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AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN
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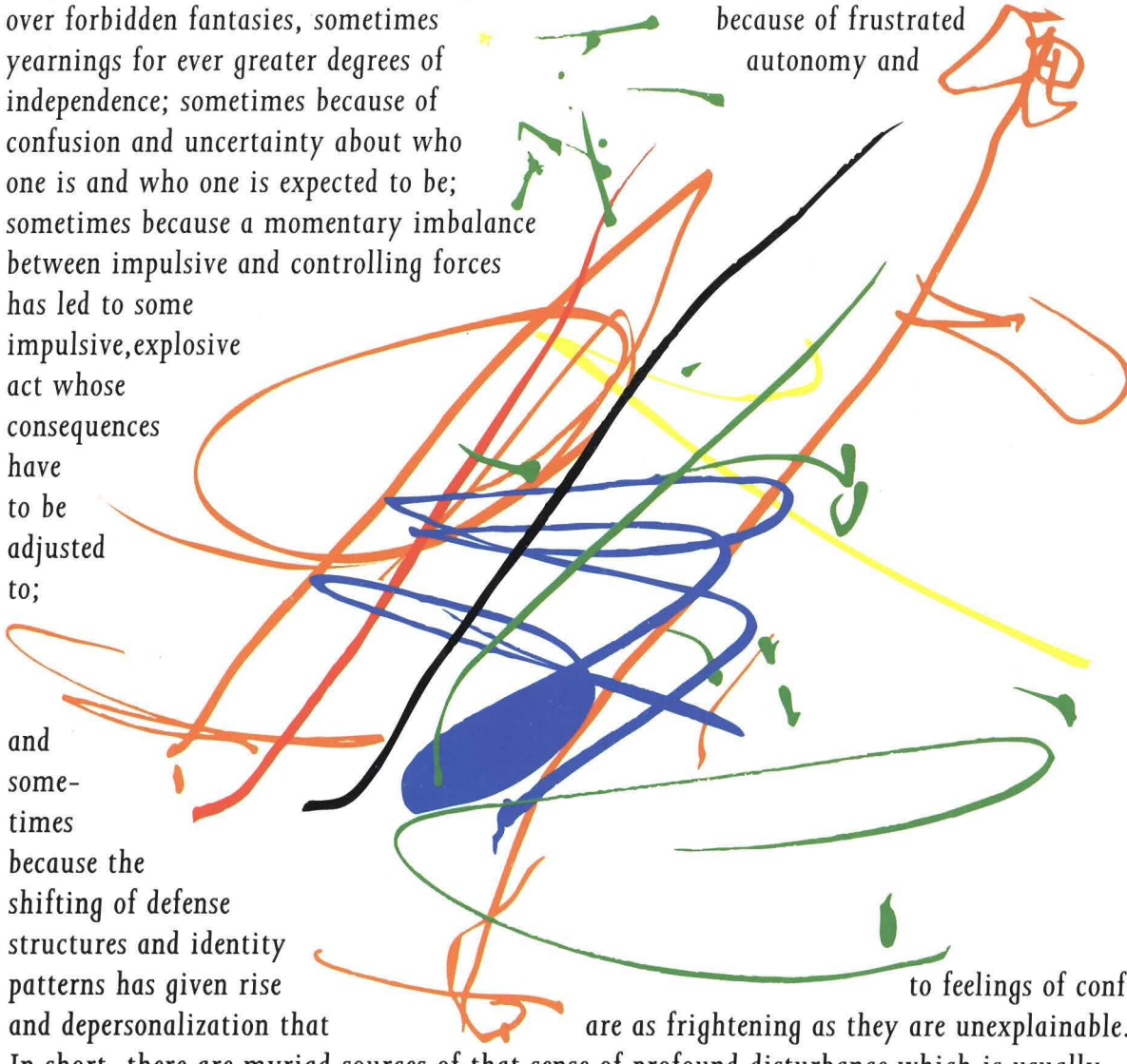
In any event, the predictable state of affairs for any given youngster is a condition of episodic turmoil, sometimes ensuing because of guilt over forbidden fantasies, sometimes because of frustrated yearnings for ever greater degrees of autonomy and independence; sometimes because of confusion and uncertainty about who one is and who one is expected to be; sometimes because a momentary imbalance between impulsive and controlling forces has led to some impulsive, explosive act whose consequences have to be adjusted to; and sometimes because the shifting of defense structures and identity patterns has given rise to feelings of confusion and depersonalization that are as frightening as they are unexplainable. In short, there are myriad sources of that sense of profound disturbance which is usually designated as adolescent turmoil.



—Joseph D. Noshpitz, M.D.

I AM TIRED. EVERYONE'S TIRED OF MY TURMOIL.

—Robert Traill Spence Lowell

ASDC AMERICAN SOCIETY OF DENTISTRY FOR CHILDREN

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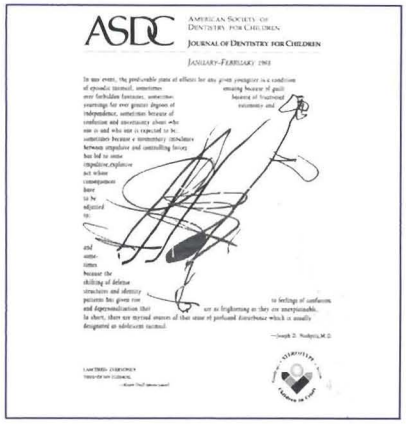
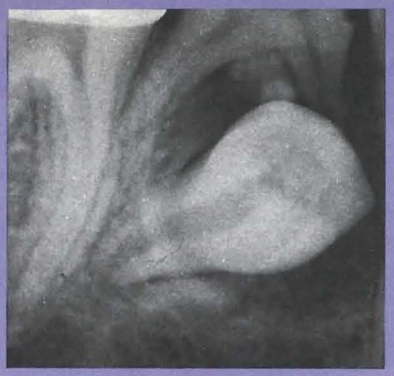


Children should be given opportunities to develop their special talents and strengths; those opportunities should not necessarily be dependent on or in accordance with parental fixations or cultural stereotypes.

Cover art and design by Sharlene Nowak-Stellmach



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For the busy reader

Oral cleanliness of dentally anxious schoolchildren and their need for periodontal treatment—page 17

In 1988, 32 percent of twelve-year-olds in Scotland and 47 percent in Lothian were caries-free. This new generation, because of limited experience with operative dental treatment, have different attitudes toward dental care than older generations.

Direct inquiries about reprints to Dr. Raman Bedi, Department of Children's Dentistry, The Dental School, University of Birmingham, St. Chad's Queensway, Birmingham B46NN England.

A child's sleeping habit as a cause of nursing caries—page 22

The article is based on a survey conducted in a private pediatric dental practice in a community with a water supply fluoridated to 1 ppm. One hundred and fifty six responses were considered valid. Of the 56 percent who were put to bed with a bottle, 37 percent developed nursing caries.

Direct inquiries about reprints to Dr. Steven S. Schwartz, 195 Bridgetown Street, Staten Island, New York 10314.

Local treatment of minor aphthous ulceration in children—page 26

None of the proposed treatments for minor aphthous ulceration is definitive. The authors describe the use of a cyanoacrylate adhesive to provide fast symptomatic relief and to shorten the healing time.

Direct inquiries about reprints to Dr. Jean R. Jasmin, UFR D'Odontologie, Parc Valrose, avenue Joseph Vallot, 06034 Nice Cedex, France.

Impaction and malformation of a maxillary central incisor: Sequelae of trauma—page 29

Injury to a primary maxillary incisor requires radiographs and a good history for diagnosis, treatment, and follow-up care.

Direct inquiries for reprints to Paul E. Kittle, Col, DC, 2370 Yellowstone Court, Fort Lewis, WA 98433.

Parental education leads to preventive dental treatment for patients under the age of four—page 33

Ultimately the responsibility for acceptance of the concept of preventive dental care for infants and very young children lies with the dental profession. Efforts to educate parents about the importance of prevention without the input and cooperation of the profession will have only token effects.

Direct inquiries for reprints to Dr. Howard S. Schneider, P.O. Box 23633, Jacksonville, FL 32241.

Problems your pediatric patients may face—page 38

The challenge faced by providers of pediatric dental care is to recognize the fact that many children face problems within their own families that require providers to give service that transcends the usual boundaries of dental service.

Direct inquiries for reprints to Dr. H. Barry Waldman, Department of Dental Health, School of Dental Medicine, State University of new York at Stony Brook, Stony Brook, NY 11794-8883.

Trends in the perceived need for dental care for children: 1982-1990—page 43

National data on the dental status of children (as reported by dental investigators) are not available for the period since 1986-87. Parents and guardians continue to report ongoing problems of acute dental conditions and related problems, however, although at a much reduced rate.

Direct inquiries for reprints to Dr. H. Barry Waldman, Department of Dental Health, School of Dental Medicine, State University of new York at Stony Brook, Stony Brook, NY 11794-8883.

The composite resin restoration: A literature review part I
Proper cavity preparation and placement techniques—page 48

Today's composite materials, though vastly improved, still have some major drawbacks, which must be overcome before they can serve as a reliable replacement for amalgam.

Direct inquiries for reprints to Dr. Clem Full, University of Iowa, School of Dentistry, Department of Pediatric Dentistry, 402 Dental Sciences Bldg. North, Iowa City, IA 52242-1010.

The composite resin restoration: A literature review part II
Comparisons between composite and alloy restorations—page 52

Posterior composite restorations can be expected to gain acceptance for primary teeth before acceptance as state of the art for permanent teeth, because they are not required to last as long.

Direct inquiries for reprints to Dr. Clem Full, University of Iowa, School of Dentistry, Department of Pediatric Dentistry, 402 Dental Sciences Bldg. North, Iowa City, IA 52242-1010.

The composite resin restoration: A literature review part III
What the future holds—page 57

Excessive occlusal wear, marginal staining, and marginal leakage decrease acceptability of composite restorations as a viable alternative to amalgam.

Direct inquiries for reprints to Dr. Clem Full, University of Iowa, School of Dentistry, Department of Pediatric Dentistry, 402 Dental Sciences Bldg. North, Iowa City, IA 52242-1010.

Behavior management of a patient with Mobius syndrome: Report of case—page 60

The lack of expression and communication complicates management of patient behavior, because there is no immediate feedback as to the patient's mental state.

Direct inquiries for reprints to Dr. Gary R. Badger, 8303 Crosspointe Drive, Fairfax Station, VA 22039.

Enamel pearls in the primary dentition: Report of two cases—page 63

Presence of an enamel pearl, depending on location may cause delayed exfoliation of the primary tooth, because the enamel resorbs more slowly. It is difficult to depict enamel pearls radiographically.

Direct inquiries for reprints to Dr. N. Rozenfarb, Department of Pediatric Dentistry, The Hebrew University Hadassah, School of Dental Medicine, Ein Karem, Jerusalem, Israel.

Neurofibroma of the gingiva in a child: Report of case—page 67

This tumor occurs rarely in children. The case reported here occurred in a two-year-old boy, and appeared as a swelling in the right maxillary frontal gingiva.

Direct inquiries for reprints to Dr. Hirotsugu Yamamoto, Professor of Oral Pathology, Nihon University School of Dentistry at Matsudo 870 1, Sakaecho, Nisi-2, Matsudo-shi, Chiba-ken 271 Japan.

CLINIC

Oral cleanliness of dentally anxious schoolchildren and their need for periodontal treatment

Raman Bedi, MSc, FDSRCS
Philip Sutcliffe, PhD, FDSRCS
Peter T. Donnan, MSc
John McConnachie, BDS

The aim of this study was to examine the relationship between self-reported dental anxiety and (1) the oral cleanliness and (2) need for periodontal treatment of Scottish secondary schoolchildren.

The extent to which high dental anxiety is prevalent in a community has been estimated to be between 7 percent and 14 percent and the majority of people who are dentally anxious believe that this fear developed during their childhood.[1-7] It has been established in a number of studies that highly anxious adults have a greater proportion of missing teeth and untreated decay.[8,9] Few studies have attempted to examine the clinical outcome of dental anxiety, however, in a schoolchild population. Vignesa *et al* (1990) claimed to do the first study to evaluate the effect of dental fear on the oral health of children.[10] They found no difference in the oral cleanliness or periodontal status of the high- and low-fear Singaporean primary grade 4 and 5 (8-9 year-olds) schoolchildren.[10] Whether these clinical findings would be similar for older dentally anxious schoolchildren is uncertain.

The declining prevalence of dental caries in the present Scottish schoolchild population has meant that, in 1988, 32 percent of twelve-year-olds in Scotland, and 47 percent in Lothian were caries free.[11] This new generation, which had experienced little or limited operative dental treatment, have different attitudes to dentistry and dental care than older generations. In testing the hypothesis that highly anxious people try to prevent dental disease (and thus treatment) by maintaining high levels of oral care, the present state of oral cleanliness and periodontal disease may be more sensitive than dental caries experience (DMFT) in those children who have or are developing a high dental anxiety. This is because the DMFT index reflects a life history of dental care and, of course, the primary dentition is not included.

METHOD AND MATERIALS

Sample selection

The Lothian Education Authority provided a list of eight secondary schools that had been randomly selected and

Mr. Bedi and Dr. Sutcliffe are in the Department of Preventive Dentistry, University of Edinburgh; Mr. Donnan is with the Medical Statistics Unit, University of Edinburgh; and Dr. McConnachie is with the Community Dental Services, Lothian Health Board.

The project was funded by a grant from the Scottish Department of Home and Health.

The authors wish to thank first and foremost all the children and schools who participated in this project, without whose help this study would not have been possible. We are grateful to Mr. J. Craig (Chief Administrative Dental Officer), Mrs. C. Wright (Senior Dental Officer) both from the Lothian Health Board and Miss H. Moore (Research Assistant) for their help and support throughout the survey. We are also grateful to Miss B. Wohlgemuth (Computing Officer, Preventive Dentistry) and the staff of the Medical Statistics Unit from the University of Edinburgh for their help.

stratified by social background so as to be representative of the Authority's secondary results.

Children in grade three were selected in all the schools, because this was the oldest age-group in which the children were taught primarily in class units and not in their optional subject groups. In addition they had not yet embarked upon work experience, and so were not likely to be absent from the school for varying periods of term time.

A letter was sent to all the parents of the senior level three children, outlining the aims and procedures of the study, and informing them that if they did not wish their children to participate, they were to inform the appropriate school administration.

Survey instrument

A self-administered, structured questionnaire was used. The questionnaire had five domains; personal and family background, dental anxiety, dental experience and attendance, oral cleanliness habits, use of fluorides, and lastly, information was gathered on the consumption of sugar.

The dental anxiety domain gathered information on the Corah Dental Anxiety Scale (CDAS) which is a well-established index that measures reactions on a five point scale of ascending anxiety to four different dental treatment situations.[17] The CDAS has been shown to be both reliable and valid in distinguishing between fearful and nonfearful patients.[13-15] In addition questions on perception of anxiety, fear of specific dental procedures, and the subjects' disposition toward fear in general were measured according to the Geer Fear Scale (GFS), which records reactions to different potentially threatening items, on a seven point ascending scale.[16] The original GFS was modified so that only eighteen specific items were included; this modified version has been published and used in other dental surveys.[14,15]

Survey procedures

The questionnaires were completed in the classroom and supervised by one of the authors (RB). A standard introduction was given by the author (RB) before the completion of the questionnaire, outlining the purpose of the study and the confidential nature of the information provided. The children were encouraged to discuss the topics covered in the questionnaire in groups and then complete the questions themselves. While the questionnaires were being completed, the moderator (RB) was available to address any problems that arose. The questionnaire was completed by most children in approximately 30-35 minutes.

All the dental examinations were conducted in school by one calibrated examiner (JM), who was unaware of the results of the questionnaire survey at the time of examination. A (60 watt) anglepoise lamp provided the illumination and compressed air was available. The oral debris and Community Periodontal Index of Treatment Need (CPITN) were recorded for each child, according to the diagnostic criteria and guidelines published by the WHO.[17]

Statistical methods

The extent of periodontal disease was measured in six regions of the mouth and the CPITN score was defined as the maximum score of these regions. For the purpose of analysis and presentation, this measure has been dichotomized to give a binary variable: disease (Code 1-4); no disease (Code 0).

For the purpose of description the CDAS score was divided into three categories: no anxiety (0 to 9); moderate anxiety (10 to 14); and highly anxious (15 plus). For some analyses the categories of no anxiety and moderate anxiety have been combined.

The Geer Fear Scale (GFS) was categorized so that a score of 6 or 7 was regarded as an extreme fear for that specific item. When five or more extreme fears were noted for an individual, he was considered to have an overall high general fear. In this form contingency tables were constructed to consider dental anxiety and general fear.

Social class was defined in terms of father's occupation and was assessed in the logistic regression model using two dummy variables, indicating the odds ratios of high and middle social classes relative to lower social classes.

Categorical analyses were carried out using chi-squared tests. In order to assess the individual and adjusted effects of fear, social class and gender in predicting periodontal disease (disease/no disease) the logistic regression program in the statistical package BMDP was used.[18]

RESULTS

All eight schools that were approached agreed to participate in the study. There was a total of 1237 children on the third year school roll and 1103 (89 percent) children took part in the questionnaire survey and 1004

(81 percent) children in the clinical examination. Ten children were excluded from the study because of parental objections and 124 children did not participate because they were absent from school during the time of the study. The clinical survey was completed in January 1990, following completion of the questionnaires in October 1989.

Participants' reactions on the CDAS and the GFS were only included in the analysis, if the responses had been completed unambiguously. Hence, for the Corah Dental Anxiety Scale, 27 responses were treated as missing, leaving 1076 for data analysis. Not all the questions were answered and as such the baseline totals for differing variables vary in the Tables.

There were 563 boys (51 percent) and 540 girls (49 percent) with an overall mean age of fourteen years (s.d. = 0.35 years). The prevalence of high dental anxiety is 7.1 percent (95 percent confidence interval = 5.6 percent, 8.6 percent).

In examining the hypothesis that anxious children are more likely to help themselves by more frequent tooth cleaning, it was found that dental anxiety and general fear were related to the frequency of toothbrushing (Table 1). This relationship was not a linear one, however, and high dental anxiety or general fear was associated with either very low toothbrushing frequency or greater than twice a day toothbrushing frequency. The gender difference was clear, however, with females being more likely to brush their teeth compared to males ($p<0.0001$). The use of dental floss did not differ between males and females and was unrelated to dental anxiety or general fears. The results on *bleeding on toothbrushing* were similar to those found on toothbrushing frequency, with the exception that there appears to be no gender differences.

In examining the hypothesis that anxious children are more likely to have cleaner mouths, it was found that measures of debris and need for treatment (CPITN) indicate that dental anxiety and general fear were unrelated to the overall cleanliness of the children's mouths (Table 2). As previously the gender difference was evident, females having significantly lower debris scores than males ($p<0.001$) and were more likely to require no treatment (Table 2). The extent of treatment was also likely to be less for females, when treatment was required, compared to males (Table 2).

The hypothesis that anxious children would be more likely to seek help and advice regarding professional cleaning (so as to avoid more complicated dental treatment at a later date) was tested. It was found that those with high dental anxiety or high general fear were more likely to defer visits to the dentist (Table 3). As well as deferring dental appointments, high dental anxiety and high general fear groups were more likely to cancel dental appointments (Table 3) and to do so more frequently. Males were more likely to cancel appointments than females, although this difference did not reach statistical significance. The extent of worry over a scaling and polish was significantly greater for those with high dental anxiety and high general fear (Table 3). Gender was also related to worry over professional cleaning, with males more likely to not worry compared to females.

The results of logistic regression indicated that nei-

Table 1 □ Oral cleanliness by dental and general anxiety.

	Toothbrushing frequency (%)+			Use of dental floss++		Bleeding on brushing+++		
	>2 times	1-2	<once	Yes*/Some	Rarely/Never	Nearly always /Often	Occassionally	Rarely /Never
High CDAS (CDAS >=15)	15 (10)	47 (6)	13 (17)	24 (9)	52 (6)	16 (21)	13 (17)	47 (62)
Low/moderate CDAS (CDAS <15)	134 (90)	796 (94)	64 (83) ***	245 (91)	750 (94)	102 (10)	171 (17)	721 (73) **
High GFS (extreme fear >=5)	22 (16)	58 (7)	8 (13)	20 (8)	69 (9)	16 (18)	16 (18)	57 (64)
Low/moderate GFS (extreme fear < 5)	118 (84)	731 (93)	55 (87) **	226 (92)	677 (91)	89 (10)	154 (17)	658 (73) *
Male	64 (42)	435 (50)	58 (74)	133 (48)	425 (52)	66 (12)	92 (16)	400 (72)
Female	88 (58)	431 (50)	20 (26) ***	142 (52)	398 (48)	54 (10)	96 (18)	387 (72)
Total population	152 (14)	866 (79)	78 (7)	275 (25)	823 (75)	120 (11)	188 (17)	787 (72)

CDAS (Corah Dental Anxiety Scale)
GFS (Geer Fear Scale)
* $p<0.05$ ** $p<0.01$ *** $p<0.001$
Yes* = Combined responses; nearly always, often and occasionally.
+ 7 missing values
++ 5 missing values
+++8 missing values

Table 2 ☐ Mean total debris score and percentage of children in each CPITN treatment need category according to dental anxiety (corah dental anxiety scale) and general fear (geer fear scale).

	n	Total debris score + Mean (s.d.)	No treatment	OHI (TN1)	CPITN OHI & scaling (TN2)	OHI, scaling & complex treatment (TN3)
High dental anxiety (CDAS > = 15)	66	0.91 (1.43)	45	29	12	14
Low/Moderate dental anxiety (CDAS < 15)	913	0.91 (1.44)	40	23	15	22
High general fear (extreme fears > = 5)	75	1.07 (1.58)	44	23	8	25
Low/moderate general fear (extreme fear <5)	840	0.88 (1.44)	40	24	15	21
Male	509	1.09 (1.56)	34	24	15	27
Female	495	0.72 (1.30)***	45	24	14	17
Total population	1004	0.91 (1.45)	40	24	15	21

*** p<0.001 Mann-Whitney test
+ 99 missing values

Table 3 ☐ Dental attendance and response to professional cleaning by dental anxiety and general fear.

			Dental anxiety		General fear	
	Male	Female	(CDAS > = 15)	(CDAS < 15)	(Extreme fear > = 5)	(Extreme fear < 5)
Time since last dental visit			***		**	
within six months	406 (73%)	400 (73%)	40 (53%)	744 (75%)	51 (58%)	685 (76%)
6 months - 1 year	90 (16%)	91 (17%)	18 (24%)	159 (16%)	21 (24%)	140 (15%)
1 - 2 years	37 (7%)	24 (5%)	5 (7%)	55 (5%)	9 (10%)	45 (5%)
>2 years	26 (4%)	24 (5%)	12 (16%)	38 (4%)	7 (8%)	35 (4%)
Cancellations or 'no show' of appointment			***		***	
never	457 (82%)	458 (85%)	30 (40%)	860 (86%)	63 (71%)	778 (86%)
once or twice	68 (12%)	53 (10%)	19 (25%)	100 (10%)	18 (20%)	92 (10%)
a few times	11 (2%)	14 (2%)	7 (10%)	18 (2%)	1 (1%)	15 (2%)
often/always	24 (4%)	15 (3%)	19 (25%)	20 (2%)	7 (8%)	21 (2%)
'Worry' over professional tooth cleaning	**		***		***	
none	412 (80%)	364 (71%)	19 (31%)	736 (78%)	37 (45%)	682 (79%)
a little	73 (14%)	106 (21%)	21 (35%)	152 (16%)	29 (35%)	135 (15%)
some	16 (3%)	30 (6%)	10 (16%)	36 (4%)	8 (10%)	32 (4%)
great deal/always	14 (3%)	12 (2%)	11 (18%)	15 (2%)	8 (10%)	16 (2%)

CDAS (Corah Dental Anziety Scale)
GFS (Geer Fear Scale)
** p<0.01
*** p>0.001

Table 4 ☐ Logistic regression with CPITN as outcome (Disease/No disease)

Variable	Odds ratio	95 percent confidence interval
Gender	1.68***	(1.25, 2.25)
Father's occupation (low relative to high)	1.86*	(1.02, 3.41)
Father' occupation (low relative to middle)	0.83	(0.73, 2.21)
Size of family	0.98	(0.85, 1.13)
High general fear (GFS, extreme fears > = 5)	1.01	(0.59, 1.74)
High dental anxiety (CDAS > = 15)	1.01	(0.97, 1.06)

* p<0.05
** p<0.01
*** p<0.001
GFS (Geer Fear Scale)
CDAS (Corah Dental Anxiety Scale)

ther dental anxiety nor general fear was significantly related to the presence of disease, after adjustment for other factors. Gender, however, was a significant predictor of disease, the adjusted odds ratio indicating that the odds of disease was 68 percent higher for males relative to females (Table 4).

Social class as defined by father's occupation was also significant after adjusting for gender. Father's social class was entered into the regression model as two variables with the odds of disease in low social classes being 86 percent higher relative to high social class ($p = 0.04$), while the odds ratio of disease in the middle social classes to lower social classes was not significant.

DISCUSSION

The findings of the study show that 60 percent of fourteen-year-olds in Scotland required some form of treatment according to the CPITN index, although 24 percent only require oral hygiene instruction. Dental floss was not widely used, with 75 percent of children either

rarely or never using it; toothbrushing was commonplace, however, with only 7 percent of children reporting that they brushed their teeth less than once a day.

Overall dentally anxious children do not help themselves with regard to keeping their teeth clean. Their levels of self-care were not higher, or did they seek professional help more frequently than their contemporaries. This lack of motivation may simply arise because highly dentally anxious children perceive that maintaining high levels of oral cleanliness does not reduce the likelihood of restorative dental treatment. The national children's dental health survey in the United Kingdom in 1983 showed, however, that 74 percent of parents of fifteen-year-old children perceived that cleaning their teeth would stop teeth decaying.[19] It could be reasonably assumed, therefore, that anxious children do realize that by frequent brushing they might minimize the likelihood of dental caries developing and thus avoid having to receive more complicated dental care at a later stage. Alternatively, dentally anxious children may have resigned themselves to having poor dental health, because of the belief that good dental health is not possible without visiting or receiving professional care. A possible health promotion strategy would be, therefore, that since 45 percent of all the dentally anxious children require no treatment according to the CPITN index, and that 29 percent only require oral hygiene instruction, to improve the periodontal condition, then, the majority of this population (74 percent) do not need to attend a dental surgery for the care they need.

If dentally anxious children did not help themselves with regard to self-care, they also did themselves little advantage in seeking professional help. Dentally anxious individuals were more likely to defer dental visits and either cancel or fail to keep dental appointments. In addition dentally anxious children tended to worry more, if they had to have a scaling than their contemporaries. This barrier to dental care may in fact be due to the belief by the dentally anxious children that a visit to the dentist will invariably involve treatment of any dental caries present.

Gender and social class were more significant variables in the presence and absence of disease with regard to CPITN than was dental or general anxiety. Studies have repeatedly shown, however, that dentally anxious adults have poor dental health and avoid contact with the dental profession.[2,8,9] The implications for this study show that during the early teenage years a similar pattern of attitudes toward dentistry is emerging among children who are dentally anxious. With regard to periodontal condition, however, they have a similar health status to their contemporaries; the majority could be managed, furthermore, with simple nonsurgery based treatment. Health promotion should target this dentally high-risk group, therefore, by encouraging improved self-care with regard to oral cleanliness and by making dental professionals aware of the needs of these children and that many of them (74 percent) can be treated with simple noninvasive dental procedures, which can be carried outside the context of a dental surgery.

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A child's sleeping habit as a cause of nursing caries

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Bottle mouth caries", "nursing bottle caries", and "baby bottle caries" are terms used to describe a condition of rampant caries in infants attributed to the prolonged use of a nursing bottle containing fermentable carbohydrate liquids. It is also seen in children who suck a pacifier dipped in a sweetener and in children who have been breast fed.[1] This condition is currently referred to as nursing caries".[2]

Clinical examination of this condition discloses a distinctive pattern. The teeth most often involved are the maxillary central and lateral incisors, and the maxillary and mandibular first primary molars. The maxillary and mandibular second primary molars and canines are involved to a lessor degree. The mandibular primary incisors are relatively unaffected. The maxillary primary incisors are the most severely involved with deep carious lesions-appearing on the labial and lingual surfaces that may extend into the interproximal areas.[3]

Over the years studies have been conducted on infant feeding practices and their relationship to nursing caries. Kroll and Stone found a correlation between the presence of nursing caries and the amount of time the patient slept with the bottle in the mouth.[4] Dilley *et al* described a sample of children with nursing caries and studied the backgrounds of those children and their families. They found that subjects with nursing caries experienced prolonged bottle feeding and breast feeding. They found that a greater percentage of these children were second siblings.[5] Johnsen similarly found that a great percentage of the children with nursing caries slept overnight with the bottle, but none of the caries-free children slept overnight with the bottle, even though 45 percent went to sleep with the bottle.[6] In a later study, he found an increased susceptibility of children with nursing caries to future molar decay.[7] Rosenzweig has suggested a correlation between hypoplastic defects in primary teeth and nursing caries.[8]

The dentist who is presented with a patient with nursing caries is faced with the difficult task of restoring the child's dentition to good health.[9-11] In addition, the dentist must explain to the parents the cause of the problem. A response to such explanations is disbelief, because in many cases, older siblings have slept with the bottle without ill effects. Because of the frequency of this response, this investigation was conducted to determine whether there were any feeding practices by infants that would favor development of nursing caries in one child over another.

METHODS

A survey was conducted in a private pediatric dental practice in an urban community with a water supply fluoridated to 1 ppm. Questionnaires were distributed

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to two hundred consecutive new patients at the initial visit (Figure 1). The questionnaires were worded in such a manner that the parents did not realize that information specifically regarding nursing caries was sought. Forty-four responses were discarded, due to incomplete information provided by the parent; or the inability to examine the primary maxillary incisors, due to normal exfoliation or early extraction of the teeth. The remaining patients were examined and classified as having "nursing caries" or "no nursing caries". For this classification the earlier definition of "nursing caries" was used (e.g. if a child solely had two occlusal carious lesions on their lower first primary molars the patient was classified as "No caries" for the results). The patients' ages ranged from fourteen months to eight years with a mean age of thirty-one months.

RESULTS

The data shown in Table 1 indicate that more than half of the children in the survey (56 percent) were put to bed with a bottle. Yet only 37 percent of these children that were given the bottle at bedtime developed nursing caries (Table 2).

An examination of the drinking habits of the children given the bottle at bedtime (Table 3) reveals that 70 percent discarded the bottle before falling asleep, while the remaining 30 percent fell asleep with the nipple in the mouth. Of those who discarded the bottle, only 27 percent developed nursing caries, while of those who fell asleep with the bottle, 62 percent developed nursing caries.

Table 4 reveals that most children who sleep with a bottle have milk or juice as its contents. It should be noted that some children had a combination of the liquids and not all parents answered this question.

Table 5 compares the age at which the bottle was stopped and the incidence of nursing caries. Not all parents were able to answer this question.

Table 6 compares the age at which brushing was started and the incidence of nursing caries. Again not all parents were able to answer this question.

The results in Tables 2, 3, and 4 were evaluated using a Chi-square analysis. It was determined that children given the bottle at bedtime experience significantly more cases of nursing caries than those who did not go to bed with the bottle. Also the children who fell asleep with the bottle experienced significantly more cases of nursing caries than did those who discarded the bottle before falling asleep. The evaluation of the contents of the bottle as a cause of nursing

Figure 1. Dental and dietary survey.

1. *What is the chief reason for this visit?*
2. *Has your child received dental care before? Briefly describe (at what age, reason, behavior?)*
3. *Has your child experienced any major injury to the face or teeth? When? How?*
4. *What are your child's usual snacks? How often?*
5. *Does your child brush his/her teeth? (type of paste, how often? Do you assist?)*
6. *At what age did your child start brushing his/her teeth?*
7. *Did your child ever sleep with a bottle?*

IF THE ANSWER TO #7 IS NO, DO NOT CONTINUE.
IF YES:

8. *Until what age did your child sleep with the bottle?*
9. *What liquids were in the bottle?*
10. *Which best describes your child's bottle habit?*
    a. *The child drank and finished the liquid in the bottle, and then threw the bottle away, and then fell asleep.*
    b. *The child fell asleep with the bottle in his/her mouth. Was the bottle taken away or left in the mouth for the night?*
    c. *Other*

Table 1 ☐ Incidence of children sleeping with a bottle.

		Percent of total
Number of children given bottle	88	56 percent
Number of children not given bottle	68	44 percent

Table 2 ☐ Incidence of nursing caries.

	Number with caries	Number with no caries
Children given bottle	33 (37%)	55 (63%)
Children not given bottle	0 (0%)	68 (100%)

Table 3 ☐ Children given bottle—sleeping habits.

	Incidence	With caries	With no caries
Discarded bottle before falling asleep	62 (70%)	17 (27%)	45 (73%)
Fell asleep with bottle	26 (30%)	16 (62%)	10 (38%)

Table 4 ☐ Contents of bottle.

Contents	With caries	With no caries
Milk	23 (50%)	35 (49%)
Juice	19 (41%)	31 (43%)
Formula	3 (7%)	6 (8%)
Other	1 (2%)	0 (0%)
Totals	46 (100%)	72 (100%)

Table 5 ☐ Age child stopped sleeping with bottle.

Age	With caries	With no caries
12 months	1 (6%)	3 (10%)
18 months	4 (25%)	7 (22%)
24 months	6 (38%)	10 (32%)
36 months	3 (19%)	11 (36%)
48 months	1 (6%)	0 (0%)
60 months	1 (6%)	0 (0%)

Table 6 ☐ Children who slept with bottle—age toothbrushing commenced.

Age	With caries	With no caries
12 months	3 (11%)	5 (10%)
18 months	6 (22%)	9 (18%)
24 months	7 (25%)	18 (36%)
36 months	11 (40%)	15 (30%)
48 months	1 (3%)	3 (6%)

caries revealed no significant differences between the various liquids in the bottle. A non-parametric correlation was used to evaluate the age at which the child stopped sleeping with the bottle as well as the age at which the child started brushing their teeth, and neither of these factors had a significant impact on the incidence of nursing caries.

DISCUSSION

The results obtained indicate that the predominant factor in determining whether a child who was given the bottle at bedtime developed nursing caries was the manner in which the child fell asleep. Of the children given the bottle at bedtime, those who drank the contents of the bottle, discarded the bottle, and then fell asleep, only 27 percent developed nursing caries. Those who fell asleep with the nipple in the mouth had a statistically significant greater rate of nursing caries than those who did not retain the bottle during sleep.

These results can be explained on the basis of eruption of primary teeth and the physiology of deglutition and digestion. The normal eruption pattern of the primary dentition included eruption of the maxillary and mandibular incisors by one year of age, the first primary molars and canines by the second year, and the second primary molars by the third year. With the exception of the lower incisors, the pattern and extensiveness of decay follow the eruption pattern. The earlier the appearance of the tooth into the mouth, the greater the likelihood and severity of decay. The exception of the mandibular incisors from following this pattern is due to the fact that the child's tongue covers these teeth during deglutition and sucking.[12,13]

It has been shown that:

- ☐ Decay occurs in the mouth, when a fermentable carbohydrate is broken down by bacteria with a resultant production of acid, which in turn attacks the enamel of the teeth.[14]
- ☐ The rate at which carbohydrates are cleared from the oral cavity is a determinant in caries initiation. The longer the fermentable carbohydrates and acid-producing organisms remain in the oral cavity, the greater the caries activity.[15]
- ☐ Salivary flow is decreased during sleep.[16]
- ☐ The swallow reflex is reduced during sleep.[17]

Using the above facts, one can analyze the process involved in the initiation of nursing caries. As the child lies down with the bottle, the nipple rests against the palate, while the oral musculature forces the contents

The manner in which a child falls asleep is the most important factor in whether nursing caries occurs.

of the bottle into the mouth. The tongue is extended covering the mandibular central and lateral incisors. While the child is awake, salivary secretion and swallowing allow for clearance of the fermentable carbohydrate. As the child grows drowsier, the salivary flow and swallowing rate are decreased, allowing the liquid carbohydrate to remain in the mouth and pool around the teeth. Thus the decay process is initiated. The anterior placement of the tongue protects the mandibular anterior teeth from the decay-producing solution. Combining these facts with the typical eruption sequence of the primary teeth will give the typical nursing-caries pattern.

It is the responsibility of the dentist to counsel parents to the dangers of a child sleeping with a bottle. Parents may be lulled into a false sense of security, because one child did not develop nursing caries, even though the child went to sleep with the bottle. Parents should be warned that another child with different habits may develop nursing caries.

CONCLUSIONS

A survey conducted in a private pediatric dental practice revealed the following conclusions about infant sleeping habits and the incidence of nursing caries:

- ☐ The predominant factor in determining whether a child developed nursing caries was the manner in which the child fell asleep. There was a statistically significant greater incidence of nursing caries in children who fell asleep with the contents of the bottle unfinished than in the children who finished the contents of the bottle, discarded it, and then fell asleep. Comparisons of the contents of the bottle, the age at which the child was weaned from the bottle, and the age at which toothbrushing was started did not show significant differences between those who developed nursing-bottle caries and those who did not.

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STREPTOCOCCI IN SALIVA OF CHILDREN

The results of this study, in accordance with previous publications (McCarthy *et al.*, 1965; Carlsson *et al.*, 1970a), showed streptococci to be early colonizers of the oral cavity. Streptococci were found in all study subjects whether predentate or dentate, and their total number increased with age and with eruption of teeth. This could be partly due to changes in ecology and increase in the variety of streptococcal species in the oral cavity with the introduction of hard surfaces, necessary, for instance, for the establishment of certain species such as *S. mutans*.

Tappuni, A.R. and Challacombe, S.J.: Distribution and Isolation Frequency of Eight Streptococcal Species in Saliva....
J Dent Res, 72:31-36, January 1993.

Local treatment of minor aphthous ulceration in children

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Nicole Jonesco-Benaiche, DCD

Recurrent aphthous ulcers represent the most common oral lesions to occur on the mucosa. It is estimated that approximately 5 to 21 percent of children, four to fourteen years of age, experience these lesions.[1,2] Aphthous ulcers are divided into two groups: major (MAU) and minor (mAU) according to the size, depth and duration of the lesion. mAU (canker sores) are confined to the superficial layers of the nonkeratinized oral mucosa, namely the buccal mucosa, buccal and labial vestibules, margins of the tongue, and floor of the mouth. They present as round or ovoid erosive ulcers ranging from 2 to 10 mm in diameter, which occur singly or in groups of two to five.[3] They generally are preceded by a prodrome of burning and tingling at the site.[4] The ulcers are well circumscribed, covered by a grayish membrane and surrounded by an erythematous halo.[5] The lesions are painful, making eating and speaking difficult. They usually heal without scarring in seven to fourteen days. MAU is a more severe form, accounting for only 10 percent of recurrent aphthous oral ulcerations. They usually present as one to ten ulcers, exceeding 10 mm in diameter. They occur on the same sites as mAU, but also on the soft palate and the pharynx, causing necrosis of the deeper muscular or glandular layers. They may persist up to six weeks and usually leave scars on healing. MAU have similar clinical features to those of mAU and children presenting with this condition suffer from severe discomfort, when eating or speaking. Dysphagia and facial edema may be associated.[6] In both forms recurrence usually occurs every one to four months. It generally decreases with age.

The etiology of recurrent aphthous ulceration is still controversial. It is related to exogenous causes, such as trauma; or to endogenous causes, such as neutrophil dysfunction; immunologic factors, both cellular and humoral; hereditary predisposition; or deficiency disorders.[7-10]

Numerous systemic and topical treatments have been proposed; none is, however, definitive. Systemic treatment is used to treat or to prevent recurrences.[11] Meanwhile topical treatment is used to improve the clinical condition and to relieve pain.[12-14] In pediatric dentistry, we deal mostly with MAU, a pain producing oral lesion. Pain in aphthous ulceration lasts from eighteen hours to three days, resulting mainly from secondary infection. Isolating the ulcers from the oral environment is the best way to prevent secondary infection, restore the epithelium, reduce the healing time, and provide symptomatic relief.

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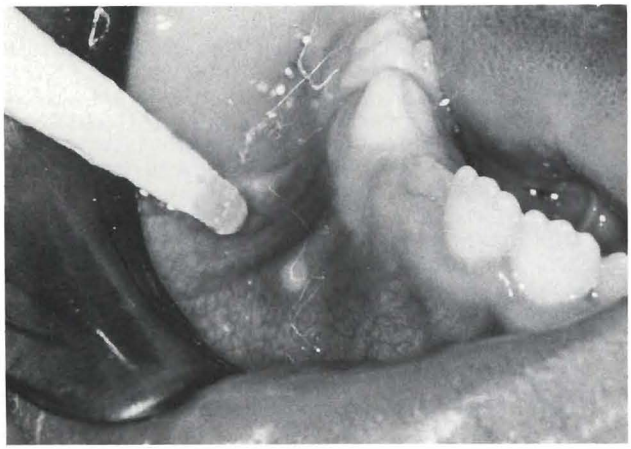

Figure 1. mAU J = O. A drop of cyanoacrylate adhesive is poured in the mAU.

Figure 2. One week later. Healing is achieved.

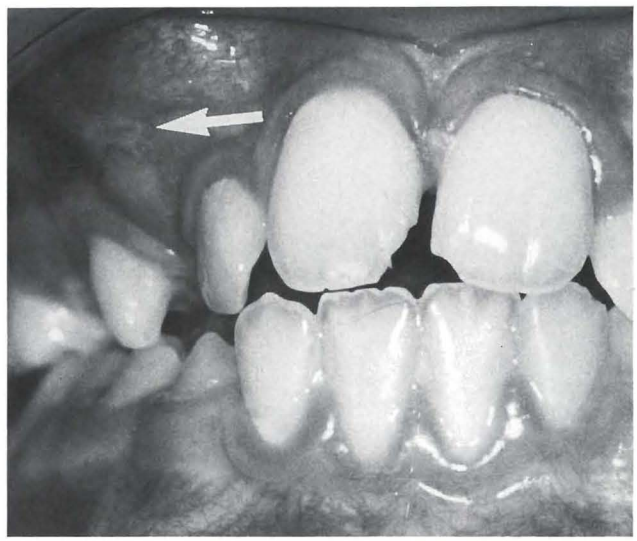

Figure 3. J = O.

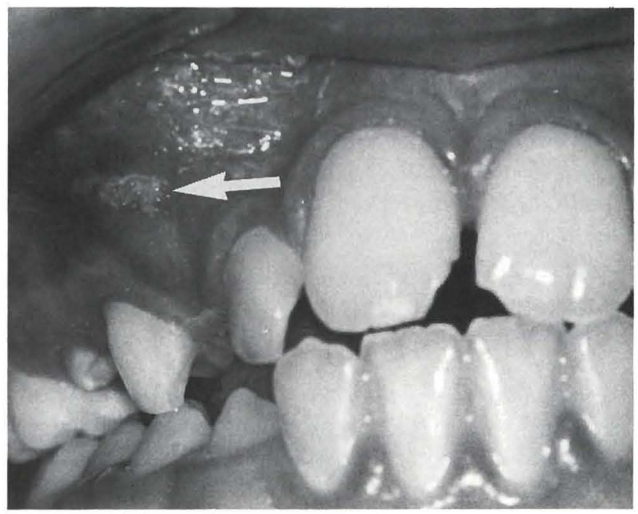

Figure 4. The surgical glue hardened. The ulcer is isolated from oral environment.

Conventional treatment includes tetracycline mouthwash, topical corticosteroids, which are effective when used at the onset of the prodromal stage; or an adhesive topical preparation (Kenalog in Orabase), which needs to be replaced four to five times daily, since adhesive time is short[6] None of these treatments relieves pain quickly. A few years ago, we introduced in the Department of Pediatric Dentistry of Lenval's Children's Hospital a cyanoacrylate adhesive to treat mAU. This material*, a surgical glue, covers the aphthous ulcers and relieves pain within two to five minutes. This glue is available in a tube, which permits applying drops of cyanoacrylate in a precise place. To prevent displacement, it should be placed on the aphthous ulcer, after gently washing the lesion and adjoining tissue with distilled water and gently air-drying (Figures 1 and 2). The ability of cyanoacrylate to harden within seconds, and its well-known adhesive properties make isolation of the ulcer from the oral environment possible, thus preventing secondary infection. Pain and discomfort disappear within two to five minutes, allowing the patient to eat and drink normally. The healing time is reduced to five to seven days (Figures 3,4,5).

*Surgical Aron Alpha S-2. Cyanoacrylate adhesive, Toagosei Chemical Industry Co Ltd.

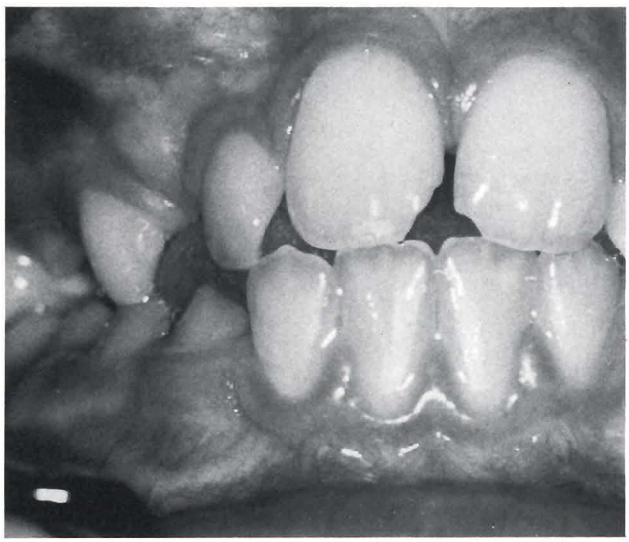

Figure 5. A week later. No more clinical evidence of the ulcer.

Widespread use of isobutyl cyanoacrylate as an adhesive in surgery(injured kidneys, vascular defects, skin grafts) and in dentistry (free mucosal graft) has been reported.[15] Cyanoacrylate was found to be biocompatible and hemostatic.[16] Thus, using a cyanoacrylate to isolate mAU from the oral environment is an effective and inexpensive way to relieve pain and discomfort within seconds.

SUMMARY

Pain is commonly associated with minor aphthous ulceration in children. It results mostly from secondary infection and lasts from eighteen hours to three days. The use of a cyanoacrylate adhesive provides a symptomatic relief within minutes and shortens the healing time.

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ACQUISITION OF MUTANS STREPTOCOCCI

In this study, the acquisition of mutans streptococci (MS) was monitored in "high-risk" infants. The designation of high risk was based primarily on elevated levels of MS in the saliva of mothers; these samples fell within the upper quartile (27%) of the saliva from over 260 mothers who met initial eligibility criteria and from whom multiple saliva samples were obtained. Children of mothers having high levels of MS are more likely to exhibit levels of MS corresponding to their mothers' levels (van Houte *et al.*, 1981; Kohler *et al.*, 1984; Caufield *et al.*, 1988), and often experience a higher caries incidence (Kohler *et al.*, 1984).

Caufield, P.W. *et al:* Initial acquisition of mutans streptococci by infants: Evidence of a discrete window of infectivity.
J Dent Res, 72:37-45, January 1993.

Impaction and malformation of a maxillary central incisor: Sequelae of trauma

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Trauma to primary incisors may cause structural defects in the developing succedaneous teeth or affect their positions.[1] Epidemiological studies reveal that up to a third of children younger than seven years of age sustain injury to the primary incisors.[2] Disturbances of tooth development and eruption of succedaneous teeth secondary to dental injuries in the primary dentition range from 12 to 69 percent.[3]

A study by Garcia-Godoy *et al* revealed:

- ☐ The most common trauma to the primary teeth was concussion.
- ☐ One-to-two-year olds presented the highest number of injuries.
- ☐ Falling against an object was the most common cause of injury.
- ☐ Most of the injuries occurred in the home.[4]

Trauma sustained at an early age may cause malformation of the permanent successor, which can be manifested in many ways.

Ravn studied the frequency and type of developmental disturbances of permanent teeth after avulsion of their primary predecessors. The study revealed that the central incisor was the most frequently involved tooth. The highest frequency of disturbance was in the birth-to-two-year age-group (94.5 percent). The more serious disturbances, including external enamel hypoplasia and crown or root malformation, occurred most frequently when the injury occurred at less than three years of age.[5] The age at the time of injury was of major importance, with fewer complications seen in individuals over four years of age.[3]

The primary maxillary central incisor root is completed at eighteen months. The permanent maxillary central incisor begins its hard tissue formation at three to four months with completion of enamel at four to five years of age.[6] Any trauma during the stages of ameloblastic development can seriously disturb the enamel formation of the developing tooth.[3] The anatomic manifestations of injury to the permanent tooth bud may include one or more of the following: white or yellow-brown discoloration with or without horizontal enamel hypoplasia crown dilaceration, odontoma-like malformation, root duplication, vestibular root angulation, lateral root angulation or dilaceration, partial or complete arrest of root formation, sequestration of entire tooth germ, and ectopic, premature, or delayed eruption or impaction.[2,3] The close anatomic relationship between the apices of primary teeth and their developing permanent successors explains why injuries to primary teeth may involve the permanent dentition.[3,6]

The extent of malformation of a permanent incisor

The opinions contained in this article are the private views of the authors and are not to be construed as official or reflecting the views of the Department of the U.S. Army or the U.S. Army Dental Corps.

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depends on the developmental stage of the permanent tooth, force of impact, and direction of the traumatic forces on the primary incisor.[1,2] When a force is applied to the lingual surface of a primary maxillary incisor crown, the root of the primary incisor is moved in a palatal direction thereby causing trauma to the developing permanent tooth. In cases where a force is applied to the labial surface of a primary maxillary central incisor crown, the root will move labially away from the permanent tooth. Therefore with a force applied to the labial surface, less chance exists for a disturbance to the permanent tooth.[5] Stewart reported a number of cases in which he described a phenomenon called the ectopic development of the tooth germ. He observed that some teeth developed with the tooth germs in ectopic positions. The roots of these teeth lay with the apices backwards, close to the palatal vault. The root of a maxillary permanent incisor was molded to conform to the palatal curvature which formed a developmental dilaceration. He concluded that the dilaceration of these teeth was a developmental anomaly, not due to trauma.[7] Early trauma, however, can never be excluded with certainty.

CASE REPORT

A ten-year-old Caucasian male was referred to the pediatric dental service for a dental examination. The chief complaint was concern about an unerupted front tooth, which had resulted in an unesthetic appearance. The medical history was noncontributory. His dental history revealed trauma to the maxillary left primary central incisor at the age of sixteen months. His mother reported the patient had fallen against a bedpost and the maxillary left primary central incisor was avulsed. The parents stated that the dentist was concerned that there were no root fragments remaining. The parents did not recall if any information was given concerning the possible injury to the permanent successor.

A subsequent routine examination with radiographs was performed at the age of four. The parents remembered being informed that the permanent maxillary left central incisor would be slow to erupt and might be discolored. Reexamination of the maxillary occlusal radiograph showed the development of the maxillary left central incisor to have been in Nolla's stage 4 with a questionable crown malformation (Figure 1).

Further review of the dental history revealed that annual routine examinations followed. Bite-wings, panorex, and maxillary occlusal radiographs were taken at eight years of age. The parents were concerned about the missing left maxillary central incisor since the right maxillary central incisor had erupted at the age of six. The treating dentist counselled the parents to wait and watch. The maxillary occlusal radiograph revealed the maxillary right central incisor at Nolla's stage 7, with the maxillary left central incisor showing apparent crown malformation and onset of distal root angulation (Figure 2).

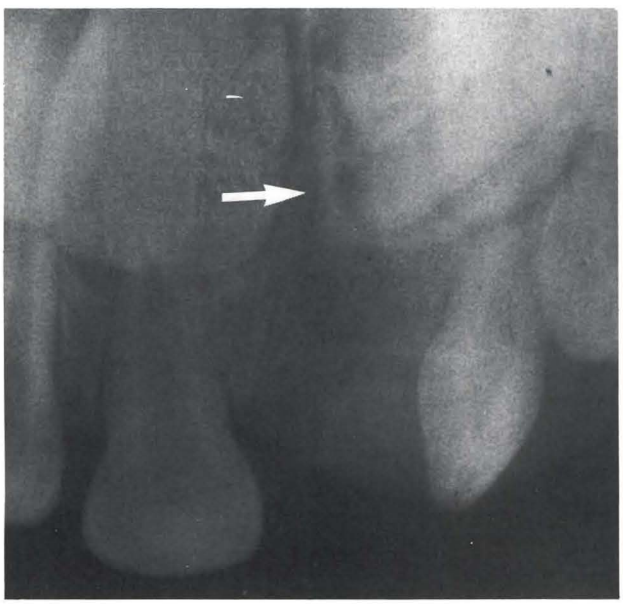

Figure 1. Maxillary left central incisor in Nolla's stage 4; notice questionable crown malformation.

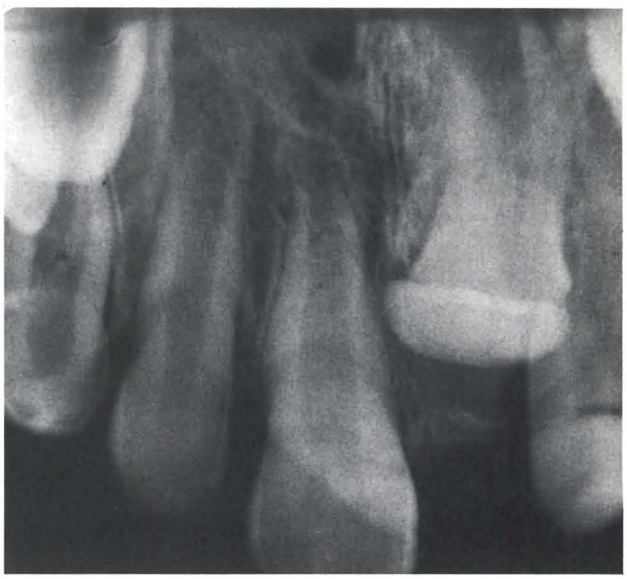

Figure 2. Maxillary left central incisor showing apparent crown malformation and onset of distal root angulation.

At ten years of age, the patient was referred to the pediatric dental service for treatment. A comprehensive examination was performed with bite-wings, periapical films of the maxillary left central incisor area, and maxillary first and mandibular second primary molars. The oral examination revealed: permanent molars in an end-on relationship; left canine, Class II; right canine, Class I; overbite, 90 percent; overjet, 2 mm; maxillary midline shift to the left, with only 4 mm of space between the maxillary right central incisor and the maxillary left lateral incisor; no crossbite/habit; maxillary first and mandibular second primary molars were ankylosed. Radiographs revealed the maxillary right permanent canine to be erupting under the maxillary right first primary molar with no root resorption of the maxillary right primary canine. A periapical radiograph of the maxillary left central incisor area confirmed an impacted maxillary left permanent central incisor with the absence of the periodontal ligament space along the mesial aspect of the root. The tooth exhibited crown malformation and mesial vestibular root angulation. The maxillary left central incisor was in Nolla's stage 9. Its antimere, the maxillary right central incisor, was in Nolla's stage 10 (Figure 3).

Treatment

A treatment plan consisting of correction of the end-on molar relationship with cervical pull headgear was proposed. The ankylosed teeth and the maxillary right primary canine were extracted. Orthodontic procedures were initiated to correct the midline deviation and provide space for orthodontic alignment or an esthetic replacement for the impacted maxillary left central incisor.

After three months of minor tooth movement, adequate space was achieved and surgical exposure was performed. A presurgical radiograph revealed the permanent maxillary left central incisor to have complete root formation. Upon exposure, the impacted central incisor appeared hypoplastic with hypocalcific changes. The incisal one third of the crown had a ninety-degree palatal dilaceration. The exposed labial surface of the tooth was resistant to etchant for bonding of an orthodontic bracket. A hole was prepared, therefore, in the incisal area with a small round bur. Two ligature wires were inserted through the hole. One ligature wire attached directly to the archwire. A power chain was inserted on the other ligature wire and attached to the archwire. This attachment provided the extrusive force necessary for movement of the tooth.

Figure 3. Maxillary left central incisor depicting definite crown malformation and mesial vestibular root angulation.

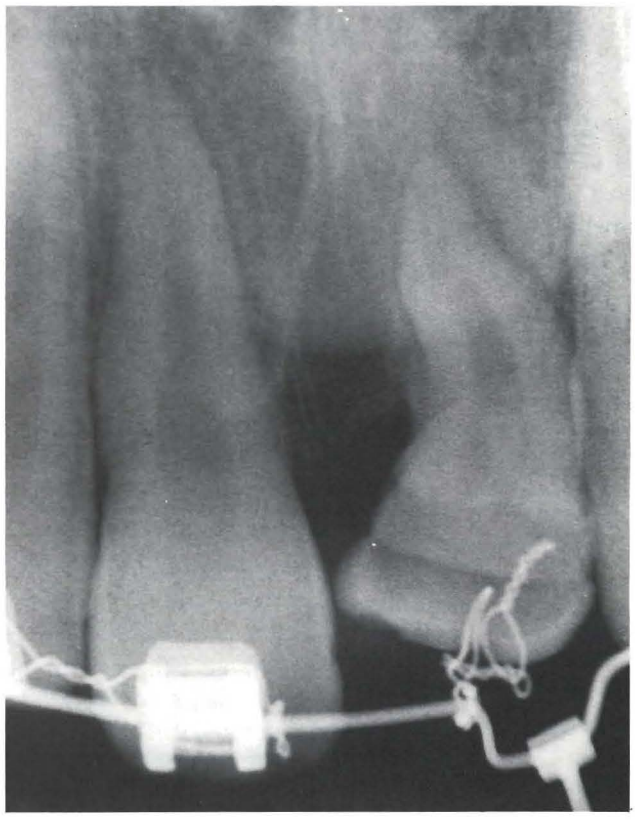

Figure 4. Complete root formation and questionable periodontal support of the maxillary left central incisor.

At the time of this writing orthodontic forces were applied for five months. The impacted central incisor had moved approximately 5 mm. A third of crown's incisal edge was visible. The exposed portion was hypoplastic and dilacerated. A periapical radiograph revealed the tooth had completed it's root formation and periodontal support was questionable (Figure 4). The parents were informed that restoration of the tooth depended on the tooth's periodontal support, soundness of tooth structure, and the location of the pulp upon preparation of the tooth if a crown was to be fabricated. Interdisciplinary consultation with the departments of periodontics, prosthodontics and endodontics would determine the final outcome of this tooth.

DISCUSSION

This patient demonstrated the severe consequences that may result secondary to trauma sustained at a young age. Sequential radiographs depicted the developing deformation in a stepwise fashion. An area that had a history of trauma should be observed carefully and the parent should be informed of the possible sequelae. When a maxillary incisor is impacted, every effort should be made to regain the space and orthodontically align the tooth in its correct location. If the root or crown deformation of the impacted tooth is severe, extraction of the affected tooth is indicated.[8] Surgical procedures should be performed when the least chance of injury to the developing adjacent teeth would result. Space should be maintained until final prosthodontic restoration is possible.

This case exemplified some of the factors consistent with early trauma to the primary dentition:

- ☐ An injury occurring at home.
- ☐ A child less than three years old.
- ☐ A fall against an object.
- ☐ A central incisor was affected.
- ☐ A serious malformation occurred as a sequela of early trauma.[4,5]

CONCLUSION

When an injury to a maxillary primary central incisor occurs at a young age, severe, deleterious malformation may occur during formation of the maxillary permanent central incisor. Appropriate radiographs and a thorough history are necessary components for diagnosis, treatment, and follow-up care. Informing the parent of the possible sequelae to the permanent successor is a vital part of the treatment, The patient should have follow-up appointments and appropriate periodic radiographs of the traumatized area. The final result of the trauma may take years to evolve.

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MUTANS STREPTOCOCCI ARE ACQUIRED AT AROUND TWO YEARS

The fact that most teenagers and adults eventually acquired mutans streptococci (MS) (Klock and Krasse, 1977), at least according to cross-setional surveys, indicates that transmission occurs readily in human populations; our data suggest that children acquire MS at around two years of age. Several studies indicate that the mutans streptococci are transmitted vertically, along familial lines, from mother to child (Berkowitz and Jordan, 1975; Caufield *et al.*, 1982, 1988; Davey and Rogers, 1984; Masuda *et al.*, 1985; Caufield and Walker, 1989; Hagan *et al.*, 1989; Kulkarni *et al.*, 1989). Intuitively, a mother colonized by MS, and who often has the most contact with the child in terms of feeding and caring for the child, would also be the most logical source of transmitting MS to the child.

Caufield, P.W. *et al:* Initial acquisition of mutans streptococci by infants: Evidence of a discrete window of infectivity.
J Dent Res, 72:37-45, January 1993.

PREVENTION

Parental education leads to preventive dental treatment for patients under the age of four

Howard S. Schneider, AB, DDS, MSD

The results of a 1987 survey by the American Dental Association indicated that there are 140,000 dentists practicing in the United States. Of that total, 88 percent are in private practice. Dental specialists number 19,847, with some 2,700 of these specializing in pediatric dentistry. Only 1.9 percent of this country's dental manpower, therefore, devote their attention toward caring for the 10 million children under the age of four years who could benefit from early dental examination and care.

Treatment of the child under four years promotes sound health habits. Thus, this investigator believes that a child should have a dental examination as soon as the primary central and lateral incisors have erupted, or no later than twelve months of age.

The purpose of this paper is to review the records of a twenty-three-year practice, during which dentistry for children under the age of four years was promoted; and, to determine whether this practice has increased the percentage of children seen at a younger age.

Current dental literature divides infant care into three categories:

- ☐ Protocol for early dental treatment.
- ☐ Prevention.
- ☐ Specific dental problems.

An infant should be examined soon after eruption of the first primary tooth. T.P. Croll denounces the "three-year myth" that a child should be seen for the first dental visit after the eruption of all primary teeth, since management may be a significantly greater problem at that time than at an earlier age.[1,2] The initial visit should occur before the age of two, and a system of dental care for children to be followed by parents can be outlined and emphasized.[3,4]

A protocol for preventive procedures to begin early in infancy will include the use of fluoride and instruction in proper home dental care.[5-7] Some pediatric dental care programs recommend fluoride supplements soon after birth, or offer schedules of fluoride supplements for infants and young children.[9,10]

Richardson *et al* emphasize infant feeding practices that will prevent caries; specific feeding guides are available, furthermore, to help prevent decay in the infant's teeth.[11,12]

Crossbite correction in the infant is described by Croll *et al* they also suggest management strategies for traumatized primary anterior teeth.[13-17] Many of these problems are associated with thumbsucking.[18,19] Current dental texts now include chapters on infant care.[20,21]

MATERIALS AND METHOD

Three years after this investigator began practice, a check of 1,675 patient records for the period 1966-1969 revealed that 185, or 12 percent of children seen for initial appointments were under four years of age (Table 1, Group A).

A preventive dental program for children under four years of age was established, to learn whether we could

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Table 1 ☐ Reasons for examination of patients under the age of four years.

	Group A 1966–1969	
Injuries	96	51.89%
Preventive services	47	25.41
Dental caries	31	16.76
Other: Soft tissue	9	4.86
Other: Orthodontics	2	1.08
Total	185	100.00%

Table 2 ☐ Reasons for examination of patients under the age of four years.

	Group B 1970–1971	
Injuries	71	39.45%
Preventive services	58	32.26
Dental caries	42	23.33
Other: Soft tissue	7	3.89
Other: Orthodontics	2	1.11
Total	180	100.00%

encourage parents to bring more children under four years of age to the dentist.

The following questions were considered: Would parents accept the recommendation of an oral examination for their child under the age of four years for a preventive service? And, in promoting dentistry for the young child, would this change the reason he/she was seen for an initial appointment in this investigator's pediatric practice?

A "reception room inspection" was made of the child under the age of four who had accompanied an older sibling being treated. This inspection consisted of seating the child on the dentist's lap in the reception room and performing a visual examination with a pen light while casually questioning the parent as to the child's eating habits, use of the nursing bottle, and toothbrushing habits. The parents were informed that the child should be examined and have fluoride applied to his teeth. Emphasis was placed on the need to prevent dental caries in the younger child's teeth, which may not have been the good fortune of the older sibling. An observation was made regarding the degree of decay between the younger child in the family compared to the older sibling now a patient in the practice.

After evaluating the child, a preventive dental program was outlined, including the following steps:

- ☐ The child to be examined as soon as the primary central and lateral incisors are erupted, or not later than twelve months of age. This would be a visual examination and radiographs would be limited to an occlusal film of the anterior segment of the maxillary and mandibular arches as needed.
- ☐ A cleaning would be performed and fluoride applied.
- ☐ A recommended home-care program stresses a balanced diet and explains how to brush the child's teeth. The parent would be instructed to eliminate the bottle by the time the primary central and lateral incisors have erupted.
- ☐ Necessary restorative procedures including amalgam restorations, stainless crowns, pulp therapy, and space maintenance will be performed.
- ☐ The child is scheduled for a six-month recall examination, cleaning and fluoride, with necessary radiographs, until finally, at age three, a complete radiographic survey is to be performed.

In 1971 office records were again reviewed and a comparison made between the initial period of practice (1966-1969) and the period 1969-1971, after the start of the preventive program for children under four years of age.* At this time, 941 patients were seen, of whom 180, or 20 percent, were under the age of four at the initial visit (Table 2, Group B). Reasons for visits were identified.

Records for 10,324 patients were examined for the period 1980-1988, and 2,617, or 26 percent, were under the age of four at the time of the first visit. Reasons for visits were noted.

RESULTS

A review of the records for patients in Group A (N = 185) revealed the following reasons for dental visits: injuries, 51 (89 percent); preventive services, 47 (25.41 percent); soft tissue lesions, 9 (4.86 percent); and orthodontics, 2 (1.08 percent) (Table 1).

Parents of Group 8 patients (N = 180) indicated their reasons for seeking dental care for the child as: injuries, 71 (39.45 percent); preventive services, 58 (32.26 percent); dental caries, 42 (23.33 percent); soft tissue lesions, 7 (3.89 percent); and orthodontics, 2 (1.11 percent) (Table 2).

Review of the records for Group C (N = 2,617) listed their reasons for dental visits for the child under four

*Schneider, H.S. (1971): *Prevention is the best treatment in examination of children three years or younger.* Paper presented at the annual meeting of the American Academy of Pediatric Dentistry, Dallas, TX.

Table 3 ☐ Reasons for examination of patients under the age of four years.

	Group C 1980–1988	
Injuries	274	10.50%
Preventive services	1807	69.00
Dental caries	361	13.80
Other	175	6.70
Total	2617	100.00%

Parents learned about the advantages of preventive treatment.

years as: preventive services, 1,807 (69 percent); dental caries, 361 (13.8 percent); injuries, 274 (10.5 percent); and "other", 175 (6.7 percent) (Table 3).

A sample of 100 records from the 10,324 records available were subject to an 8 percent +/-error rate, with a 95 percent probability factor. The findings were recorded by "nondental" personnel.

Prevention was the leading reason for patient visits in Group C. Comparison with Group B shows a 36.74 percent increase for prevention from the period 1970-1971. Decay as a reason occurred more frequently than injury for Group C, when compared to either Group A or Group B, where injury led decay as a reason for a dental visit. The number of patients in the smallest category of "other" conditions trailed consistently behind prevention and injury as reasons for seeing the dentist. Stained or "dark" teeth were an important reason for parents seeking dental advice in the "other" category, despite the fact that the problem may have been due to a fall or other injury. Herpes virus was the next most common reason in the "other" category prompting the parent to seek dental treatment for the child.

Table 4 shows the breakdown by age for Group C patients. Medicaid patients were identified, although dental exams were the same as for private patients. It appears that most children initially visited the dentist at the age of three, with prevention as the main reason. The 3.5-year age-bracket has few children in it, and there are not many visits before the age of one year. There is an even distribution of initial patient visits from one year of age through 2.5 years. The largest category of injuries occurred in the 2-year-old bracket, which coincides with the growth pattern of learning-to-walk at this age.

DISCUSSION

Analysis of patient records from the time spans of 1966-1969, 1970-1971, and 1980-1988 indicate an increase in the number of patients scheduled for preventive treatment. Children under the age of four now account for 69 percent of the patient pool seen for prevention. This increase is attributed to active promotion of preventive dentistry to parents with an older child already a patient in the practice.

The education of parents about the advantages of preventive treatment has alerted them to the fact that children need early treatment. Thus a substantial re-

Table 4 ☐ Group C: Total new patients under four years of age seen 1980–1988.

										Reason seen				Classification	
(age)	80	81	82	83	84	85	86	87	88	PRV	FRC	CAR	OTR	PR	MCD
< 1 yr	2	7	6	14	8	4	7	0	4	21	5	26	–	39	13
1 yr	16	30	27	50	20	29	16	12	31	146	33	29	23	150	81
1½ yrs	24	30	41	25	41	29	31	39	27	189	27	24	47	194	93
2 yrs	80	69	95	87	81	48	61	64	73	444	154	40	30	421	247
2½ yrs	32	36	28	7	17	21	17	15	12	113	9	22	41	136	49
3 yrs	118	156	174	174	106	89	99	96	109	857	42	190	32	621	500
3½ yrs	13	11	18	7	8	3	0	10	3	37	4	30	2	58	15
TOTAL	285	339	389	374	281	223	231	236	259	1807	274	361	175	1619	998

PRV = Prevention FRC = Fracture CAR = Carious OTR = Other PR = Private patient MCD = Medicaid recipient

duction in dental caries has been observed in my dental practice for children treated before the age of four. Many sugar-water bottles and sugar coated pacifiers were removed from children who would have been their victims. More dental caries was seen in the medicaid patient of this age-group than in the private patients (Table 4). In general, parents comply with instructions for home dental care measures, when they are indoctrinated in the benefits of good oral-health care for very young children.

During the early years of this practice, it was noted that few parents asked at what age the younger sibling should be seen by the dentist. They were under the impression that the child should be examined between the ages of three and five years, or when a specific problem presented itself. Before 1971, few articles were published relating to oral treatment of children under the age of four years. Dental literature usually presented descriptions of specific diseases, in particular case histories.

Since 1971, there has been a change in the educational approach to the treatment of the patient under the age of four. Many schools have opened "infant" clinics where young children are examined and treated. As seen in the literature review, texts and numerous articles have appeared on this subject. The American Dental Association, American Society of Dentistry for Children, and American Academy of Pediatric Dentistry have each promoted the need for dentistry for this young age group.

CONCLUSION

Records show that this investigator has been able to increase the number of patients seen for preventive services from 32.26 percent in 1971 to 69 percent in the 1980-1988 period. Whether this trend prevails in other pediatric dental offices or in the general practice of dentistry is a subject for future inquiry. When this investigator asked dentists their opinions on treatment of the child under the age of four, the main objection centered on the difficulty of behavior management in this age-group. There were isolated reports of dentists who did not believe in restoring primary teeth. Furthermore, there were divergent methods of treatment for accidents and pulp maintenance. Although dentists are now treating children at an earlier age, relatively few are examining infants except for pediatric dentists. Yet figures indicate that one can build a preventive dental practice with patients under the age of four years.

An important factor, which may alter the concept of dentistry for patients under four years, is the role played now and in the future by the insurance industry. Many insurance plans dictate that the person seeking dental treatment be examined first by a "primary" dentist. The role of the pediatric dentist has been totally eliminated from such plans, and in many cases the child patient is referred to the pediatric dentist, only if the child cannot be treated by the primary dentist. Unless the referring dentist believes in a preventive approach for this age-group, the child is not referred to the specialist. Most insurance companies have limited benefits available for treating the young dental patient. If the insurance company was really concerned with patient dental care, every effort would be made to promote preventive dentistry from birth and to rear a "decay-free" generation. Ultimately, the responsibility to accept this concept and promote dentistry at a young age lies with the membership of the dental profession itself. It is the belief of this investigator that awareness leads to preventive treatment. Prevention is the best treatment, and the public wants it and will accept.

Shades of 1927. There are still dentists who do not believe in restoring the primary teeth.

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MISBEHAVIOR AS A NORMAL CHARACTERISTIC OF DEVELOPMENT

It is vital that parents focus on their attitude toward discipline before settling issues of technique. They need to see misbehavior as normal, the medium through which children learn self-control and social mastery, and they must develop a positive, assertive attitude toward the process of disciplining. Punishment can still be employed with the same positive attitude, but for this to happen, it is the child who must feel the urgency and wrestle with the problem of self-control. When the parent has an appropriate mind-set, the consequences follow the behavior in a mechanical fashion. When the child chooses to behave in certain ways, he also chooses certain consequences. In a sense, the child punishes himself; the parent simply walks away. When you can approach problems this way, the fun goes out of misbehavior.

Williamson, P.: *Good kids, bad behavior.*
New York: Simon Schuster, 1990, p 98.

DEMOGRAPHICS

Problems your pediatric patients may face

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

There is no such thing as a typical family – that was the title of an earlier presentation in the Journal of Dentistry for Children.[1] The conclusion of the report was that the dramatic developments in the structure and composition of U.S. households demand equally significant changes in dental practices.

"The proportion of children under 18 living with only one parent has doubled in the past two decades, from 12 percent to 25 percent."[2]

"In part because of the continuing rise in out-of-wedlock childbearing, more than half of all children are likely to experience a period of living with a single parent during the 1990s, usually in reduced economic circumstances."[3]

"The many practice procedures that have been geared to the 'traditional family' arrangements (from financial collections to home care and appointment schedules) will undergo transformation, if a successful (or beginning) family practice is to prosper in the 1990s and beyond."[4]

But the successful practitioner (in particular the pediatric dentist) will need to be concerned with more than "just" the numeric availability of one or two parents, the increasing involvement of women in the workforce and the great number of children being reared in conditions of poverty or near poverty. Increasingly, pediatric practitioners will need to consider the very nature of the environment within which their patients are reared, the effects upon the children and the impact on patient services. Available federal agency reports now detail the extent of 1) family disintegrations, 2) maltreatment of children, 3) substance abuse by children, and 4) the use of mental health services. These reports and other sources can provide practitioners with some idea of the magnitude of the problems that can and do affect their patients.

"Each year since 1972, over one million children have seen their parents divorced."[5]

"Overall, 18.1 percent of adults said that they lived with an alcoholic at sometime during their childhood."[6]

"In outpatient (mental health) programs, children and youth accounted for a larger percentage of the caseload ... than those aged 18-24 and those aged 65 and over ..."[7]

SINGLE PARENT SETTING

In 1990, 15.9 million children (25 percent of all children) were living with one parent. Of particular significance were the major differences by race and ethnicity in the percent of children living in single parent setting – 19.2 percent of white children, 54.8 percent of black children, and 30 percent of Hispanic children (Table 1). (Note: Hispanic children may be of any race.)

DIVORCES

A continuing flood of lay and professional publications have emphasized the increased numbers of children

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Table 1 ☐ Children less than 18 years of age living with one parent by race and Hispanic origin of child: 1960, 1970, 1980, 1990.[2]

	1960	1970	1980	1990
	(All numbers in millions)			
All children	63.7	69.1	63.1	64.1
One parent families				
White				
Total	55.1	58.8	52.2	51.4
Living with one parent	3.9	5.1	7.9	9.9
Percent with one parent	7.1%	8.7%	15.1%	19.2%
Black				
Total	8.7*	9.4	9.4	10.0
Living with one parent	1.9*	2.9	4.3	5.5
Percent with one parent	21.9%*	31.8%	45.8%	54.8%
Hispanic **				
Total	na	na	5.5	7.2
Living with one parent			1.2	2.2
Percent with one parent			21.1%	30.0%

* Nonwhite
** May be of any race

Table 2 ☐ Percent distribution of children less than 18 years of age living with one percent by marital status of parents and by race and Hispanic origin of child: 1960, 1970, 1980, 1990.[2]

			White	
Marital status	1960	1970	1980	1990
Divorced	28.4%	39.1%	52.0%	49.1%
Married, spouse absent	41.1	35.7	28.4	23.9
Widowed	29.0	22.7	12.7	7.8
Never married	1.6	2.6	7.0	19.2
Total	100.0%	100.0%	100.0%	100.0%
			Black	
Marital status	1960*	1970	1980	1990
Divorced	11.9%	14.6%	25.1%	20.4%
Married, spouse absent	57.2	55.1	36.6	22.8
Widowed	21.3	16.1	9.6	5.1
Never married	9.6	14.1	28.7	51.8
Total	100.0%	100.0%	100.0%	100.0%
			Hispanic **	
Marital status	1960	1970	1980	1990
Divorced	na	na	30.6%	26.6%
Married, spouse absent			40.6	33.8
Widowed			8.9	6.9
Never married			19.8	32.6
Total	100.0%	100.0%	100.0%	100.0%

* Non white
** May be of any race

Table 3 ☐ Percent distribution of divorcing couples by number of children: 1984.[5]

Number of children	Percent of divorces
None	46.5%
1	25.5
2	19.9
3	6.1
4 or more	2.0

Note: Data are for the 31 states that participated in the divorce registration system. In 1984, these states accounted for 48 percent of the divorces in the United States.

born to unwed mothers. For example, in 1990, 1.9 million white children, 2.8 million black children and 0.7 million Hispanic children living in single parent families were born to never married parents.[2] Far less attention has been directed, however, to the problems faced by the greater numbers of children who are reared in a divorced and married-but-spouse-absent family arrangement (almost 10 million children in 1990).[2]*

Between 1960 and 1990, nationally, the percent of children living with a single parent as a result of a divorce increased from 23 percent to 39 percent. In 1990, as a result of divorce, 49 percent of white children, 20 percent of black children and 26 percent of Hispanic children were living with a single parent (Table 2).

Each year in the United States, more than one million couples divorce. In the mid-1980s, 53.5 percent of divorcing couples had at least one child under 18 years of age (Table 3). Many more children have to cope with results of family disintegration than did children in previous generations. The number of children whose parents divorced more than tripled between 1950 and the mid-1980s.

☐ Black and white couples had nearly equal family sizes at the time of divorce and were equally likely to have children.

☐ Men and women with a college education were more likely to be childless at the time of divorce than their counterparts with less education.

☐ While differences were small, divorcing couples in the Southern part of the nation were least likely to have children and divorcing couples in the Midwest and West were most likely to have children.[5]

ALCOHOLISM

"About 43 percent of U.S. adults—76 million people have been exposed to alcoholism in the family..."[6]

"Longitudinal studies suggest that children who live with an alcoholic parent are at greater risk of becoming alcoholic than are children who do not live with an alcoholic parent."[8,9]

More than 18 percent of males and 24 percent of

*The National Center for Health Statistics receives an annual count of the number of divorces and annulments granted each year in the fifty states and the District of Columbia.

females (between 18 and 44 years) reported that they lived with an alcoholic or problem drinker at some time during their childhood.** Reports of having grown up with an alcoholic were less common for 1) older populations, 2) individuals with a college education and higher incomes, and 3) black and other minority populations (Table 4).

Although there has been a decrease in the percent of youngsters between twelve and seventeen years of age who report consuming alcohol, (as well as those who reported the use of cigarettes and marijuana) in 1990, more than one quarter of fourteen-year-olds reported drinking alcohol during the past month (14 percent of fourteen-year-olds smoked cigarettes and 10 percent of sixteen-year-olds smoked marijuana) (Table 5).

The 1990 Survey of High School Behavior carried out by the Federal Centers for Disease Control reported that:

- ☐ One half of students drink
- ☐ One third smoke
- ☐ One quarter had seriously considered suicide
- ☐ Twenty percent carried weapons.[11]

It is difficult to separate a discussion of alcoholism (in both adults and children) from other forms of substance abuse. While less than 1 percent of children between twelve and seventeen years reported the use of cocaine in 1990, a note must be introduced about drug abuse by parents and the consequences for the involved children. In particular, there are the thousands of "crack babies" (with their numerous physical, psychological and learning difficulties) that now are reaching the entry levels of our school systems and the offices of dental practitioners.[10]

Table 4 ☐ Percent of adults who lived with an alcoholic or problem drinker at some time during their first 18 years of life by selected characteristics, 1988.[6]

	Age		
	18–44	45–64	65 & over
Gender			
Male	18.6%	15.7%	9.0%
Female	24.1	17.3	8.2
Education			
Less than 12 yrs	27.2	17.6	9.0
More than 12 yrs	18.1	15.5	7.6
Income			
Less than $10,000	26.0	17.4	9.2
$10,000–$24,999	24.2	16.7	8.5
$25,000–$39,999	20.8	16.2	10.1
$40,000 or more	18.5	18.3	9.7
Race			
White	22.0	17.3	8.6
Black	18.5	11.8	7.4
Other	17.0	10.9	7.7
Hispanic origin			
Hispanic	19.7	13.7	4.9
Non-Hispanic	21.5	16.7	8.6

Table 5 ☐ Use of selected substances in the past month by youths 12-17 years of age: 1974, 1985, 1990.[10]

	Percent of population		
Substance, age and gender	1974	1985	1990
Alcohol			
12-13 yrs	19%	11%	8%
14-15 yrs	32	35	26
16-17 yrs	51	46	38
12-17 yrs			
Male	39	34	25
Female	29	28	24
Cigarettes			
12-13 yrs	13	6	2
14-15 yrs	25	14	14
16-17 yrs	38	25	18
12-17 yrs			
Male	27	16	12
Female	24	15	11
Marijuana			
14-15 yrs	12	11	5
16-17 yrs	20	21	10
12-17 yrs			
Male	12	13	6
Female	11	11	4

CHILD NEGLECT AND ABUSE

A continuing series of news stories have increased lay and professional awareness of the tragedy of child neglect and abuse. Nevertheless, except for those professionals directly involved with these daily events, many practitioners may still be unaware of the extent and increasing severity of the problem. The latest U.S. Department of Justice report indicates that between 1980 and 1987, the national number of reported cases of child neglect and abuse increased by 158 percent (to more than two million cases). The number of reported cases by one thousand children increased by 160 percent (to 34 cases by 1,000 children) (Table 6).

In 1987, the greatest numbers of cases were reported in the States of California (370,633), New York (171,952), Ohio (115,929), Michigan (110,841) and Florida (109,521). These cases include instances of deprivation of necessities, minor physical injuries, sexual and emotional maltreatment. In 1986, the average age of the

**Unless otherwise specified, alcoholism data are from the 1988 National Health Interview Survey on Alcohol conducted by the National Center for Health Statistics in cooperation with the National Institute on Alcoholism and Alcohol Abuse. A total of 43,809 adults ages 18 and over were interviewed for the study with a response rate of 90 percent.[6]

perpetrator was 31.7 years; 44.1 percent were males and 55.9 percent were females.[12,13]

There were wide variations in the rate of reported cases of child neglect and abuse per one thousand children in the various states; ranging from 7.1, 16.2, and 17.8 cases per one thousand children, respectively, for the States of Pennsylvania, Hawaii, and New Mexico, to 54.5, 56.9 and 59.8 cases per one thousand children, respectively, for the States of South Dakota, Nevada and Missouri.[13] The highest rates per one thousand general population were in the Mountain and Westnorth Central states; the lowest in the Middle Atlantic and Westsouth Central states.[12]

In addition, in a 1989 Gallup Poll, 18 percent of female adults and 11 percent of male adults responded in the affirmative to the question, "Do you personally know any children you suspect had been physically or sexually abused?" And further, 10 percent of adult females and five percent of adult males reported that they had been victims of child abuse.[13]

MENTAL HEALTH

In 1986, throughout the nation approximately 1.7 million were under care in mental health programs—in inpatient, outpatient and partial care programs.† In particular, 16 thousand children (< 18 years of age) were in inpatient mental service programs, 221 thousand children used outpatient services and 17 thousand used partial care services (Table 7). Children accounted for 10 percent of all inpatients, 16 percent of outpatient populations and 13 percent of partial care facility services.[7]

†A mental health program that is a free-standing facility which offers only day or night partial care.

Table 6 ☐ Reported child neglect and abuse cases: 1980-1987.[12,13]

Year	Total number	Number per 1,000 children
	(in 000s)	
1980	785.1	13.0
1982	924.1	20.1
1984	1,155.6	27.3
1986	1,973.4	32.8
1987	2,025.2	34.0

Table 7 ☐ Use of mental health services by children: 1986.[7]

	Number of children	Number of admissions to programs
Inpatient	16,182	112,215
Outpatient	221,633	552,141
Partial care*	17,281	18,400

* A mental health program that is a free-standing facility that offers only day or night partial care.

Inpatient care:

- ☐ Private psychiatric hospitals admitted a higher percentage of children and youths to their inpatient programs than did other types of organizations (e.g. state, county and general hospitals).
- ☐ The under-18-year age-group had a longer median number of days as inpatients than other age groups (25 vs. range of 12 to 16 days). (Note: for inpatients who were discharged)

Outpatient care:

- ☐ In outpatient programs, children accounted for a larger share of the caseload (16 percent) than those age 18 to 24 (nine percent) and aged 65 and over (6 percent)..

Partial care:

- ☐ Children and youths had a fairly low under-care rate, relative to their numbers in the civilian population (27 percent 100,000).[7]

Reported cases of child abuse increased by 158 percent between 1980 and 1987.

MORE THAN "JUST" PEDIATRIC DENTAL PATIENTS

"But these children come from a good family," is probably the comment that many of us (both lay and professional) have made about most children. In very many cases we have been correct. Yet, many children have faced difficulties within their families as they grow to adulthood. The challenge faced by pediatric dental providers is to recognize these unfortunate children and take into consideration physical and emotional factors that transcend the "usual" boundaries of dental services. In addition, the mandated requirements to notify proper authorities in instances of suspected child neglect and abuse (and consequences of not fulfilling these obligations) are well known to all practitioners.

The challenges of single parent families and families at or close to levels of poverty are a reality. The emotional difficulties of divorces are not concerns "just" for the involved adults. Alcoholism and substance abuse are not problems that "just" mom and dad must face. Child neglect and abuse have been ugly secrets that have torn at the physical and emotional fabric of all-too-many developing children. The child with emotional and general mental health problems is an unfortunate outcome.

But most pediatric dentists have confronted the "obvious" cases in the course of treating children. Unfortunately, all too often the manifestations of these difficulties may be exhibited in some disguised manner. The need is for increased numbers of practitioners to develop an appreciation that these problems develop even in the "best of families"—even in the families of some pediatric practitioners. The need is to evolve treatment programs in concert with other professionals that support the youngest victims in and of our society.

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Trends in the perceived need for dental care for children: 1982-1990

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

Decreases in dental caries do not mean that children no longer need dental services"[1]

"...there will be a continuing demand by parents and guardians for high levels of dental services for children in our communities."[2]

Those were the conclusions of previous reviews by this writer of the results from National Health Interview Surveys (NHI Survey) conducted by the National Center for Health Statistics.[3]* Parents and guardians continue to identify their children's major dental needs** and resultant difficulties. The availability of recently published data through 1990 now provides an opportunity to review evolving parental perceptions over a period of time (between 1982 and 1990***) of their children's dental needs.

It is unfortunate that comparisons cannot be made to the evolving levels of dental disease and the use of dental services by children into the 1990s—particularly when parents and guardians report in 1990 that their children had a half million acute conditions**** related to dental origins. (The last national studies on the oral health of U.S. children and their use of dental services were carried out in 1986-87.)[4,5] In addition, for children less than five years of age, respondents indicated that only 58 percent of their acute conditions were treated; 16 percent were treated for children between five and seventeen years.†

SOURCE OF DATA

The NHI Surveys are based on data collected annually in a continuous nationwide survey by household interview. Each week a probability sample of the civilian noninstitutionalized population of the United States is

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*Unless otherwise specifically noted, all data, definitions, etc. in this presentation are drawn from the series of reports on the NHI Surveys.

**Generally, need is defined as a biological and psychological state of health as perceived by trained health personnel. For purposes of the National Health Interview Survey, however, need is defined in terms of the respondent's perception. A demand is associated with market behavior, which is related to consumer wants, prices for health services, prices of other goods and financial resources.

***Although the annual NHI Surveys have reviewed varying components of dental health status and use of dental services by the population for more than twenty-five years, the 1982 study report was the first presentation that included a format that permitted a review of parental and guardian perceived dental status of children.

****A condition is considered "acute" if a) it was first noticed no longer than three months before the reference date of the interview, and b) it is not a condition that is considered chronic regardless of the time of onset.

†It should be noted that, for the most part, ratio and percent data regarding dental needs of children and their associated difficulties (e.g. acute dental conditions per one hundred persons, percent of acute dental conditions treated) used in the NHI Survey reports, have relative standard errors in excess of 30 percent and should be used with extreme care. For the most part, these ratio and percent data have not been included, therefore, in the current presentation. The relative standard error of an estimate is obtained by dividing the standard error (i.e. primarily a measure of sample variation) by the estimate itself and is expressed as a percent of the estimate.

interviewed by personnel of the Bureau of the Census. The 1990 Survey interview sample was composed of 46,476 households containing 119,631 persons. The total noninterview rate was 4.5 percent; 2.7 percent was the result of respondent refusal, and the remainder was primarily the result of failure to locate an eligible respondent at home.

PRESENTATION OF DATA

The data are presented in a series of general graphs to facilitate the communication of an extensive set of estimated information that covers a lengthy reporting period. Thus it is essential that this review be used as a general guide to the trends in the public's subjective view of the evolving picture of dental health care needs for children and not as exact numeric indicators. (Readers are referred to the series of nine expansive volumes of original material covering the 1982-1990 period for more detailed information, including the determination of the statistical standard error of estimates for the wide variety of data in each of the reports.)

NUMBER OF CHILDREN

Between 1982 and 1990, there were some limited increases in the number of children in the United States, particularly in the number of younger children. There was an increase from 17.3 million to 19.1 million children less than five years of age. During the same period, there was an increase from 45.3 to 45.6 million children between five and seventeen years of age. Overall, the number of children less than eighteen years of age increased from 62.6 to 64.7 million. Thus, the general rate of decreases in the number of reported acute dental conditions and associated difficulties (reported in the following sections) are to some degree greater when considered from population rate perspective. (See previous footnote on ratio and percent data presentations in the Survey reports.)

ACUTE DENTAL CONDITIONS

By gender

Between 1982 and 1990, there was a general decrease in the number of reported acute dental conditions for males and females less than five years of age and between five and seventeen years of age. For children less than five years of age, the number of reported acute dental conditions decreased from .81 million to .34 million. For children between five and seventeen years of age, the decrease was from .65 million to .16 million. Throughout the period, more acute dental conditions were reported for females between five and seventeen years of age than their male counterparts (Figures 1 and 2).

By race

During the period under review, the number of reported acute dental conditions for white children under eighteen years of age decreased from 1.1 million to .2 million. There were minimal changes reported for black children (Figure 3).

By family income

There was a general decrease in the reported numbers of acute dental conditions for children in families with incomes below $10,000 and families with incomes of

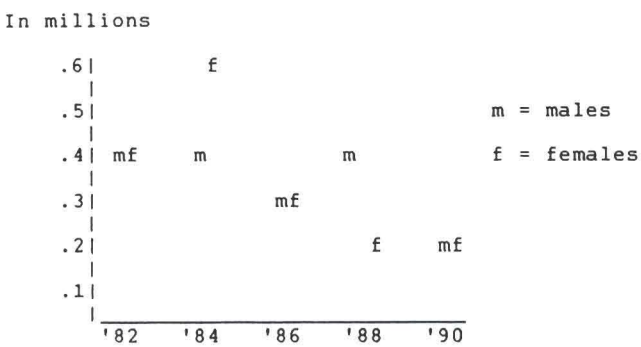

Figure 1. Acute dental conditions reported for male and females less than five years of age: 1982-1990.[3]

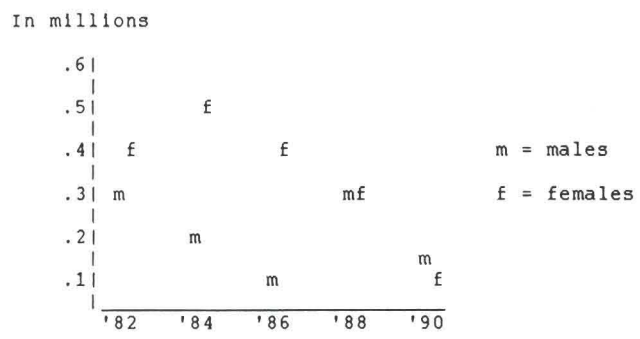

Figure 2. Acute dental conditions reported for male and females 5-17 years of age: 1982-1990.[3]

$35,000 and above, particularly for children in higher income families (Figure 4). (See discussion below on trends in perspective.)

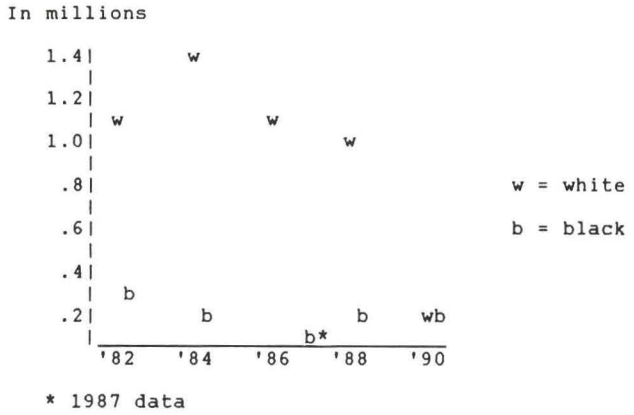

Figure 3. Acute dental conditions reported for white and black children less than 18 years of age: 1982-1990.[3]

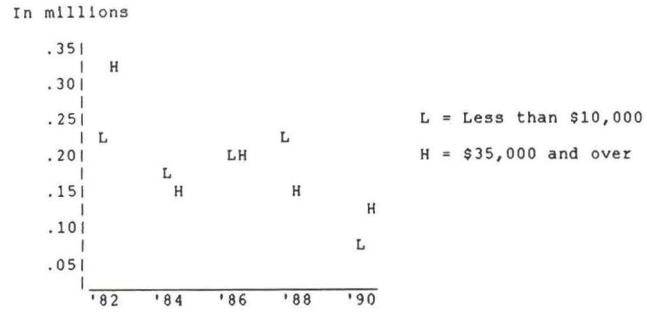

Figure 4. Acute dental conditions reported in terms of family income for children less than 18 years of age: 1982-1990.[3]

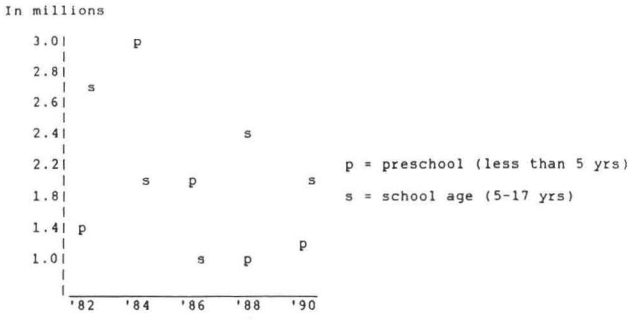

Figure 5. Restricted activity days associated with acute dental conditions reported for children less than five years and 5 to 17 years of age: 1982-1990.[3]

CONSEQUENCES OF ACUTE DENTAL CONDITIONS

Restricted activity days

Between 1982 and 1990, there were wide variations in the number of reported restricted activity days†† associated with acute dental conditions for both preschool and school age children. In every year reported (including those not specifically presented on the figures in this report) more than three million restricted activity days associated with acute dental conditions were reported, however, for children less than eighteen years of age (Figure 5).

Bed days

More than a million bed days‡ associated with acute dental conditions were reported annually for children less than eighteen years of age. There were wide variations in the reported incidence of these bed days, however, especially when the intervening years not specifically illustrated in the figures in this report were considered (Figure 6).

Lost school days

Between 1982 and 1985 the reported number of lost school days‡‡ associated with acute dental conditions

††Restricted Activity Day refers to a relatively short-term reduction in a person's activities below his or her capacity.

‡Bed Day refers to a day during which a person stayed in bed more than half of the day because of illness or injury.

‡‡Lost School Day refers to a day in which a student five to seventeen years of aged missed more than half a day from school in which (s)he was enrolled.

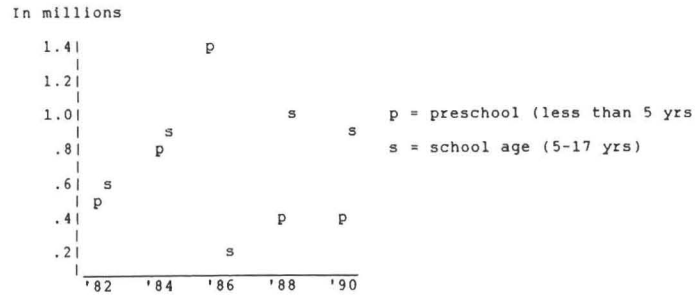

Figure 6. Bed days associated with acute dental conditions reported for children less than five years and 5 to 17 years of age: 1982-1990.[3]

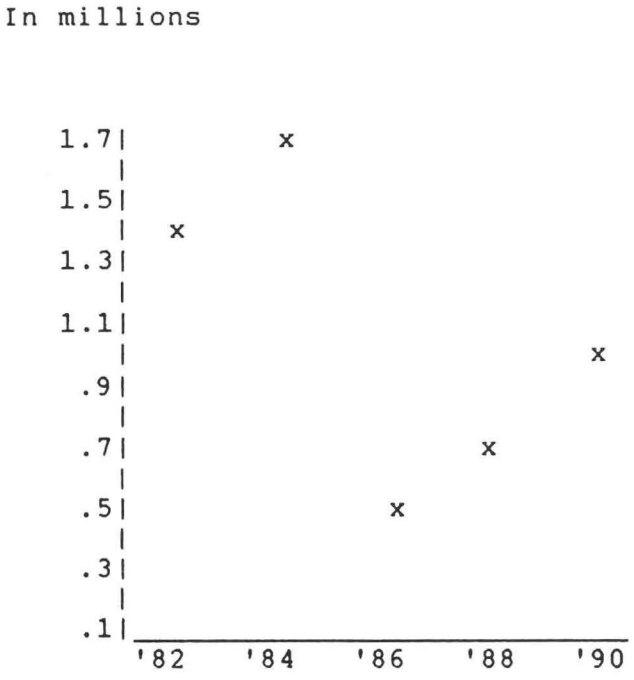

Figure 7. Lost school days associated with acute dental conditions reported for children 5-17 years of age: 1982-1990.[3]

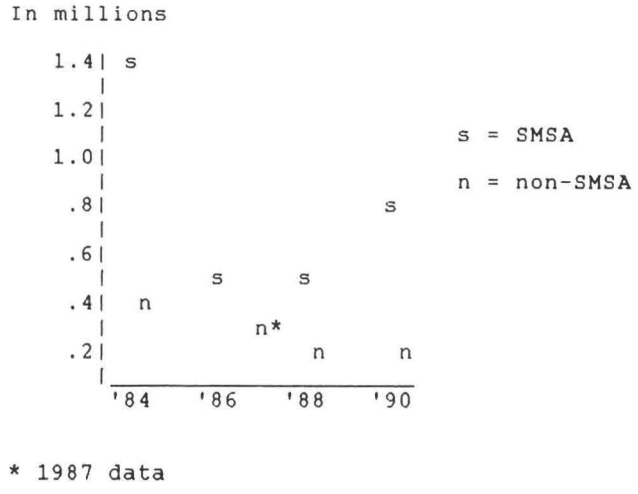

Figure 8. Lost school days associated with acute dental conditions reported for children 5-17 years of age by place of residence: 1984-1990.[3]

ranged between 1.4 and 1.8 million days. Since 1986, the number of lost school days associated with dental conditions decreased to between less than a half million and a million days (Figure 7). While the decreases in lost school days were reported in both Standard Metropolitan Statistical Areas (SMSAs) and non-SMSAs, the greatest decreases were in SMSAs (Figure 8).

TRENDS IN PERCEPTION

Do the decreases in dental caries mean that children no longer need dental health care? National data on the dental status of children (as reported by dental investigators) are not available for the period since 1986-87. Parents and guardians continue to report ongoing problems of acute dental conditions and related difficulties, however, albeit at a much reduced rate.

It should be emphasized that NHI Surveys report acute dental conditions and exclude conditions that did not include a visit to a dentist or at least resulted in one day of restricted activities. Since previous reviews have reported 1) lower use of dental services by minority families than nonminority families and 2) a direct relationships between increasing family income and use of dental services, then by definition of an acute condition (i.e. visits to dentist), NHI Surveys would tend to estimate the actual changes in perceived dental needs for nonminority families and for higher income families, while underestimating the dental conditions of minority children in lower income families.[6]

Such an analysis would tend to confirm the need for pediatric dentists to intensify efforts to provide services to underserved populations.[7] But as noted previously by this writer, such an effort would require increased public relations efforts to reach the media and government agencies.[8] Or are pediatric dentists sufficiently secure in 1) the evolving trends in the need for dental care for children and 2) the economics of practice, that such an effort is unnecessary?

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TISSUES AND CELLS

Around 400 B.C., Hippocrates likened the long, distended veins radiating from some breast tumors to the limbs of a crab, whence *karkinoma* in Greek and, later, its Latin equivalent *cancer*. But 23 centuries passed before the nature of malignant tumors could be even vaguely comprehended.

Robert Hooke's discovery in 1665 that a slice of cork viewed under the microscope is made of small compartments seeded the idea that living tissues are composed of unit building blocks that he termed cells. By 1837, Hooke's work was generalized to a theory that all living tissues are built up as aggregates of cells.

The modern realization that all living tissues follow a common building plan did little to address the origin of cells in normal and cancerous tissues. As late as the 1840s a number of German pathologists, Rudolf Virchow among them, embraced the idea that cells arise spontaneously from some shapeless extracellular substance, perhaps coagulated from circulating blood. By 1855, however, Virchow had changed his tack, generating an aphorism that was to become a cornerstone of modern biology: *"Omnis cellula a cellula"*—All cells arise from (other) cells. Cells could not arise as spontaneous aggregates of matter, but only through the growth and division of preexisting cells.

In one simple phrase, Virchow struck down a host of theories on the origin of tissues. His dictum forced a simple logic on the developmental plan of complex organisms: all the cells within a mammalian body must arise as direct descendants of a single original cell. Starting with the fertilized egg (zygote), an adult human being of more than 10^{13} cells could be assembled from the products of 45 successive rounds of cell division.

Virchow's logic meant that cancerous tumors, too, must form from cells that descend through a lineage of divisions ultimately traceable back to the zygote. Yet this insight initially provoked more questions than it resolved. How could biologists describe the cell pedigree that begins with a fertilized egg and ends with the mass of cells recognized as a tumor? More specifically, from what kinds of normal cells do tumors descend?

Varmus, H. and Weinberg, R.A.: *Genes and the biology of cancer*. New York: Scientific American Library, 1993, p 26.

REVIEW

The composite resin restoration: A literature review part I Proper cavity preparation and placement techniques

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W.R. Hollander, DDS, MSD

Composite resin restorations have recently been advocated due to their seemingly innocuous presence as a restorative material. There will no doubt be an increase in patient requests for these fillings, now that new questions have been raised concerning the safety of amalgam.

There has been much concern over the length of time that composite restorations remain intact, based on research articles that indict them due to their pulpal irritation, high occlusal wear rate, and marginal leakage because of shrinkage during polymerization.[1-8] A review of the literature will help to describe the Class II preparation and material placement techniques that may help to increase the success of these restorations.

ACID ETCHING

The first modification that separated the composite restoration from the classic amalgam filling was the introduction of acid-etching to enhance retention of acrylic restorations. This was first published by Buonocore in 1955, who related the need to treat metal surfaces with acid in order to obtain a better adhesion of paints and resin coatings.[9]

Buonocore felt that the acids help to remove surface and other contaminants from the metal, or convert the oxides to phosphate groups. Because tooth enamel had probably reacted with saliva, creating various ions, the superficial layer was thought to be quite different from the underlying enamel.

Two acids were tested: a 50 percent dilution of phosphomolybdate with 10 percent oxalic acid, and an 85 percent phosphoric acid. The phosphoric acid gave best results.

Unfortunately, this technique was not clinically applied for another fifteen years. The delay is thought to have been due to the inability to observe the etched enamel, until the creation of the scanning electron microscope in the late 1960s.[10]

Reports on the adhesion of resins to etched enamel raised hopes that a superior method of bonding composite to enamel could be achieved. Studies of dye-penetration found that although marginal leakage was still present in acid-etched teeth, only minute traces could be found at the enamel-resin interface.[11] The enamel margin, though imperfect, was intact.

PREPARATION OF THE CLASS II CAVITY

Though acid-etching helped to retain the composite restoration, modifications of the original G.V. Black cavity preparation were introduced. These sought not only to provide an increased surface area for the composite, but also to encourage the success of posterior composites by conserving tooth structure, since there was a strong correlation between the size of the restoration and clinical performance.[12] The more conservative restorations received the highest percentage of ideal scores.

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One preparation involved removing enamel only to gain access to the interproximal decay. Tunnel preparations kept the marginal ridge intact by removing the interproximal decay from an opening in the occlusal surface and then guiding the bur into the demineralized enamel just below the point of contact with the adjoining tooth.[13,14]

Another modification involved removing the marginal ridge to gain access to the decay, and extending onto the occlusal surface only enough to gain interproximal entry.[15] The failure rate of this restoration was 21.4 percent over two years, most likely due to the inadequate retention and resistance form.[15,16]

Cavosurface Beveling

One of the first reported methods of beveling the enamel margin occurred when a dentist decided to prevent a "prismless" etch after an anterior restoration had failed shortly after its placement.[17] The practitioner reduced the enamel surface by a fraction of a millimeter for a distance of 3 mm beyond the fracture line, and subsequently had a successful result. Modified preparations with a slightly beveled cavosurface were reporting retained composite restorations for up to thirty six months after placement, due to the elimination of the butt-joint.[18]

Scientific papers presented studies on the extent of beveling necessary to retain a composite restoration, and showed a correlation between enamel reduction and the covering of the bond site with residual composite after fracture.[19] As little as one tenth of a millimeter in enamel surface reduction could significantly increase the shear strength of the resin-enamel bond.[20]

The extent of fractured enamel next to the bevel was also examined, since it was felt that this could lead to possible marginal discoloration or leakage.[20] Three varieties of cavosurface margins in class V preparations were examined in extracted teeth: unbeveled, a slight bevel of 0.25 to 0.50 micron, or a moderate bevel of 0.50 to 1 micron-wide surface.

Fractures were observed in all three types of cavities, but for the three different composite systems utilized, an increased bevel offered a greater likelihood that there would not be a fracture in the enamel.

The literature has been inconclusive regarding the opinion that beveling of margins had no effect on decreased leakage, that both beveled and nonbeveled margins produced similar surface topography following etching, or that beveling reduces marginal leakage.[21-29]

Sealing Over the Etched Surface

Although silver amalgam restorations are self-sealing with age, due to accumulation of corrosion products in the marginal defects, the gap at the composite-enamel interface tends to persist, thus inviting postoperative sensitivity, adverse pulpal reactions, and recurrent decay.[30,31] Rebonding over the completed restoration after final polishing yields excellent results by significantly reducing the extent of marginal leakage.[32-35]

Al Rafei and Moore (1975) found, when cavities in extracted teeth were restored with a class V composite, using a liner, finishing to the enamel margin, acid-etching, marginal leakage occurred in almost three fourths of the specimens.[36] When the same type of preparation was completed with a 1 to 2 mm feather-edged extension and the bis-GMA liner was rebonded over the restoration, 100 percent of the teeth showed no marginal leakage.[36]

SHRINKAGE FROM POLYMERIZATION

Insertion of Composite

With the advent of light-cured composite material came the ability to shape the restoration to the practitioners liking, before the material polymerized. When placed in increments, the composite was allowed to shrink within vectors toward the margins of the cavity preparation, instead of shrinking away from the walls.[37]

The strain produced in the placement and polymerization of Class II posterior composite resins in primary teeth was examined using Scotch bond P-30 in mandibular and maxillary second molars.[38] The investigators either placed the composite in one bulk application before curing, placed and polymerized the composite in gingivoclusal increments, or placed and polymerized the composite in buccolingual increments.

The buccolingual increments produced a significantly lesser strain on the tooth than occurs during polymerization of a single unit of the composite. The difference between the complete unit and the gingivoclusal increments was not significant.

A later article examined the cuspal inflection or "amount of bending toward the center of the tooth", utilizing the same three placement techniques. The complete placement and polymerization deflected the cusps 19.7 microns. The gingivoclusal increments deflected them 14.7 microns, and the buccolingual increments were responsible for 5.2 microns of cuspal deflection.[39]

An article utilizing the same placement and curing techniques in extracted permanent teeth found no difference between the placement of the P-30 composite increment buccolingually or gingivoclusally with regard to marginal leakage.[40] One reason cited may be due to the use of a light-cured dycal base, which has the potential to adhere to the resin. Though none of the methods produced perfectly sealed margins, the degree of leakage was observed to be less than those observed in permanent teeth.[41]

Incremental placement also allowed the practitioner to provide optimal contour, especially in difficult restorations.[42]

Incremental complications

Air voids have been detected within the interfaces of the various segments and the proximal surfaces of restorations placed gingivoclusally in increments have been shown to have distinct layering with irregularities between the segments.[43-45] A modified approach to this would be to have the first layer extend from the gingival floor the length of the matrix wall, The other layers could then be placed within this polymerized layer, allowing for a smooth contour in both the buccolingual and gingivoclusal directions.

BONDING AGENTS

Enamel

A fairly recent contribution has been the use of bonding agents over the last decade. The purpose of the unfilled enamel resin is to become incorporated into the acid-treated enamel surface by extending into the surface porosities. The filled composite resin could then become bonded to the unfilled resin and provide added retention to the restoration.

The use of a low-viscosity bonding agent was first tested with a self-curing material, in order to test its benefits with regard to enamel bond strength, penetration into the etched enamel, and microleakage.[46] The Adaptic bonding agent was not found to provide superior results in any of the tested hypotheses.

Later studies found that etching and enamel bonding did reduce the degree of marginal leakage noted in nonetched and nonbonded teeth.[47]

Dentin

Scotchbond was the first dentinal bonding agent to improve the bonding of dental restorations. An early study reported that although Scotchbond did not reduce microleakage at the occlusal margin, there was a significant decrease of leakage in the gingival region.[48] Third-generation bonding agents also exist; they provide a means of conditioning the dentinal surface to allow penetration of the resin into the tubules.[48] Products like Tenure and Gluma provide covalent chemical bonds of the resin to the dentin, in order to help provide for a longer retention period of the restoration.[49]

CONCLUSION

Today's composite materials, though vastly improved, still have some major drawbacks that must be overcome, before they can replace amalgam as a viable posterior restorative material. Modifications of the tooth preparation and placement of the composite may help to diminish the inherent drawbacks.

It was suggested that the combination of acid-etching, beveling, and rebonding over the finished margin creates the best chance for success.[50,51] Preparing a tooth to receive the composite resin material adequately can only help but enhance the likelihood of an esthetic and long-lasting restoration.

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The composite resin restoration: A literature review part II Comparisons between composite and alloy restorations

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The dental profession has always aspired to find a restorative material that is not only esthetically pleasing, but functional and durable as well. Specifically what is wanted is a material that has natural color, ease of handling, and an acceptable longevity.

Although the composite restorations appear in some respects to approach the fulfillment of these objectives, they have several disturbing qualities that decrease their desirability as a restorative material for posterior teeth. One of the most often cited problems is that of occlusal wear, which may not appear for two or three years. The patient's desire for a tooth-colored filling is countered by the practitioner's knowledge that the restoration may have to be replaced several times over the life span of the tooth.

By looking at the research that explored the relationship between amalgam and composite restorations and how such things as occlusal wear were measured, one can appreciate the difficulty associated with coming to a decision on which material to use.

THE FIRST STUDIES

Rating the Composite Restoration

In 1973, Ryge and Snyder described a reproducible way to determine the quality of a restoration shortly after it had been placed.[1] These quality control criteria were applied to the surface, color, anatomic form, and the marginal integrity of the restoration. The ratings could be applicable for either amalgam or composite (with the exception of color match) and served as a reproducible way to observe a restoration over an extended period of time.

A satisfactory restoration met two categories: *Meets all standards*, and *Observe; at next visit* for various defects such as over- or undercontouring, a roughness of the surface that could be refinished, or evidence of a crevice along the margin between tooth structure and the restoration in which a dental explorer could not be inserted.

Not-acceptable restorations were classified as *Replace for prevention*, due to an irregular surface that could not be refinished, exposed dentin, or a marginal overhang. *Replace status* was issued when the restoration's surface was flaking or fractured, the restoration was missing, traumatic occlusion was present, the filling was fractured or mobile, or caries was present.

These criteria were later updated into *Alpha, Beta*, and *Charlie* ratings.[2] An *Alpha* rating meant the particular characteristic was satisfactory for all aspects. *Beta* was the score given to those attributes that deviated from the ideal, but did not warrant replacement. *Charlie* ratings indicated that the restoration required replacement.

These ratings, developed by the Materials and Technology branch of the Division of Dental Health, United States Public Health Service, San Francisco, judged

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restorations on anatomic form, marginal adaptation, color match, and cavosurface marginal discoloration.

THE FIRST LONGEVITY STUDY

Since first generation materials were found to possess color instability, due to the great difference in hardness between the filler particles and the resin matrix, introduction of the smaller quartz or strontium particles provided the dentist with several alternatives.[3]

A three-year-longevity study was first published in 1971 by Phillips *et al.*[4] Class II restorations were made with Adaptic, a chemically cured composite resin, or Velvalloy amalgam.

At the baseline examinations, the restorations of the two materials were judged to be essentially equal in terms of anatomic form; after one year, however, the data favored the composite restorations. The amalgam alloys suffered ditching of the margins, whereas the composite remained intact. Three fractured amalgam fillings were seen after a year, while all composites remained functional, though their compressive and tensile strengths were inferior to amalgam.

A two-year report recorded a loss of anatomic form confined to the occlusal surface of the composite restoration, with no loss of contact observed.[5] After two years there were ninety alpha and two beta alloy restorations. The composites included forty-one alpha and forty-nine beta restorations. The third-year report by the same researchers found forty alpha and four beta amalgam restorations and six alpha with thirty-six composite-resin restorations. There was no evidence of severe or irreversible pulpal injury with the techniques or materials used. Composite-resin was deemed superior for marginal adaptation.

There was a progressive loss of anatomical form, however, on the occlusal surfaces of the composite restorations, particularly in the marginal ridge areas, over three years time, compelling the authors to conclude that the routine use of the material was contraindicated, except where esthetics was the main concern, or until improvements of the material provided a solution to surface wear.

IN VIVO STUDIES PERMANENT TEETH

One and Two Year Results

The majority of composite versus amalgam studies in the early seventies found similar, if not superior quality results with the composite restoration during the first twelve months after placement. *Adaptic* composite was found to have a marginal adaptation similar to amalgam, though it did exhibit increasing marginal discoloration during the same time period. This was reason for concern and continued evaluation, because of the relationship between marginal discoloration and recurrent caries.[6]

Concise was found to have superior marginal adaptation and seemed to improve in color with aging during its first year of service.[7] By the second year, there was no significant difference with regard to marginal adaptation, but amalgam was found to be superior with regard to occlusal wear. Other researchers found that not only did the occlusal surface wear at a greater pace, there was also a flattening of the contact areas resulting in a shifting of adjacent teeth.[8]

IN VIVO STUDIES IN PRIMARY TEETH

Composite resins placed in primary teeth did not fare much better, according to some articles. Posterior composite restorations were more likely to fail at or after eighteen months due to fracture of the isthmus or recurrent caries; whereas the contralateral amalgam would remain intact until the third year in service.[9]

Profile, another quartz-filled composite placed in primary molars was found to show substantial wear and significant staining at the cavosurface marginal interface, indicative of leakage between the tooth-resin interface.[10,11]

FAVORABLE RESULTS

A small group of research projects published at the same time as the above articles were optimistic about the use of composites in posterior teeth.

A quartz-filled *Adaptic* composite, when compared to amalgam, was found to be inferior in maintaining its anatomic form, though caries recurrence and anticipated fractures did not occur after four years in Class I preparations, and after three years in Class II preparations.[12]

The same material in primary teeth was found to compare equally to amalgam after two years, without the loss of anatomic form as reported in permanent teeth.[13]

INHERENT DISADVANTAGES

Pulp sensitivity

Researchers were discovering problems with long-term composite restorations that indicated a compromise with

their utilization. Pulpal sensitivity occurred for longer periods of time than in teeth restored with amalgam or gold.[14]

Postoperative sensitivity has been reported in 5-20 percent of the patients.[15-18] Sensitivity occurred in the permanent teeth, but the primary teeth appeared to be unaffected by sensitivity.[19]

REASONS FOR EXCESSIVE WEAR

Abrasive wear is a complex phenomenon, which could not be predicted by the *in vitro* testing of the materials. Some composites with high values for strength or hardness did not necessarily have high resistance to abrasive wear.[20] Materials that were found to withstand aggressive toothbrushing in the laboratory did not fare so well, when placed in a patient's mouth for an extended period of time.[21,22]

Air incorporation

Some researchers felt that in the self-curing composites, excessive wear was due to incorporation of air in the material, during the mixing of the catalyst and base, creating voids within the restoration.

Intermittent polymerization

Physical manipulation was also to blame, because the self-cured composites began to polymerize as soon as the two pastes were mixed, and the polymerization was continuously interrupted throughout mixing and insertion into the cavity preparation.[23]

Microstructure

The microstructure of the material was also held responsible, because it was thought that the number of voids was reduced as particle size became smaller.[23] Thermal and mechanical stresses as well as chemical degradation of the resin matrix may occur, or masticatory forces may cause microcracks at areas of stress, where filler particles project from the matrix, causing the particles to exfoliate.

Microfilled resins were found to be as strong or stronger than the conventional composites when viewed *in vitro*.[21]

Wear in Primary Teeth

There has been speculation that this apparent lack of wear in primary teeth is due either to a more generalized wear of the primary molar enamel itself, less wear of posterior composite restorations in the primary molars, or a combination of these two factors.[11,17,24]

One researcher postulated that the similar wear rates between composite and primary enamel was the reason for the unusual increase of alpha ratings for marginal adaptation, between three and four years.[25] Others felt that lighter occlusal forces or the more anterior position of primary teeth was responsible for its greater resistance to wear.[17,26]

As methods for determining actual wear became more sophisticated, it was discovered that primary and permanent teeth exhibited comparable degrees of occlusal abrasion.

QUANTITATIVE ASSESSMENT

Until now, researchers have had to depend on their notes, to assess the status of a restoration between recall visits. Goldberg *et al* (1984) described two methods of evaluating the *in vivo* wear of restorations quantitatively, by having a permanent record of what the amalgam or composite looked like at a specific point of time.[27]

A quadrant impression was taken of the restoration and poured in dental stone. The casts were then ranked by degree or extent of anatomic wear from best to worst, by lining up all the models that represented the same recall visit for all the subjects involved.

The second method selected four casts that had a distinct and approximately linearly increasing loss of restorative material at the cavosurface margin. This wear was then measured by a traveling microscope at four sites within each model, and the mean values of wear for the four models were found to be 1, 190, 330, and 580 microns.

The remaining models could then be classified according to the similarity of their wear-patterns to the wear-patterns of these casts, or between two of the measurements. It is then possible to determine the wear as having one of seven possible wear scores: 1, 95, 190, 260, 330, 455, and 580 microns.

Variations of these methods included stone casts covering the range from zero wear to severe, in intervals of approximately 100 microns, and investigators making both die stone casts and photographs so that color match could be determined as well.[28-30] Bitewing radiographs were advocated to assess the integrity of the gingival margin of the various restorations, as long as the composite was sufficiently radiopaque to be visualized.[31]

When the quantitative method was compared to clinical evaluations, it was found that wear was steadily increasing.[32] Van*net al* found that though no wear was clinically detected after twenty-four months in primary molars, there was actually an average of 93 microns of wear, when observed quantitatively.[33]

It was confirmed by others that quantitative wear was essential to achieve accurate determination of wear.[34] Long-term studies found that even after four years, primary molar composites were still no more resistant to wear than the permanent molar restorations in the same children.[35]

STANDARDS FOR CLINICAL PERFORMANCE

Guidelines were established that determined the extent of wear allowable for a composite to be considered as acceptable for posterior usage. Current and proposed standards including acceptance proposed by the ADA Council on Dental Materials, Instruments and Equipment were developed in 1987.[36] Provisional acceptance meant a material complied with the standards of color-match ability, cavosurface margin discoloration or microleakage, recurrent caries, and wear or loss of anatomical form over a three-year period. Full compliance had to prevail for five years. In primary teeth the time frame was reduced to two years for provisional and four years for full acceptance.

Centric holding areas had to wear less than 100 microns per year and generalized wear had to be less than 50 microns per year. Recent studies have found that *Ful-fil, Occlusin, Estilux posterior*, and *P-10* all wear within the range of 34-49 microns per year in primary teeth and, therefore, are provisionally accepted.[37]

CONCLUSION

It is the consensus of the majority of practitioners that the use of composite resin restorations for posterior teeth is a compromise in both the permanent and primary dentitions.[38-40] Recent advances have made it even more tempting to replace amalgam with the more esthetic tooth-colored restorations, but close attention to detail is necessary, if some of the inherent drawbacks of the material are to be alleviated.

ACCEPTANCE FOR PRIMARY TEETH

With primary teeth it seems certain that several compromises must be made, in order to be successful in the use posterior composites. Problems regarding the isolation of teeth in children have led some to advocate composite only as an anterior restoration.[41]

The life span of composite restorations precludes their use in children until the late primary or early mixed dentition.[17]

The young permanent teeth of children must be carefully considered before using a composite as a viable alternative to amalgam. Since wear of the newer composites are in areas of occlusal stress, rather than a general loss of substance, the composite should be restricted to areas of esthetic concern, where there is little tendency for occlusal stress, and a conservative cavity preparation is indicated.[42,43]

Posterior composite restorations will most likely gain acceptance for primary teeth before acceptance as the state-of the art for permanent teeth, simply because the restoration is not required to last longer than ten years.

It should be cautioned, however, that reliance on a material solely for its esthetic value is a considerable compromise. The acceptance of posterior composite restorations in dental practice can be achieved, but only after the dentist is able to obtain a material with a high resistance to wear, low coefficient of shrinkage from polymerization, and is able, furthermore, to modify the preparation and insertion techniques to adjust successfully for pulpal sensitivity and marginal leakage.

Until technology is able to create a composite material that possesses all of these characteristics within a single system, the dentist will be forced to be selective, when deciding to restore with a filled resin or amalgam.

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The composite resin restoration: A literature review part III What the future holds

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There has been a renewed emphasis recently on composite restorations, due to the public's concern over mercury toxicity in amalgam restorations. The composite materials sold today are the result of a multitude of changes, improving on earlier acrylic resins, first utilized during the early part of this century.

A review of the conceptualization and evolution of the composite material will not only illustrate to the practitioner the advances that the newest materials have accomplished, but also the disadvantages that still exist.

Silicate cements were introduced more than ninety years ago, but restorations with that material were short-lived, due to its solubility.[1] First generation composite resins were marketed by the 3M Company over twenty years ago, and were enthusiastically accepted by the dental profession.[1]

Since that time, there have been numerous composite resin materials developed. Today, esthetics are so satisfying that investigators suggest outlining the cavity margin with a wax pencil or red fingernail varnish so that the enamel can be distinguished from the restoration while finishing.[2,3]

Nevertheless, properties not related to the esthetic quality could conceivably cause the use of composite to decline, if other factors inherent in the resin materials cause undue failure of the restoration.

The Council on Dental Materials and Devices in 1971 defined the term *composite* to indicate the presence of reinforcing fillers such as glass rods and beads, aluminum silicate, quartz, and tricalcium phosphate, which are surface treated to bond to a resin that serves as a matrix material.[4] Several of these improved dental restorative materials soon came on the market.

First-generation, composite materials consisted of a separate base and catalyst component, which were mixed together, producing a chemical reaction that provided for a process of autopolymerization.

EARLY ENTHUSIASM

Due to the lack of long-term data during the early seventies, many practitioners undoubtedly were placing posterior composite restorations at an optimistic rate. One author wrote an article describing his "all composite" practice, stating he had used *Adaptic* composite resin for eight months with excellent results.[5]

Shortly after this publication, a retired senior research associate of the ADA at the National Bureau of Standards wrote an editorial in Dental Abstracts on the short-sightedness of the above author.[6] He felt that the practitioner had not observed the restorations long enough to dictate a substitution of amalgam by a composite material, and that the dentist's early enthusiasm would become muted.

Esthetics, low thermal conductivity, and alleged ease of manipulation were observed to be the premier reasons for practitioners to begin using them as a posterior restoration, although their compressive and tensile

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strengths were found to be lower than the minimally acceptable standards needed to withstand the forces of mastication.[7]

Many of these first generation materials did not provide for a variety of different shades, and were found actually to possess color instability and increasing marginal discoloration, due to the great difference in hardness between the filler particles and the resin matrix.[8] This in turn was thought to be a precursor to recurrent caries. An introduction of the smaller quartz or strontium particles provided the dentist with several alternatives.[9]

These improved composites provided success over earlier silicate and acrylic materials in the anterior teeth, due to the color match and hardness of the reinforcing material. Many investigators, pleased with its appearance, saw it as a viable alternative to amalgam in posterior restorations.[10]

INHERENT DISADVANTAGED

Esthetics encouraged practitioners to substitute the newer composite restorations for use in the posterior teeth, where amalgam would most likely be indicated. Interproximal lesions were also being restored, although the composites had not been indicated for that purpose. As patients returned for recall examinations after the composite's initial placement, several drawbacks to the material were immediately recognized.

Anatomic form was lost in the majority of the composite restorations; and one study even noted a flattening of the proximal contact surface resulting in a shifting of adjacent teeth.[11,12] Marginal staining at the cavosurface marginal interface was still being seen in quartz-filled materials, especially in primary teeth.[13,14]

THE FUTURE OF POSTERIOR COMPOSITE

It has been the consensus of the majority of practitioners that the use of composite resin restorations for posterior teeth is considered a compromise in both the permanent and primary dentitions.[7,15,16] Recent advances have made them, however, even more tempting to replace amalgam with the more esthetic tooth-colored restorations.

Hybrid composites

Experimental composite materials with a variety of different fillers have been tested since the late 1970s.[17] Quartz was replaced by softer and still smaller-sized particles, like barium and strontium. These provided radiopacity, and an increased resistance to wear. Unfortunately these were hydrolytically unstable and materials like P-10 (strontium) were found to have extreme marginal discoloration.[13]

Materials with different properties such as carvability have also been tested, though the company's claims do not always hold true when placed clinically.[18]

Some of the newest composite materials to appear are the hybrid composites, which contain more than one filler within the resin matrix. An experiment utilizing *Ful-fil*, a composite with a barium glass/silicon oxide filler appears promising with regard to occlusal wear.[19] A failure rate of 9.5 percent in Class II restorations indicates that the interproximal restoration is still more at risk for failure.

An experimental composite H-120, is a visible-light-cured material, containing barium glass/organic filler particles. Except for wear there was little difference between the composite and amalgam restorations after twenty-four months.[20] Wear was greater in the composite than in the amalgam, particularly in the permanent tooth restorations. Marginal integrity appeared better in primary teeth, possibly due to the flatter anatomy, allowing easier finishing.

Compared to previous experiments utilizing *Ful-fil*, *H-120* had better color, but more wear was evident. Because of this greater wear, *H-120* cannot be recommended as a restorative material in permanent teeth, according to the author.

Herculite is another hybrid material that has recently been introduced. Authors claim that the esthetic results more than justify the time required to place it, though a higher fee is indicated.[21] They caution, however, that even this new material should not be seen as a replacement for the conventional alloy, until long-term studies have been completed.

THE FILLER-RESIN INTERFACE

Earlier articles mentioned that success or failure of a composite may hinge on the quality of the bond between the resin matrix and the filler component, since this seems to be the weakest link.[22] Rather than attempting to create even smaller particle sizes to help ascertain composite success, some manufacturers are concentrating on bonding the resin more closely with its filler. A diphasic glass filler has been introduced, which is etched before being imbedded within the resin matrix.[23] *Bis-fil* is one of these third-generation composites that may display superior resistance to wear.

THIRD GENERATION BONDING

Another area of concentration appears to be with the dentinal smear layer.[24] A liquid is applied to the dentin, which conditions or modifies the dentinal surface so that the tubules are directly exposed to the unfilled resin.

Two of the newer dental adhesives provide covalent chemical bonds of the resin to the dentin.[25] Whether the adhesive bonds to the inorganic phase (calcium} like *Tenure* or to the organic phase (collagen) as *Gluma* does, the removal of the smear layer may provide for a longer retention period of the restoration.

ACCEPTANCE BY PRACTITIONERS

Although earlier complications in primary Class II restorations do not exist as abundantly as they once did, there is still major agreement that the ideal composite restoration for primary molars is difficult to achieve.[26]

Although some composite materials disappeared shortly after their introduction, due to their failure rate *in vivo*, there are still a variety of brand names that are being utilized without the backing of long-term data to justify their use.[25]

In vitro studies, often supplied by the manufacturer cannot be depended on to predict accurately which materials will be successful, since the designated "filled" or "composite" resins do not provide a basis for predicting the clinical performance of a restorative resin since the behavior cannot be accurately charted by examining particular properties.[27]

A further complication seems to be that several hundred restorations may have already been placed by the time complications are observed, usually after the second or third year.[28,29]

CONCLUSION

Although the public may demand a dental material free from supposed mercury toxins, and esthetically pleasing, it would be an injustice to restore Class II lesions without regard to the disadvantages the material may present. Excessive occlusal wear, marginal staining, and marginal leakage decrease acceptability of composite restorations as a viable alternative to amalgam.

Even though the composite resin restorative materials of today are a vast improvement over what was previously offered, there are still many challenges to be overcome, before the use of the material as a Class II restorative material becomes fully acceptable.

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REPORTS

Behavior management of a patient with Mobius syndrome: Report of case

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Mobius syndrome is characterized by the absence of function in neuromuscular units served by the sixth and seventh cranial nerves. The etiology of the facial paralysis is unknown, although multiple factors may possibly be involved including genetic and environmental. It has been postulated if the functional connection of the neuron to the synoptic end organ is absent, the nerve fibers will die.[1] Without proper innervation, muscles atrophy and become nonfunctional, as is the case in Mobius patients.

Although it was first reported by von Graefe in 1880, Mobius is credited with the comprehensive review of the syndrome.[2] The distinguishing features include bilateral facial palsy, isolated and asymmetrical muscle-fiber activity, occasionally extreme ophthalmoplegia, ptosis, and asymmetric tongue paresis. Developmental anomalies and mental retardation may also be present. The lack of facial mobility may contribute to a decrease in parental bonding.[3] Speech production is affected and may be a combination of dysfunctional speech and hearing mechanisms. The combination of facial and mental retardation makes dental management difficult. The following is a dental case report involving a twelve-year-old patient with Mobius syndrome.

T.Y. is a twelve-year, four-month-old Caucasian female who presented for dental treatment in 1991. She was a term baby weighing 7 lbs and 14 oz with an APGAR score of 7/9. She was born to a gravida 5, para 2, twenty-one-year-old mother and twenty-two-year-old father. The child was in an awkward womb position with the arm wrapped around the chin to the back. At birth, it was noted the child had micrognathia and paralysis of the facial muscles. There are two unaffected older siblings.

At nine months, it was noticed the left eye could not look left, drooling, but with normal gag, and neck and shoulder movement. An evaluation at twenty-two months of age indicated the child had gross and fine motor delay, approximately eleven to twelve months behind the chronological age. She displayed hypotonicity, lack of balance and visual acuity problems. At twenty-eight months of age, an EMG was performed and it was noted no motor unit action potentials existed on the frontalis and orbicularis oris. She also had PE tubes placed at this time, noting mild to moderate hearing loss; and a year later, an operation to release the restriction of both eyes.

At rest, T.Y. exhibited apertognathia (photos 1 & 2) with occlusion occurring only at the first molars. She breathed predominately through her mouth and the gingival tissue was enlarged and inflamed. The teeth exhibited hypoplastic enamel throughout with retained maxillary second primary molars and a retained mandibular left second primary molar. Crowding existed in the mandibular incisor region. The maxilla exhibited

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"Behavior Management of a Mobius syndrome": The views expressed in this article are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

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a high vault but no crossbite (photos 3 & 4).

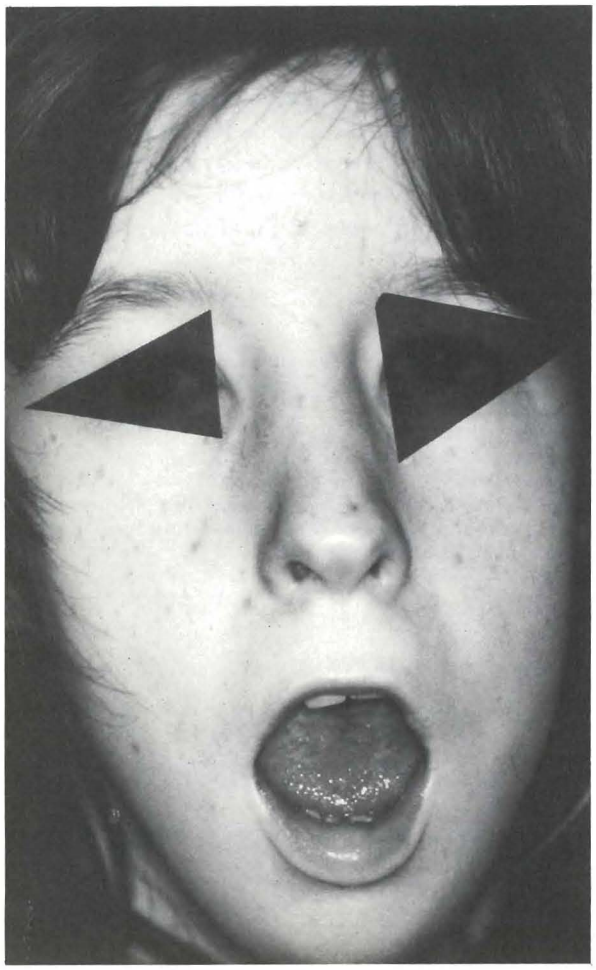
At ten years of age, she was taken to the operating room, where dental restorations were completed. She was again admitted at age twelve for restorative care and thorough oral evaluation. In January 1992, at age thirteen, she was admitted to restore two lower incisors that had fractured.

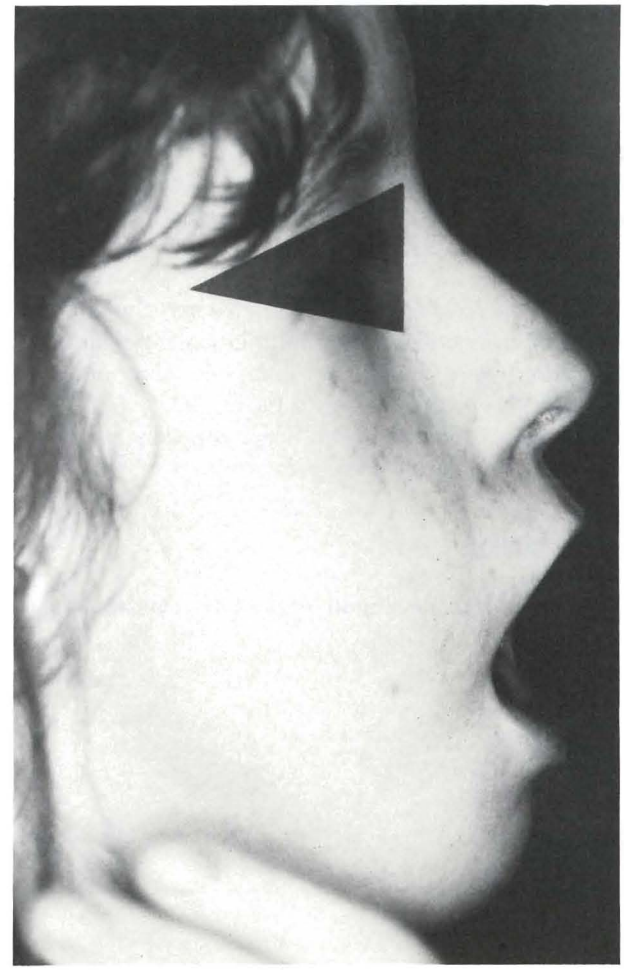
BEHAVIOR MANAGEMENT

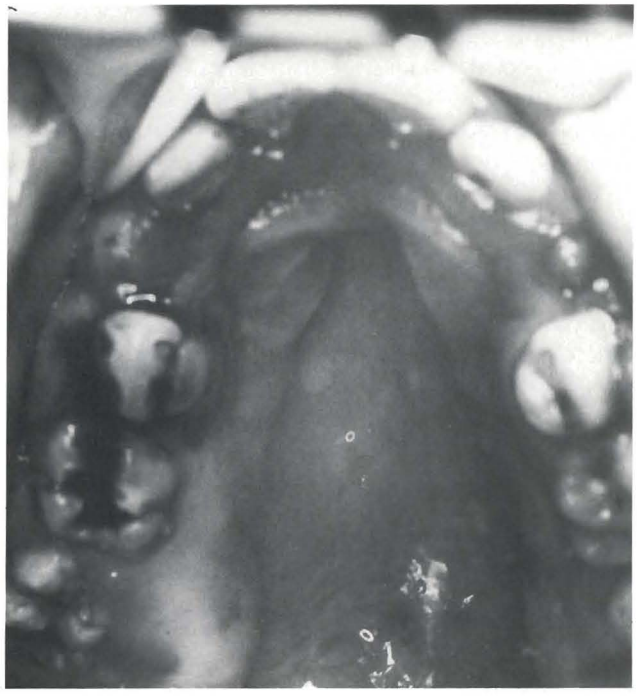
At first presentation, the behavior management was at issue. Both parents felt that hospitalization was needed to do an examination. Their complaint was the child had ceased eating and was pointing to one side of her mouth. The child weighed 110 lbs. and was 5′4″ tall. Restraint was not a consideration, yet admitting this patient without visual observation of the problem was not satisfactory. T.Y. is moderately mentally retarded but physically healthy. Communication was accomplished through signing and gesturing with the parents and occasional sounds that the parents recognized. The father admitted that the imperative procedures, such as tooth-brushing, were accomplished with physical restraint and determination.

With some calm TSD, the patient was able to tolerate a cursory intraoral examination, as long as she had her hand on the handle of the mouth mirror and probe. She would occasionally become alarmed and turn suddenly away. Through this process, we were able to determine that several teeth required restorations and that hospitalization was in order. On March 11, 1991 she was taken to the operating room, where general anesthesia was administered through nasoendotracheal intubation and dental restorative procedures were used.

Ten months later, the parents indicated that T.Y. had fallen once and broken two lower central incisors. She was examined in the same fashion as previously







described and admitted for dental restorations. The anesthetist chose to use intranasal medication after prolonged attempts at mask induction failed. The drug resulted in a more cooperative patient and with mild restraint, mask induction occurred. The father assisted in the operating room with the induction with some success.

Due to increasing combative behavior, the child is soon to be institutionalized; multiple sealant/composite restorations were placed, therefore, on molars and premolars in the preventive resin technique.

The patient tolerated both hospitalizations well and recovered completely postoperatively.

DISCUSSION

The behavior management of Mobius syndrome patients is fraught with obstacles, the foremost being the intellectual capacity of the patient and learned responses to medical stimuli. In this circumstance, it was evident that parental support and cooperativeness were needed. The result was an outpatient evaluation. The lack of expression and communication complicates the management of behavior, because there is no immediate feedback as to the mental state of the patient. Observation of the eyes and bodily movement were the only clues to interceptive behavioral skills.

The open-mouth appearance and dental dehydration will continue to influence the oral health of this individual.

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Enamel pearls in the primary dentition: Report of two cases

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The enamel pearl, also known as enameloma, was first described in 1842 by Linderer and Linderer as enamel droplets and by Salter in 1874 as enamel nodules.[1-4] They have also been referred to as enamel globules, enamel knots and enamel exostoses.[5] The enamel pearl is an ectopic focus of enamel formation. It appears as a small globule of enamel, firmly adherent to the tooth. The diameter of the enamel pearl varies in size and has been reported to be between 0.3mm to 4mm.[6] The enamel pearl sometimes contains a small core of dentin and rarely a pulp horn extending from the pulp chamber or root canal of the tooth.

Three types of enamel pearls have been described: the true enamel pearl consisting entirely of enamel; the enamel-dentin pearl or composite enamel pearl containing a core of tubular dentin and the enamel-dentin-pulp pearl containing pulp tissue as well as enamel and dentin.[7]

Enamel pearls are most commonly found on the roots of the maxillary molars followed by their occurrence on the roots of the mandibular molars.[6] Pearls are rarely associated with teeth anterior to the maxillary molars, but there have been reports of pearls found on the roots of maxillary premolars and incisor teeth.[8] Although enamel pearls can occur anywhere on the roots they are usually found at the furcation area or near the cementoenamel junction.[1] One pearl is usual, two pearls unusual, three pearls are very rare and four have been described.[7] Radiographically the enamel pearl appears as a well defined radiopacity comparable in radiodensity to the enamel of the crown. The differential diagnosis should include an isolated piece of calculus or a pulp stone.[9]

The etiology of enamel pearls remains obscure. The most common theory is that the pearls are products of localized activities of portions of Hertwig's epithelial root sheath that have remained adherent to the dental surface after root development.[10] These cells then may differentiate into functioning ameloblasts and produce enamel deposits on the root.

REPORT OF CASES

Case 1

A fourteen-year-old white female was referred to the clinic by an orthodontist for extraction of an over-retained primary right mandibular second molar. Clinical examination revealed that the tooth had undergone mesial slicing for orthodontic purposes. At first examination of a bitewing radiograph no morbidity was observed (Figure 1). A periapical radiograph revealed an extended intraradicular radiopaque mass and a dis-

The authors thank Dr. Y. Michaeli for the histological preparations.

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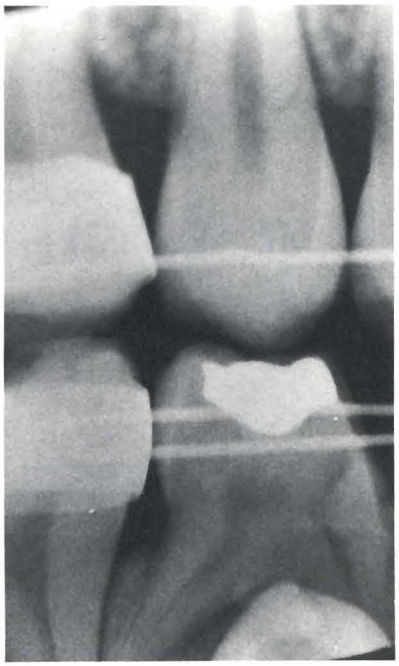

Figure 1. Bitewing radiograph. Note, superimposition of succedaneous tooth over radiopaque projection in the area of the retained second primary molar.

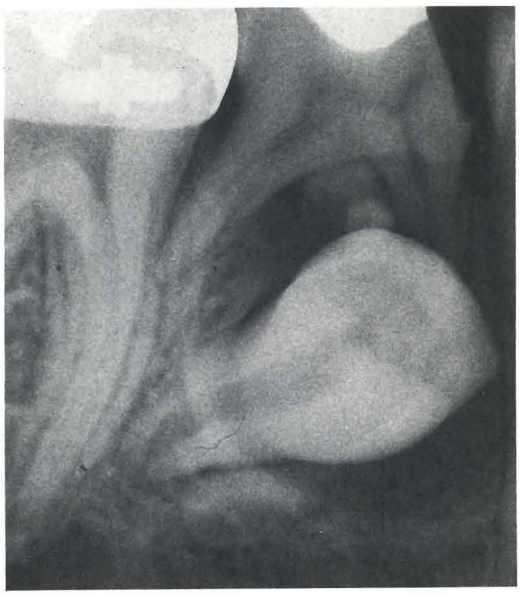

Figure 2. Periapical radiograph of the same area as Figure 1. demonstrating multiple enamel pearls and displaced second premolar.

placed permanent second premolar (Figure 2). The tooth was extracted and three enamel pearls were found in the furcation area (Figure 3). The pearls were easily differentiated from the cemental surface by their color and texture. The diameters of these enamel structures were found to be 2.2mm, 1.2mm, and 0.8mm, respectively. Following sectioning and histologic examination, a diagnosis of enamel pearls was confirmed. They consisted of a core of dentin surrounded by a thin layer of enamel tissue. The dentin was comprised of irregular dentinal tubules. The peduncle supporting the largest enamel pearl consisted entirely of dentin.

Figure 3. View of the enamel pearls found in the furcation area of the primary mandibular second molar immediately after extraction. (Case #1)

Case 2

A four-year-old white female presented at the Jerusalem Dental Center for Children, with pain and vestibular swelling in the mandibular right molar region. Clinical examination revealed rampant caries. The mandibular right primary second molar had large coronal decay. A routine bitewing and periapical radiograph were obtained. Radiographically,an interradicular pathosis with external and internal resorption of the distal root of the second molar was seen. A round radiopaque nodule was present in the furcation area of the tooth (Figure 4). A diagnosis of a chronic dentoalveolar abscess of the second mandibular molar was established. Drainage was obtained through the crown of the tooth. Three days later the tooth was extracted and clinically, one enamel pearl was found in the furcation area (Figure 5). The diameter of the pearl was found to be 1.4mm. Histologic examination revealed a core of dentin surrounded by a thin layer of enamel

Figure 4. Periapical radiograph showing a single enamel pearl appearing as a round radiopaque nodule in the furcation area. Note, external and internal resorption of distal root and interradicular pathosis.

(Figure 6). The dentin was morphologically normal with regularly aligned dentinal tubules.

DISCUSSION

The enamel pearl is a rare entity. In permanent molar teeth the incidence is between 1.1 percent - 9.7 percent depending on the study; while on primary teeth, the incidence is even less frequent.[6-8,11,12] In a microradiographic study of forty human primary molar teeth, however, an unexpectedly high-frequency of 33 percent was found at the interradicular line.[13] The inconsistency between the two studies suggests that the incidence of enamel pearls is higher, when the specimens are examined histologically rather than grossly or macroscopically.[14] Recently, enamel pearls were observed in two primary mandibular second molars. In the literature it has been stated that no clinical symptoms are associated with the enamel pearl, with the exception of a predisposition to periodontal pocket formation and periodontal lesions in the furcation area.[15,16] This may hold true regarding permanent teeth, but is not always the case in the primary dentition. The primary molar differs from the permanent molar in that the furcation area is in close proximity to, and contains, the developing tooth. The presence of an enamel pearl in this area, may cause delayed exfoliation of the primary tooth, due to the slower process of enamel resorption. Another possible complication may be the deviation of the permanent tooth. In case one, both complications were present. Another point particular to primary teeth is the difficulty of detecting enamel pearls radiographically. Due to the superimposition of the radiopaque succedaneous tooth, the enamel pearl may be concealed (Figure 1) and their incidence may be higher than reported.

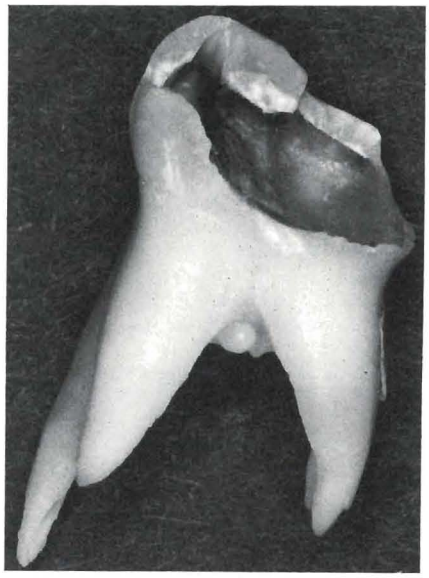

Figure 5. Typical enamel pearl located in the lingual furcation between the mesial and distal roots. (Case #2)

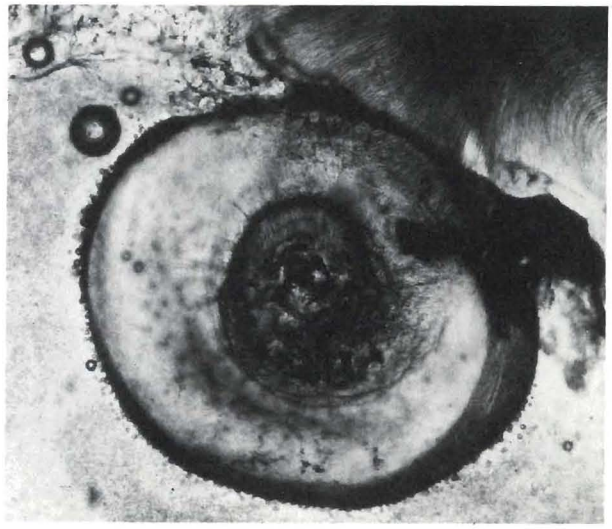

Figure 6. Histologic section of enamel-dentin pearl (Case #2). A core of dentin, containing regularly aligned dentinal tubules surrounded by a thin layer of enamel, is observed.

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THE MOST VALUABLE LESSON

The most valuable lesson you can teach your child is that privileges and freedoms are tied to responsible behavior. By behaving irresponsibly, the child is simply showing you that she is not capable of making appropriate choices concerning her behavior; she obviously needs you to make these choices for her and also to watch over her more closely. You, of course, are willing to help her because you are her parent and you love her. This means, however, that a number of privileges and freedoms get restricted in the bargain.

What you stress here is not that she is "bad" and in need of punishment. Why give her the satisfaction of seeing herself as some heroic outlaw? Instead, you grant her the power to behave as irresponsibly as she chooses. You are not there to "make her behave." However, if she chooses to behave irresponsibly, she is also choosing to give up her privileges and freedoms. Who is responsible? Who has the problem? When she can behave responsibly, she will be demonstrating to you that she is capable of self-control and ready to resume these privileges.

The attitude of the parents determines whether punishment will work or not. It is the child who must bear the burden of the problem and struggle through the process of learning self-control. Keep the overall purpose of discipline in sharp focus. Punishment is for teaching, not hurting. If you use punishment to retaliate, looking for the emotional impact, you will be assuming all of the urgency. The child needs to feel that urgency in order to want to change her behavior. It is the child who must learn to behave more responsibly—let her wrestle with the problem. Granted, most parents will have a number of questions about the technical aspects of defining rules, setting limits, making contracts, and imposing consequences. There are a million "what ifs" that arise simply because children are very creative in testing limits. But first, concentrate on your attitudes and expectations. When these are clear, the technical process of discipline will flow more smoothly.

Williamson, P.: *Good kids, bad behavior.*
New York: Simon Schuster, 1990, p 99.

Neurofibroma of the gingiva in a child: Report of case

Kasumi Kimura, DDS
Hirotsugu Yamamoto, DDS, PhD

Neurofibroma is one of several benign peripheral-nerve-sheath tumors, and occurs relatively rarely in the oral region.[1] It is found mainly in adults, but rarely in children.[2] So far, there has been no extensive or conclusive immunohistochemical study of this tumor.

Recently, we encountered an oral neurofibroma in a child, and examined it, using light microscopy and immunohistochemistry.

REPORT OF CASE

A two-year-old boy was brought to Nihon University Dental Hospital at Matsudo on May 23, 1988, with a chief complaint of swelling in the right maxillary frontal gingiva. There was nothing remarkable in the patient's and family's medical histories. Oral examination revealed a soy bean-sized tumor in the maxillary frontal region. Thereafter the tumor started to increase in size (Figure 1). On March 7, 1989, excision of the tumor was performed using general anesthesia.

MATERIAL

The excised specimen was a round tumor measuring 10 x 9 x 7 mm with a pale grey and smooth solid cut surface. For light microscopy, following fixation with 10 percent neutral formalin, the mass was cut into sections about 4 μm thick. These were examined after staining with hematoxylin and eosin and other techniques, including PAS-alcian blue at pH 2.5 and Azan Mallory.

For immunohistochemistry, the following primary antibodies were used: anti-S100 protein (S-100), anti-neuron-specific enolase (NSE), anti-neurofilament (NF), anti-glial fibrillary acidic protein (GFAP), anti-vimentin (VM) and anti-myelin basic protein (MBP) (DAKO), anti-S100 A protein (S-100 A) (Meneki Seibutsu Kenkyu, Japan), and anti-S100 B protein (S100 B) (Kyowa Medics, Japan). For detection of the antigens, labelled

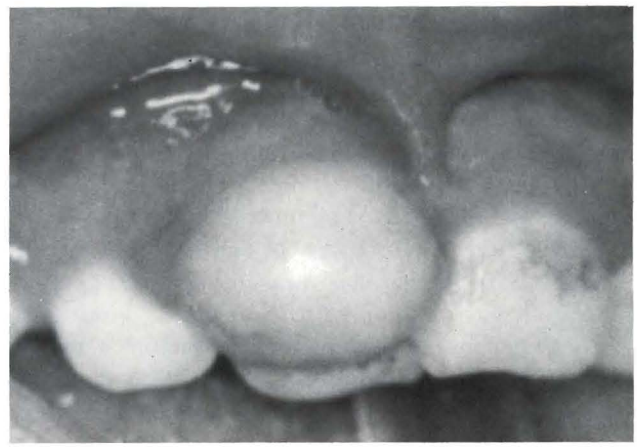

Figure 1. Macroscopical view of the tumor revealing a soybean sized tumor in the upper right gingiva.

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streptavidin-biotin complex method was used. For paraffin-embedded material, digestion with trypsin was used to enhance the specific tissue staining. The primary antibodies were generally used at the dilutions recommended by the suppliers. The incubation time was 1 hour at room temperature. Peroxidase activity was visualized using diaminobenzidine.

RESULTS

Light microscopy

Interlacing bundles of elongated large spindle cells with wavy nuclei and relatively small round cells with dark-staining nuclei were identified in the subepithelial region. These cells were sometimes intimately associated with wire-like strands of collagen, but separated by small to moderate amounts of mucoid material (Figure 2). Mast cells and lymphocytes were occasionally dotted in the stroma.

Immunohistochemistry

Table 1 shows the results of immunohistochemistry of the tumor. The immunoreactivity of S-100, S-100 a, NSE and VM was moderately to strongly positive in most of the large spindle cells (Figures 3, 4), but only weakly positive in some of the small round cells. S-100 B, NF, GFAP and MBP were also slightly immunoreactive only in some of the large spindle cells.

DISCUSSION

Neurofibroma, which is thought to be a representative neoplasm of Schwann cell origin, is one of several benign peripheral-nerve-sheath tumors. Clinically, a solitary neurofibroma appears as a relatively nontender mass in the skin or subcutaneous tissue. It is somewhat mobile and moderately firm.[3] Most solitary neurofibromas develop in individuals in their third decade. It is rarely seen in children and accounts for approximately 2 percent of all benign pediatric tumors.[2] Table 2 shows the age-distribution of neurofibroma in children based on data from several authors.[4,5] In our hospital, only two cases of neurofibroma in children were seen among sixteen benign peripheral-nerve tumors in the oral region. Among twenty-seven cases of neurofibroma reported previously,including our own cases,

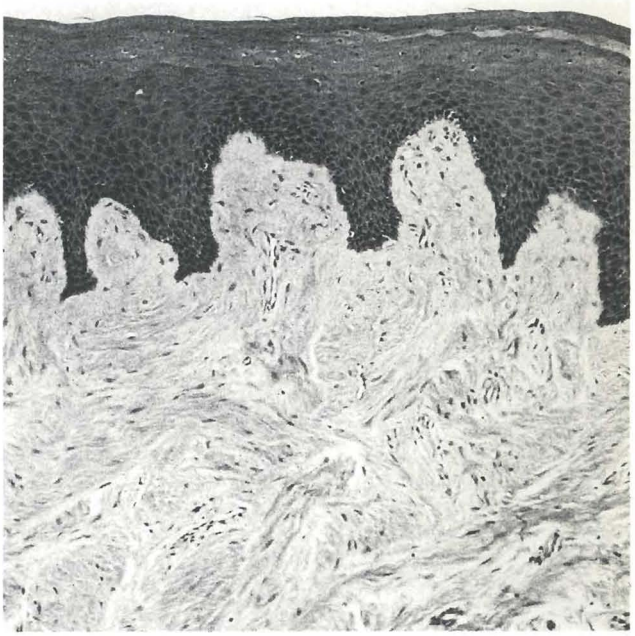

Figure 2. The tumor consists of the large spindle cells and the small round cells (Hematoxylin and eosin stain x 20).

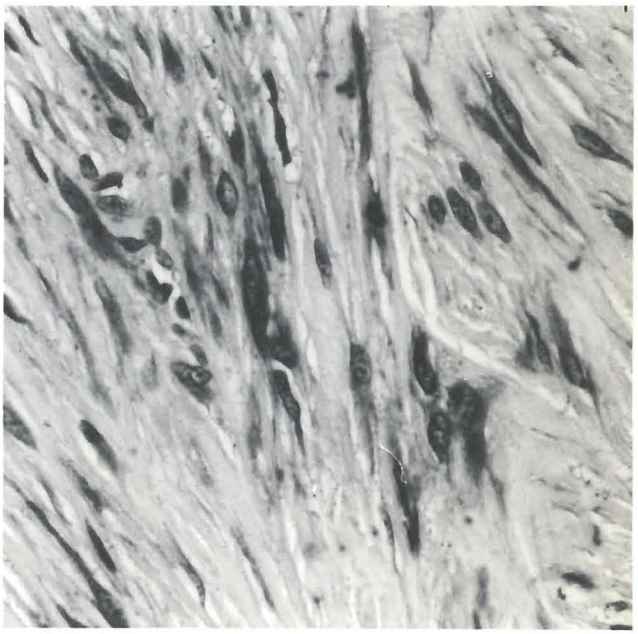

Figure 3. Strong immunostaining for NSE in large spindle cells (LSAB method diaminobenzine and hematoxylin stain x 200).

Figure 4. Strong to slight immunostaining for VM in large spindle cells and some small round cells (LSAB method diamiobenzine and hematoxylin stain x 200).

Table 1 ☐ The results of immunohistochemistry

antibodies	tumor cells: large cells	tumor cells: small cells
S-100	+ +	+
S-100α	+ +	+
S-100β	+	−
NSE	+ + +	+
NF	+	−
GFAP	+	−
MBP	+	−
VM	+ + +	+

strong positive: + + +
average positive: + +
slight positive: +
negative: −

Table 2 ☐ The age distribution of neurofibroma.

Age (years)	Authors: Victor *et al*[9]	Kawahara *et al*[12]	Kimura *et al*	Totals
0-9	1	0	1	2
10-19	0	1	0	1
20	5	18	1	24
Totals	6	19	2	27

only one case occurred in a child below the nine years of age. Although Victor reported a case of right supraorbital neurofibroma in a four-month-old child, to our knowledge, the present patient is the youngest reported so far to have a neurofibroma in the oral mucosa.[4] As for the incidence of neurofibroma and schwannoma, the former is generally less common than the latter. The ratio of cases of schwannoma to those of neurofibroma in our hospital was 3:2.

Histopathologically, neurofibroma consists of Schwann cells, perineural cells and mature collagen. In the present case, two types of cell, large spindle cells with wavy nuclei and small round cells, were recognized. Immunohistochemically, immunoreactivity for S-100, S-100 A and S-100 B was identified in the large spindle cells. S-100 protein, which is a highly acidic protein, occurs in peripheral nerves and their tumors. A decrease of S-100 protein is suggested to be associated with increased malignancy.[6] Recently, S-100 A reactivity has been detected in skeletal muscle, heart muscle, esophagus and trachea.[7] Immunoreactivity for S-100 B is usually seen in rather well-differentiated tumors.[8] In the present case, S-100 B was identified only in the large spindle cells. These cells were thought to be more differentiated, therefore, than the small round ones.

Moderate immunoreactivity for NSE was seen in many of the large cells. NSE is a glycolytic enzyme that is deposited on neurons, neuroendocrine cells, adrenal gland and smooth muscle, and there is some controversy as to its specificity.[7,9,10]

Immunoreactivity for NF, GFAP and MBP was identified in some of the large spindle cells in the present case. NF and GFAP, which are intermediate filaments in nerve cells, have been reported in some cases of neurofibroma.[4,5,11] MBP is produced by Schwann cells, which constitute approximately 30 percent of the peripheral-nerve sheath. The presence of MBP in neurofibroma has also been demonstrated.[12-14] Conclusive proof of the presence of these antigens in neurofibroma has not been obtained, however, until now. The discrepancy in their reactivities may be due to differences in heterogeneity, methods, and the types of antibodies used. The large spindle cells might be derived from the peripheral nerve sheath, i.e. Schwann cells, however, since only these cells showed staining for MBP.

In the present case, strong immunoreactivity for VM was seen in many large spindle cells and some of the small round cells. VM is one of the intermediate filaments and is sometimes called fibroblast intermediate filament (FIF). Generally, VM is recognized in astrocytes, ependymal cells, Schwann cells and several neurofibromas.[4,5,15] The small round cells might have characteristics of peripheral nerve fibroblasts. From the present immunohistochemical study, the large spindle cells can be considered to be of Schwann-cell origin,

This neurofibroma is only rarely seen in children.

whereas the small round cells may be perineural cells. Thus, immunohistochemistry was shown to be useful for revealing nerve cell markers and for distinguishing the two types of cell described above.

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ABSTRACTS

Bedi, Raman; Sutcliffe, Philip; Donnan, Peter T. *et al*: Oral cleanliness of dentally anxious schoolchildren and their need for periodontal treatment. J Dent Child, 60:17-21, January-February 1993.

The aim of this study was to examine the relationship between self-reported dental anxiety and the oral cleanliness and periodontal treatment need in Scottish secondary schoolchildren. One thousand one hundred and three children participated in the study, mean age 14 years (sd 0.35 years), and the prevalence of high dental anxiety was 7.1 percent (95 percent CI = 5.6 percent, 8.6 percent). In examining the hypothesis that anxious children are more likely to have 'cleaner' mouths in an attempt to avoid future dental treatment, it was found that children with high dental anxiety or general fear had similar overall oral cleanliness (mean debris score and CPITN) to their contemporaries. However, dentally anxious children have less contact with the dental team; that is, they were more likely to defer or cancel dental appointments. Gender and social class were more significant variables in the presence and absence of disease with regard to CPITN than were either dental or general anxiety. It is concluded that no difference could be detected regarding the periodontal treatment needs between those children who have or have not a self reported high dental anxiety. In addition the periodontal needs of the majority of this age-group (64 percent) and those with high dental anxiety (74 percent) can be treated with simple non-invasive dental procedures, which can be carried outside the context of a dental surgery.

Anxiety; Dental care; Child; Periodontal treatment

Schwartz, S.S.; Rosivack, R.G.; Michelotti, P.: A child's sleeping habit as a cause of nursing caries. J Dent Child, 60:22-25, January-February 1993.

A survey was conducted to determine the relationship between infant bottle drinking patterns and "nursing caries". The sleeping habits of the child, the contents of the bottle, the age at which the child was weaned from the bottle, and the age at which toothbrushing commenced were evaluated. Information was obtained through a parental questionnaire and a clinical examination. The results indicate that children who fell asleep while feeding from the bottle had significantly more cases of "nursing caries" than did children who discarded the bottle before falling asleep. Children who discarded the bottle before falling asleep, however, had significantly more cases of "nursing caries" than did children who were not given the bottle at all at bedtime. All other factors were not significant in increasing or decreasing the incidence of "nursing caries".

Nursing caries; Sleeping habits; Survey by questionnaire

Schneider, H.S.: Parental education leads to preventive dental treatment for patients under the age of four. J Dent Child, 60:33-37, January-February 1993.

Records from a pediatric dentist's practice, for selected periods of time over a twenty-three-year span (1966-1988), were reviewed to determine the number of patients under four years of age seen for initial dental visits and the reason for the first visit. Reasons given by parents seeking dental care for their children were categorized thus: preventive services, oral injuries, dental caries, and "other" conditions. A parental education system that stressed the benefits of a home-care program and early dental visits resulted in a 36.7 percent increase in children under the age of four seen for preventive services. Special note was taken of the influence of this program on the parents' decision to seek early preventive care for younger siblings of patients already in the practice.

Prevention; Patients under four years; Reasons for seeking care

Waldman, H.B.: Problems your pediatric patients may face. J Dent Child, 60:38-42, January-February 1993.

Children are more that "just" pediatric dental patients. They may be the product of single parent families, families in economic difficulties, families that have experienced divorce and alcoholism. The children may have been subjected to neglect and/or abuse or may have required the services of mental health programs. A review is provided of the magnitude of these problems, which can and do affect the patients and the dental services that are provided.

Children with problems; Economic difficulty; Divorce; Alcoholism; Neglect; Abuse

Waldman, H.B.: Trends in the perceived need for dental care for children: 1982-1990. J Dent Child, 60:43-47, January-February 1993.

A review is provided of the national surveys of parents and guardians on the dental status and associated difficulties of their children. Although fewer in number, complaints of acute dental problems in children continue to be made.

Acute dental conditions, trends; Gender; Race; Consequences

Full, C.A. and Hollander, W.R.: The composite resin restoration: A literature review part I. Proper cavity preparation and placement techniques. J Dent Child, 60:48-51, January-February 1993.

Interest in nonalloy restorations have increased the usage of composite resins for Class II posterior lesions. Modifications of G.V. Black's original cavity design are discussed, to familiarize the

practitioner with successful techniques that have increased the longevity of these restorations. The usage of bonding agents, and placement of the filled resin materials are also described.
Composite resins; Posterior teeth; Modifications of cavity preparation

Full, C.A. and Hollander, W.R.: The composite resin restoration: A literature review part II. Comparisons between composite and alloy restorations. J Dent Child, 60:52-56, January-February 1993.
Composite resin restorations have been advocated as a posterior restoration for Class II lesions, due to their esthetic quality and lack of mercury content. This report investigates early studies that compared amalgam and composite restorations, and cites their advantages and disadvantages. The various methods previous investigators implemented to assess the longevity of the restorations are also described.
Composite resins; Alloy restorations

Full, C.A. and Hollander, W.R.: The composite resin restoration: A literature review part III. What the future holds. J Dent Child, 60:57-59, January-February 1993.
This article discusses the evolution of composite resins as a posterior restoration and describes recent advances in both unfilled and filled resin materials. The future of today's composite material as an amalgam alternative is also described.
Composite resin; Posterior restoration: Filled and unfilled resin materials

Badger, G.R.: Behavior management of a patient with Mobius syndrome: Report of case. J Dent Child, 60:60-62, January-February 1993.
A twelve-year old Mobius syndrome patient was successfully examined as an outpatient, using patience, tactile desensitization, and cooperative interaction. Restoration of carious teeth was accomplished, using general anesthesia. Behavioral intervention was successful, thus avoiding an unnecessary hospitalization for examination only.
Mobius syndrome; Restoration of teeth; General anesthesia

Kupietzky, A. and Rozenfarb, N.: Enamel pearls in the primary dentition: Report of two cases. J Dent Child, 60:63-66, January-February 1993.
Two cases of enamel pearls present in the furcation area of primary mandibular second molars are reported. Clinical and histologic examination revealed that the pearls were composite enamel pearls. Complications arising from this uncommon entity may include delayed exfoliation of the primary tooth and/or deviation of the succedaneous tooth. Radiographic interpretation and detection of the enamel pearl may be complicated by the superimposition of the developing permanent tooth, and their incidence may be higher than reported.
Enamel pearls; Primary teeth; Complications

Kimura, K. and Yamamoto, H.: Neurofibroma of the gingiva in a child: Report of case. J Dent Child, 60:67-70, January-February 1993.
A rare case of neurofibroma in a two-year-old boy is reported, with details of light microscopy and immunohistochemistry. Microscopically, the tumor was composed of large spindle cells and small round cells. Immunohistochemically, moderative positivity for S-100, S-100 α and NSE was seen in the large spindle cells, but only weak positivity was evident in the small round cells. The large spindle cells were thought to be more differentiated than the small ones, because S-100 β, a marker of well-differentiated nerve tumors, was identified only in the spindle cells. The large spindle cells may be derived from Schwann cells, and the small round cells from the perineurium cells. The literature on neurofibroma in children was reviewed and discussed.
Neurofibroma in infant; Histology of lesion

Coming in March-April

A review of fluoride intake from fluoride dentifrice by Steven M. Levy, DDS, MPH.

The poisoning of our children by H. Barry Waldman, BA, DDS, MPH, PhD.

Dental management of the child and adolescent with major depression by Arthur H. Friedlander, DDS; Ida Kreinik Friedlander, RN, BSN, MS; John A. Yagiela, DDS, PhD; Spencer Eth, MD.

Gender trends among specialists in pediatric dentistry by Michael W. Roberts, DDS, MscD; F. Thomas McIver, DDS, MS; Ceib L. Phillips, PhD, MPH.

Prevalence of postoperative sensitivity with indirect class II resin composite inlays by C.M. Kreulen, DDS, PhD; W.E. van Amerongen, DDS, PhD; R.J.M. Gruythuysen, DDS, PhD; P.J. Borgmeijer, DDS, PhD; H.B.M. Akerboom, DDS, PhD.

A restorative dentistry renaissance for children: Light-hardened glass ionomer/resin cement by Theodore P. Croll, DDS; Constance M. Killian, DMD; Mark L. Helpin, DMD.

Electrosurgical pulpotomy: A retrospective human study by Ronald B. Mack, DDS and Jeffrey A. Dean, DDS, MSD.

Evaluation of mandibular infiltration versus block anesthesia in pediatric dentistry by Daniel Donohue, DDS; Franklin Garcia-Godoy, DDS, MS; David L. King, DDS, PhD; George M. Barnwell, PhD.

and others.