride can be measured. The argon laser has recently been suggested as a useful clinical tool in the diagnosis of initial caries lesions.

Fluoride concentration; Argon laser; F uptake

Legett, B.J., Jr.; Garbee, W.H.; Gardiner, J.F.; Lancaster, D.M.; The effect of fluoridated chocolate-flavored milk on caries incidence in elementary school children: two-and three-year studies. J Dent Child, 54:1821, January-February, 1987.

This study examined the effect of chocolate-flavored, sweetened, low-fat fluoridated milk on the caries incidence of elementary school children. A total of 706 students in grades K-4 living in a nonfluoridated area participated in the study and were assigned to test or control groups. Milk was distributed to the students during school lunches. A significant difference in DMFT scores for the two-year study resulted, with 77 percent fewer decayed teeth in the test group.

Fluoridation; Milk; Compliance

Garcia-Godoy, F.: Evaluation of an iodoform paste in root canal therapy for infected primary teeth. J Dent Child, 54:30-34, January-February, 1987.

The purpose of this study was to evaluate the effectiveness of an iodoform paste in a two-session root-canal treatment of infected primary teeth. The sample consisted of fifty-five children aged 2.5-9 years old. After 6 to 24 months, no clinical or radiographic signs/symptoms of failure were observed in 95.6 percent of the treated teeth. The results show that the iodoform paste is a suitable root canal filling material for infected primary teeth.

Iodoform paste; Root canal treatment

Mulder, G.R.; van Amerongen, W.E.; Vingerling, P.A.; Consequences of endodontic treatment of primary teeth-Part II. A clinical investigation into the influence of formocresol pulpotomy on the permanent successor. J Dent Child, 54:35-39, January-February, 1987.

The results of this study do not corroborate the postulate that formocresol used in the pulpotomy of a primary tooth could have a detrimental effect on the formation of its permanent successor. What is less certain is the extent of possible harm to the tissues surrounding the teeth that contain it.

Pulpotomy; Formocresol; Endodontic treatment

Ranly, D.M.; Horn, D.: Assessment of the systemic distribution and toxicity of formaldehyde following pulpotomy treatment: part two. J Dent Child, 54:40-44, January-February, 1987.

As part of an effort to evaluate the toxicity of the constituents of formocresol, rats were infused with several doses of formaldehyde, Doses used were increments of the systemic load previously determined to follow a single pulpotomy treatment (basal dose). Results showed that low levels of formaldehyde are toxic; however, these levels might never be attained by diffusion from a clinically relevant number of pulpotomy sites.

Formaldehyde; Toxicity; Formocresol pulpotomy

Durr, D.P.; Novak, E.V.: Dimensional stability of alginate impressions immersed in disinfecting solutions. J Dent Child, 54:45-48, January-February, 1987.

Because infectious viral diseases may be found on the surface of an alginate impression, which present a potential reservoir of virus particles, it is appropriate to disinfect the impressions immediately after removal from the mouth. The purpose of this study was to determine the dimensional stability of alginate impressions immersed in solutions that disinfect them. The results showed that immersion produced small, statistically significant but clinically insignificant dimensional changes in the casts poured from them, compared to a master cast and those of a control group.

Alginate impression; Dimensional stability; Sodium hypochlorite; Glutaraldehyde

Waldman, H.B.: Pediatric dentistry in early and mid-1980s: a review of personnel and use of dental services. J Dent Child, 54:49-53, January-February, 1987.

A review of changing economics, dental practitioner personnel, and use patterns of dental services in the 1980s indicates some encouragement for pediatric dentistry.

Pediatric dentistry; Dental practitioners; Economics

Herbert, F.L.; Delcambre, T.J.: Unusual case of green teeth resulting from neonatal hyperbilirubinemia. J Dent Child, 54:54-56, January-February, 1987.

With the remarkable advances in neonatology, an increase in the population of children who have survived premature birth, and its attendant organic and metabolic disturbances can be an-

ticipated. One sequela of such survival requiring the attention of the dentist is unusual pigmentations of the teeth, caused by release of chemical breakdown products into the bloodstream. This report describes a case of intrinsic green staining of the primary dentition as a result of neonatal hyperbilirubinemia.

Neonatal hyperbilirubinemia; Chlorodontia

Rakocz, M.; Frand, M.; Brand, N.: Familial dysautonomia with Riga-Fede's disease: report of case. J Dent Child, 54:57-59, January-February, 1987.

A ten-month-old child with familial dysautonomia was seen with large, exophytic ulcerative lesions on the dorsum and ventrum of the tongue. Surgical removal of these lesions failed to heal the sites, and upon examination by the pedodontist, a diagnosis of traumatic ulceration (Riga-Fede's disease) was established. After the child received composite coverage of the traumatic central primary incisors, the lesions disappeared within two weeks.

Familial dysautonomia; Riga-Fede's disease

Pashley, E.L.: Hyperdontia in the primary dentition: report of case. J Dent Child, 54:60-61, January-February, 1987.

Occlusal radiographs of a well-developed, six-year-old black male, taken during routine dental care, revealed six apparently normal mandibular incisors between his canine teeth. They were all of normal size, shape, and color, and they were fully erupted in reasonable alignment.

Hyperdontia; Primary mandibular incisors

Welbury, R.R.; Maguire, A.; Murray, J.J.: Goldenhar's syndrome and hypodontia; report of case. J Dent Child, 54:62-64, January-February, 1987.

Hypodontia has not previously been reported in association with Goldenhar's syndrome. It is suggested that an increased awareness of possible dental abnormalities by medical staff, together with dental radiological review of these patients into their adolescent years, may lead to further reports of hypodontia.

Hypodontia; Goldenhar's syndrome

Glasrud, Patricia H.; Frazier, P. Jean; Horowitz, Alice M.: Insurance reimbursement for sealants in 1986: report of a survey. J. Dent Child, 54:81-88, March-April, 1987.

Lack of reimbursement for pit and fissure sealants by third-party payers has been cited as a major barrier to practitioners' using the procedure. The purpose of this study was to determine the extent of insurance coverage for sealants in 1986. Many of the responding parties that provide such coverage implemented it into their group plans since January, 1984. Doing so should ultimately improve the oral health of the public.

Sealants, Dental insurance

Waldman, H. Barry: Changing patterns of dental disease in children and the use of dental services. J Dent Child, 54:89-92, March-April, 1987.

A review is provided of the continuing need for, and use of, dental services by children 40 years after the first adjustment of the fluoride content of a community water supply.

Dental disease, Fluoridated water, Epidemiology

Nathan, John E.: Management of the refractory young children with chloral hydrate: dosage selection. J Dent Child, 54:93-100, March-April, 1987.

This paper discusses the problematic issues associated with the use of chloral hydrate in the management of severely uncooperative young pedodontic patients. It is often selected for its wide range of safety, either alone or in combination; however, a high frequency of failure to achieve adequate levels of sedation has been reported when using the manufacturer's recommended hypnotic dosage.

Chloral hydrate; Sedation; Patient management

Levy, Steven M.; Rozier, R. Gary; Bawden, James W.: Knowledge about systemic fluoride supplements among pediatric dentistry faculty and practitioners. J Dent Child, 54:101-105, March-April, 1987.

As approximately half the U.S. population does not have access to optimally fluoridated water, systemic fluoride supplements should be considered as an alternative. Relatively few practitioners assay their patients' water for fluoride content, however, and therefore the unnecessary risk of fluorosis exists. Private dentists and dentistry faculty members were surveyed about knowledge and protocol. Differences in responses were not as great as might have been expected.

Systemic fluoride, Fluoride supplements, Fluoride tablets and drops

Hagan, Patricia P.; Levy, Steven M.; Machen, J. Bernard: Validation of the children's oral health status index (COHSI). J Dent Child, 54, 110-113, March-April, 1987.

It is becoming increasingly important to develop meaningful barometers of the effectiveness of the health care system, such as with a composite health status index. Recently, the Children's Oral Health Status Index (COHSI) was developed as an integrated, comprehensive measure of oral health status of pediatric populations. Findings presented here provide support for the validity of the COHS Index.

Pediatric dentistry, COHSI, Epidemiology