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It is the responsibility of every adult—especially parents, educators, and religious leaders—to make sure that children hear what we have learned from the lessons of life and to hear over and over that we love them and that they are not alone. Daddy used to say that in school we got our lessons from our teachers first and then got examined on how well we had learned them. In life the consequences often come first and the lessons afterward. In today's era of AIDS and drugs and violence and too-early and unsafe sex, the consequences can be deadly or last a lifetime. So parental communication, guidance, and example are more crucial than ever.

Too many young people—of all colors, and all walks of life—are growing up today unable to handle life in hard places, without hope, without adequate attention, and without steady internal compasses to navigate the morally polluted seas they must face on the journey to adulthood.

—Marion Wright Edelman

THERE IS ONLY ONE THING MORE POWERFUL THAN LEARNING FROM EXPERIENCE AND THAT IS NOT LEARNING FROM EXPERIENCE.

—Archibold Mac Leish

BEHAVIOR

Children's dental fear picture test (CDFP): A projective test for the assessment of child dental fear

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In recent years several studies were conducted to determine the prevalence and etiology of dental fear in children. From studies performed in Sweden and Finland, it is known that at least 3 percent of the children experience fear of dental care.[1,2] (Klingberg *et al*, submitted for publication, 1993 a). The methods for assessing child dental fear have included such diverse measures as behavior ratings, psychometric measures, physiological tests, and projective techniques.

Behavior ratings are among the most frequently used measures for assessing dental fear in children, including, for example, *The Frankl Scale* and a Scandinavian version of this scale, developed by Kisling and Krebs.[3,4] The reliability scores of behavioral ratings are frequently high (e.g. Machen and Johnson).[5] Validity, on the other hand, is more problematic and there are reports of weak correlations between behavioral ratings and other measures of dental fear.[6]

Psychometric methods are also common and include for instance the *Dental Subscale of the Children's Fear Survey Schedule* (CFSS-DS), developed by Cuthbert and Melamed.[7] Although easy to administer, these methods do not allow researchers to obtain directly the viewpoint of very young children (as they are unable to fill out the questionnaires themselves.

Physiological techniques are restricted to specific test situations because of the special equipment required. In addition, the information obtained is limited to indirect measures of dental fear, such as heart rate, pulse rate, and basal skin response.

Projective techniques are of special interest because they suggest a way to uncover unconscious or hidden emotions. These techniques include, for example, the child's interpretation of pictures in stories, and the child's drawings of a person. The picture-story technique is also commonly used in clinical child psychology (see Bellak and Bellak).[8]

Very few studies to verify the reliability of projective techniques in association with odontology, however, have been performed. The most frequently employed technique has been to provide the child with the opportunity to make uninhibited drawings of a person.[9-11] Sonnenberg and Venham developed a *dental* scoring system for *The Human Figure Drawing* test (HFD) and reported weak, but statistically significant, correlations between HFD and age, physiological response, and direct ratings of anxiety.[12]

In 1986, Nelson and Cholera published one of the few reports of projective techniques used in association with odontology.[13] In order to estimate coping self-statements in a group of twenty-three adolescents, they used a set of five pictures depicting a person during a dental visit, where the tested person was instructed to

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decide how the persons in the pictures were feeling. The results from the tests were compared with self-reported anxiety and maladaptive behaviors during dental treatment. The percentage of coping statements was positively correlated with disruptive behavior during dental treatment and more projective anxiety was associated with fewer coping statements. Unfortunately, no data were presented on the reliability of the test and no validation was done with regard to dental fear.

The study by Nelson and Cholera was performed with adolescents.[13] So far, no similar method has been described for younger children. A projective method for assessing dental fear in younger children could give new information on other aspects of dental fear in younger children and may thereby complement the diagnosis and understanding of child dental fear.

The aims of the present study were to describe and test the reliability of a new method, using a projective technique for assessing child dental fear, the *Children's Dental Fear Picture* test (CDFP).

MATERIAL AND METHODS

Patients

Two hundred children aged five to seven and ten to twelve-years (100 dentally fearful and 100 not fearful) were selected from a population of 3,204 children previously surveyed regarding dental fear and dental health (Klingberg *et al* submitted for publication, 1993 a). Dental fear was measured by questionnaires containing the *Dental Subscale of Children's Fear Survey Schedule* (CFSS-DS), and a constructed *Short Form* of the same scale (CFSS-SF) measuring general fears, as well as some questions related to the child's experiences from dental care.

The selection of children for the present study was based on four combinations of questions in the questionnaires. Each combination, or criterion, included items from the CFSS-DS, CFSS-SF and some of the other questions. The most fearful and least fearful individuals were identified for each criterion. For the selection, unions were formed from the four criteria in order to minimize selection bias such as regression toward the mean. The selection procedure was done separately for the two age-groups and has been described in detail (Klingberg et al *submitted for publication, 1993 b).*

Additional information was gained through the children's dental records in the Public Dental Service regarding addresses, telephone numbers, dental health status etc. before the tests. Twenty-three children were excluded from the tests: fourteen due to relocation; three were mentally retarded; one child was deaf; two children had recently been transferred to foster-homes; two children had never been to dentists; one child did not speak Swedish. Thus 177 children were eligible for the study.

The Children's Dental Fear Picture test

The Children's Dental Fear Picture test (CDFP) consists of three different subtests:

- ☐ The Dental Setting Pictures (CDFP-DS).
- ☐ The Pointing Pictures (CDFP-PP).
- ☐ A Sentence Completion task(CDFP-SC).

The Dental Setting Pictures contain a set of ten pictures (ISO A4 size papers) of animals in different progressively more stress evoking dental care situations. The pictures are presented to the child in numerical order and the child is encouraged to tell a story about each picture. The following instructions were given: 'Tell me a story about what is happening in the picture", 'Tell me, what is happening in this picture"...

The cards depict the following themes:

- ☐ A baby bear brushing his teeth in the bathroom, supervised by an adult bear.
- ☐ A puppy and adult dog walking in the street, one of the houses in the street accommodates a dental office.
- ☐ A baby lion and an adult lion in the dentist's waiting room.
- ☐ A baby bear shaking hands with the dentist.
- ☐ A baby cat sitting alone in the dental chair.
- ☐ A bear lying in the dental chair, opening his mouth wide, and looking at the dental instruments.
- ☐ A dentist examining the teeth and holding instruments in the mouth of a puppy.
- ☐ A dentist drilling a tooth of a puppy, dental assistant standing beside the chair.
- ☐ A dentist giving a dental hygiene instruction to a kitten.
- ☐ A puppy being rewarded by the dentist after the treatment.

Examples are shown in Figure 1.

The Pointing Pictures contain a set of five pictures (ISO A4 size papers) showing a (human) child in five different dentally related situations:

- ☐ Just before going to the dentist.
- ☐ The dentist examining the mouth.
- ☐ The dentist giving an injection.

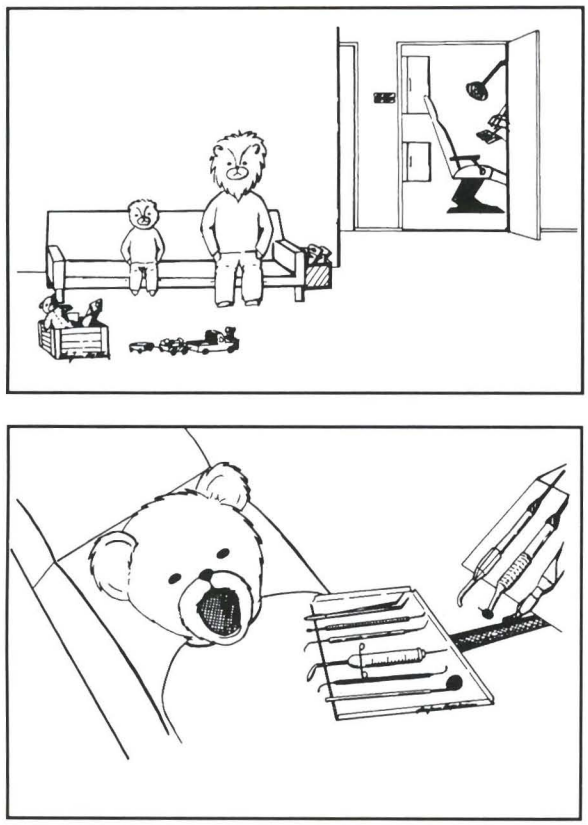

Figure 1. Examples of two (out of ten) cards in the Dental Setting Pictures (CDFP-DS).

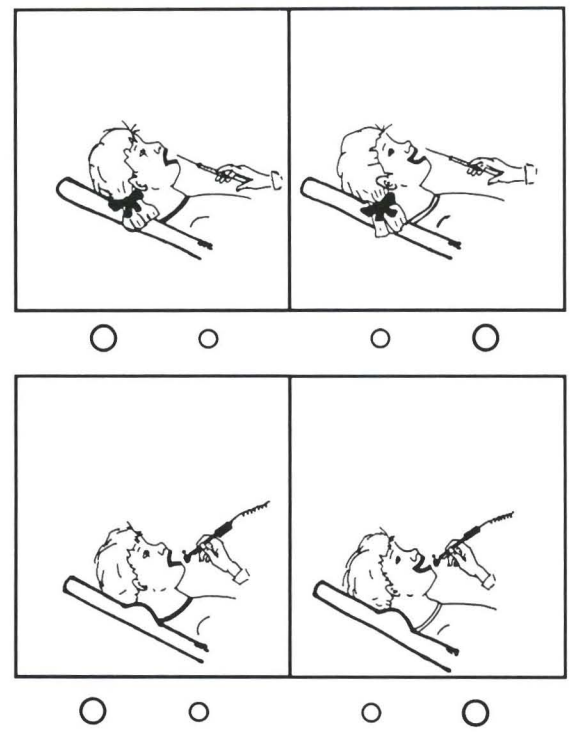

Figure 2. Examples of two (out of five) cards in the Pointing Pictures (CDFP-PP). This subtest is constructed in one girl- and one boy-version.

☐ The dentist drilling.
☐ Lying in bed about to fall asleep / dreaming about dentists.

Each card shows two different reactions; one happy, nonfearful child, and one sad and fearful child. Four rings of different sizes are situated below each picture, representing four different feelings or answers to the picture: *very happy* and not the least afraid; *feeling all right* and not afraid; *feeling somewhat afraid*; *feeling very much afraid*. Answers are given verbally as well as by pointing to the ring representing the child's choice. The answers represent scores ranging from 1 (very happy and not the least afraid) to 4 (very much afraid). Thus, the test can give a possible score ranging from 5 to 20.

The child is encouraged to give an answer on how he or she would feel, being in the same situation as the child in the picture. Each set of pictures is constructed in two versions; one for boys and one for girls. Examples are shown in Figure 2.

The Sentence Completion task contain fifteen incomplete sentences, which are read to the child consecutively. The child is instructed to complete the sentences by saying the first word or words that come to mind (Table 1).

Assessments

Each subtest (CDFP-DS, -PP, -SC) was assessed separately in three categories: *fearful*, *nonfearful*, *uncertain*. This was followed by an overall assessment of the CDFP, using the same three categories.

CDFP-DS

The *Dental Setting Pictures* (CDFP-DS) were assessed picture by picture followed by a global assessment of all ten pictures using the following criteria:

☐ *Fearful*: The child is very reluctant and hesitant in telling the story, striking in caution and taciturnity, lacking in details and imagination in the stories. Often silent for quite a long period of time. The animals in the pictures are described as feeling strange or tingling, sometimes feeling lonely or afraid. Older children may add that they have

Table 1 ☐ Items of sentence completion test.

1.	The best thing I know is...
2.	To go to the dentist is...
3.	I find it boring when...
4.	To have a tooth fixed feels...
5.	Most of all I like to...
6.	To have good and healthy teeth is...
7.	The worst thing I know is...
8.	When I open my mouth at the dentist it feels like...
9.	I think that my friends are...
10.	To brush the teeth is...
11.	I think that my dentist is...
12.	The most tasty thing I know is...
13.	When the dentist puts my tooth to sleep it is...
14.	To hear the dentist drilling feels like...
15.	When one is at the doctor's it feels...

Table 2 ☐ Assessment of child's behavior/conduct during testing. Categories and number of children assessed.

Category	Number 5-7 yrs	10-12 yrs	Totals
Shyness	20	8	28
Shyness at first, then cooperation, but reluctant	6	2	8
Speeding/restless in cooperation	17	5	22
Tension/stress	2	2	4
Social desirability	1	5	6
Language problems	4	3	7
No remarks	25	46	71
	75	71	146

experienced the same kind of feelings themselves in similar situations.

☐ *Nonfearful*: The child seems amused when telling the story. The story is rich in details and imagination, often with enumeration of different objects in the picture. No hesitation. The animals are described as finding the situation fun, being in the center of attention and important characters in the treatment situation.

☐ *Uncertain*: The child can not be categorized in either of the two groups. The child is often lacking in concentration and the tester is unable to make an assessment.

Finally, when all ten pictures have been shown to the child and assessed separately a global assessment of the *Dental Setting Pictures* is made, using the same criteria, *fearful*, *nonfearful*, *uncertain*.

CDFP-PP

The *Pointing Pictures* (CDFP-PP) are assessed as described and categorized in the same three categories as for the CDFP-DS; *fearful*, *nonfearful*, and *uncertain*.

☐ *Fearful*—Total score greater than 12 on five pictures, of which three pictures should have scores of at least 3. An exception should be made, if the child reacts with very strong emotions to a picture, making it impossible for him or her to continue the test. In this case the child is assessed as *fearful*, even though not reaching a total score of at least 12.

☐ *Nonfearful*—Total score less than 12.

☐ *Uncertain*—A child behaving in a way that renders an assessment as *fearful* or *nonfearful* impossible.

CDFP-SC

The *Sentence Completion* task is assessed based on the overall impression of the child's answers to the individual questions. Negative or reluctant (e.g. don't like, ugh, strange feeling etc.) answers imply *fearful*, while positive opinions (e.g. nice, fun etc.) imply a *nonfearful* child. *Uncertain* is based on a child not cooperating in doing the test or giving contradictory answers.

Assessment of behavior and conduct

In addition to the testing a categorization was performed of the child's behavior. Behaviors were recorded according to seven categories. The child was either assessed behaving according to one of the categories or no remarks concerning behavior were recorded. The categories are shown in Table 2.

Instructions to child before testing

All parents were informed and had given their consent before testing. The tests were performed in either the child's home (72 percent) or at the Public Dental Service clinic (28 percent) where the child received its regular dental care. In the latter case the testing was the only purpose of visiting the clinic that day. All tests took place in a separate room, with the tester and child seated by a table. The tests were audiotaped and in addition written notes were taken. Testing required forty-five to sixty minutes.

After becoming acquainted with the child, the purpose of the tests was explained to the child (i.e. "I will show you some pictures and I would like you to tell me a story about what is happening in each picture..."). The child was told that some of the pictures were connected to dental care and that further instructions would be given later in the session.

All testing was performed by two dentists who were trained using the CDFP until reaching acceptable agreement. The testers were blind to the selection criteria of the children (*fearful* or *nonfearful*). The first twenty-seven tests were assessed by both dentists; by one of the dentists at the time of the testing, and later by the other dentist based on tape-recordings and written notes. Interexaminer reliabilities were calculated for the global assessment of CDFP as well as for each subtest.

Statistics

The data were compiled and descriptive and analytic statistics were calculated, using the *Statistical Analysis System* package (SAS Institute Inc., Cary; N.C.). Chi-square, analysis of variance and log-linear analysis were employed.

RESULTS

Sample characteristics

Of the 177 children (86 *fearful* and 91 *nonfearful*) eligible for the study, thirty-one were dropped for the following reasons: not answering phone calls (14); parents declining participation (1); child declining participation (2); child too shy and not able, therefore, to cope with the test situation, according to parents (3); parents and dentists could not arrange suitable time for testing (1); illness (1); did not show up (on two occasions) (2); language problems in either the parent or child (7).

Finally 146 children (82.5 percent) were tested. Age and selection criteria (*fearful* or *nonfearful*) before testing are shown in Table 3.

Table 3 ☐ Tested children by age and selection criteria (fearful/nonfearful) before tests.

Age yrs	Fearful	Nonfearful	Totals
5-7	38	37	75
10-12	29	42	71
Totals	67	79	146

Table 4 ☐ Interexaminer reliability between testers. Percentage of agreements on assessments and the lower limits of its 95 percent confidence interval.

Test	Percentage of full agreement %	Lower limits of 95% confidence interval %
CDFP overall assessment of testings	88.89	73.73
CDFP-DS	81.48	64.94
CDFP-PP	85.19	69.24
CDFP-SC	85.19	69.24

Table 5 ☐ Number of children assessed as *fearful*, *nonfearful*, and *uncertain* in CDFP and subtests.

Test	Age (yrs)	Assessments Fearful	Nonfearful	Uncertain
CDFP				
	5-7	24	38	13
	10-12	20	41	10
	totals	44	79	23
CDFP-DS				
	5-7	20	35	20
	10-12	18	38	15
	totals	38	73	35
CDFP-PP				
	5-7	14	39	22
	10-12	15	40	16
	totals	29	79	38
CDFP-SC				
	5-7	22	37	16
	10-12	17	41	13
	totals	39	78	29

Interexaminer reliability

As described in Table 4 full agreement in the global assessment (CDFP) was found between the two dentists in 88.9 percent of the tests assessed by both dentists (lower limit of a 95 percent confidence interval was calculated at 73.7 percent). In addition, also displayed in Table 4, high levels of agreement between the testers were found in all three subtests (CDFP-DS, -PP, -SC).

Assessments of CDFP

In the global tests forty-four children (33 percent) were assessed as *fearful*, whereas seventy-nine (54 percent) were found to be *nonfearful* and twenty-three children (16 percent) assessed as *uncertain*. In the *Dental Setting* subtest, 26 percent were assessed as *fearful*, 50 percent as *nonfearful*, and 24 percent as *uncertain*. Regarding the *Pointing Pictures* subtest, 20 percent were found to be *fearful*; 54 percent *nonfearful* and 26 percent *uncertain*. The *Sentence Completion* subtest showed *fearful* in 27 percent, *nonfearful* in 53 percent, and *uncertain* in 20 percent (Table 5).

Agreement between different parts of the test

As shown in Table 6 the percentage of total agreement between the global assessment and the different sub-

Table 6 ☐ Total agreements (%) and the lower limits of 95% confidence intervals; CDFP vs. subtests for total group and groups of younger and older children.

Subtest	Total group % lower limits agreement 95% confidence interval		5-7 yrs % lower limits agreement 95% confidence interval		10-12 yrs % lower limits agreement 95% confidence interval	
CDFP-PP	77.4	71.7	76.0	67.9	78.9	70.9
CDFP-SC	89.0	84.8	85.3	78.6	93.0	87.9
CDFP-DS	84.9	80.1	85.3	78.6	84.5	77.4

Table 7 ☐ Log-linear analysis. Interaction between dependent variable (CDFP-final assessment) and independent variables in model.

Independent variable	X^2	df	p-value
CDFP-DS	18.00	2	0.0001
CDFP-PP	26.14	3	0.0000
CDFP-SC	20.17	2	0.0000
Behavior/conduct	10.45	2	0.0054

tests (DS, PP and SC) was calculated for the total group as well as for the two age-groups. This revealed a total agreement in 84.9 percent regarding the CDFP-DS; in 77.4 percent, in the CDFP-PP; and in 89.0 percent, for the CDFP-SC.

Assessment of behavior and conduct

Younger children were more frequently categorized as showing behavior that resulted in an observer comment, compared to older children (67 percent vs. 35 percent, $p < 0.001$) (Table 2). Shyness was the most frequently used comment (19.2 percent), and occurred more often in younger than older children (26.7 percent vs. 11.3 percent, $p < 0.05$).

Log-linear analysis

The log-linear analysis forms models for the cell-frequencies in contingency tables and searches, thereby, for possible statistical dependencies between variables. In this study it was important to know whether the global assessment on the CDFP was associated with the variables CDFP-DS, CDFP-PP, CDFP-SC and assessment of behavior. The analysis revealed strong relationships between each of the dependent variables and the global assessment. No variable could, however, be stated to have more influence than the others (Table 7).

DISCUSSION

In this study, a new projective method, the *Children's Dental Fear Picture* test (CDFP), assessing child dental fear in five- to twelve-year-old children has been described. The method consists of three different subtests for which the assessments all show high levels of agreements with the global assessment of the CDFP. Calculated interexaminer reliabilities indicate that the CDFP is a reliable method for measuring child dental fear.

Since only one of the dentists was present during the actual testings, it was obvious that one important dimension, namely the direct contact and interaction with the child, was lost for the second dentist who only used tape recordings and written notes for the assessments. Still the finding of high interexaminer reliability between the dentists suggests that the CDFP can easily be administered with similar results by different testers, provided they have been trained. The agreement between the dentists was lowest in the CDFP-DS which might be explained by the fact that the CDFP-DS is the most projective subtest, the interpretation of which involves more subjectivity.

Examination of reliability involves problems regarding the selection of the study population. Unfortunately selection is often associated with bias. A study population should be representative of and include fearful subjects. Because the prevalence of child dental

fear in Sweden is reported to be very low, the study population would either have to be very large or based on selection, in order to guarantee the inclusion of fearful children.[1] (Klingberg *et al* submitted for publication, 1993 a). For selection of the study population in the present investigation, great efforts were made to minimize bias. This included a well-defined control population carefully selected to cover socioeconomic factors, different Public Dental Service clinics etc (Klingberg *et al* submitted for publication, 1993 a). In addition the selection for the present study used four different criteria, from which combinations were formed in the selection of fearful and nonfearful subjects.

Approximately 50 percent of the children were assessed as *nonfearful* in the subtest and in the global assessment. The number of *fearful* and *uncertain* children varied between the different subtests of the CDFP, indicating a drift of subjects between the assessments *fearful* and *uncertain*, depending on which of the subtests was being used.

Comparing levels of agreements between the assessments in subtest to the global assessment showed that the agreement was lowest in the CDFP-PP. In this subtest more children were assessed as *uncertain* and fewer as *fearful*. The finding of similar agreement throughout the assessments in both age-groups implies that the difficulties and simplicities in the different subtests do not depend on the age of the child, but rather on the test itself. The exception seems to be the CDFP-SC, which reached higher agreement with the global assessment in older children. This was expected because a sentence-completion task requires more abstract understanding from the child and might, therefore, be difficult for young children to manage.

Interestingly, there were no differences between the age-groups in the agreement between CDFP-DS (the most projective subtest) and the global assessment. This favors the use of projective techniques in younger children. Younger children seem to have no difficulties coping with such tests. Instead, young children encounter more problems with self-reports or in situations where the child is questioned or interviewed.

The log linear analysis shows that the global assessments of the CDFP are founded on assessments from all three subtests, and shows, furthermore, that no subtest or the behavior / conduct of the child seems to have a larger impact than another. This is an important finding, indicating that all three subtests complement each other and that all of them are needed for the global assessment.

CONCLUSIONS

The proposed, *Children's Dental Fear Picture* test (CDFP), is a new test with high interexaminer reliability. The assessments in the different subtests show high levels of agreement with the global assessment. Based on the test there seem to be more difficulties in identifying fearful children than non fearful ones. Data on the validity of CDFP is still to be reported.

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PREDICTORS OF DISTURBANCE IN SEXUALLY ABUSED CHILDREN

As suggested by Fromuth and Tong et al, the expectation that sexually abused children will have poor outcomes may inadvertently produce a self-fulfilling prophecy. Undue emphasis on the anticipated impact of sexual abuse also may divert the attention of parents and clinicians from other important sources of abused children's distress. The results of this study suggest that preexisting, long-standing adverse psychosocial circumstances other than low socioeconomic status per se contribute importantly to the problematic behavior and academic performance seen later among some sexually abused children. The study findings further suggest that it is children's preexisting psychosocial circumstances, rather than the abuse, that determine, at least in part, the nature of their functional outcomes. Elmer has observed similarly in a prospective comparison of abused and control children that, after 8 years, the effects of socioeconomic disadvantage overshadowed those of physical abuse and neglect. On the other hand, these observations offer cause for guarded optimism that some sexually abused children, especially younger children and those with psychologically healthy mothers or well-functioning families, may escape serious untoward consequences of sexual abuse, at least in the near term.

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REPORTS

A recurrent traumatic bone cyst: Report of case

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The traumatic bone cyst (TBC) is a benign, nonepithelial lined lesion that has been described in the literature under a variety of terms. The hemorrhagic bone cyst, extravasation cyst, progressive bone cavity, simple bone cyst, and the unicameral cyst are a few of its synonyms.[1-5] The lack of understanding of the true etiology and its pathogenesis accounts for the multitude of names applied to this lesion. The term traumatic bone cyst (TBC), has been selected in this report not to imply etiology, but rather because it has been the most widely accepted nomenclature for this lesion.

The TBC is most frequently seen in the long bones, with a majority of the lesions occurring in the proximal aspect of the humerus and femur.[6] When the TBC occurs in the jaws, the majority of the cases affect the body of the mandible. The mandibular symphysis is the second most common site.[7] Lucas was the first to describe the TBC in the mandible.[8] By 1937 fourteen cases had been reported in the literature. In 1962 and 1965, extensive reviews of the TBC were published by Gardner and Howe, respectively.[1,9] Heubner and Turlington also published an exhaustive review of 155 cases in 1971.[10] The common use of the panoramic radiograph and the increased awareness of the lesion's existence has contributed to its more frequent detection.

There is no agreement as to the etiology of the TBC. Howe and Whinery offer good reviews of the theories of origin.[1,3] Some of these theories include origin from necrosis of fatty marrow due to ischemia; origin from bone tumors undergoing cystic degeneration; osteoclasis, secondary to a disturbance in circulation, caused by trauma creating an unequal balance of osteoclasis and osteogenesis; faulty calcium metabolism, secondary to parathyroid disease; cystic areas of focal low grade chronic infection, and intramedullary hemorrhage. While the cause remains uncertain, the theory of intramedullary hemorrhage appears to be the most tenable and widely accepted theory on the etiology of the TBC. Exponents of this theory believe that trauma of insufficient force to fracture the elastic bone of a young individual, but sufficient enough to produce intramedullary arterial hemorrhage, is the primary initiating event in the formation of the TBC. For unexplained reasons this bleeding fails to organize, and subsequently there is a dissolution or degeneration of the blood clot, leaving eventually an empty cavity. In time osteogenesis overcomes osteoclasis and the cavity heals in with bone. Howe gives an excellent guide describing the progression of the gross contents of the TBC as it relates to time.[1]

Howe and Heubner state that the majority of TBCs occur during the first two decades of life, with 60 percent of reported cases occurring in males.[1,10] The majority of the lesions are asymptomatic and the discovery of the lesion is generally incidental. The most prevalent clinical symptom is bony expansion (20 percent). A very small percentage of patients (3 percent) do present with paresthesia according to Heubner.[10] Teeth involved in the lesion are vital, even if there is rare displacement

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or mobility of the dentition. The classical radiographic appearance of the TBC is a solitary radiolucent lesion with well-defined and smoothly outlined margins that show a characteristic scalloping when involved with the roots of the teeth. The lamina dura of involved teeth is generally intact and the roots do not exhibit signs of resorption. The size of the TBC can vary from .5 cm in diameter to involvement of the entire body of the mandible and ascending ramus.

The differential diagnosis for the TBC must include: periapical dental granuloma, central giant-cell reparative granuloma, eosinophilic granuloma, desmoplastic fibroma, histiocytosis X, ameloblastoma, odontogenic cysts, nonosteogenic fibroma and fibrous dysplasia.[11] Of added clinical significance is its tendency to become a large intraosseous cavity, which may predispose the jaw to pathologic fracture. The ease with which the TBC can be misdiagnosed, may result in treatment more radical than necessary.

The final diagnosis of the TBC is based on surgical exploration. The defect is usually found to be empty or to contain straw-colored liquid with varying amounts of blood. The gross content of the TBC depends on the duration of the lesion. The surgical exploration serves as a diagnosis and a definitive treatment for this lesion. It produces bleeding into the cavity, which is eventually replaced by normal bone.

Recurrent TBCs of the jaws have rarely been reported in the literature.[12-16] The following case report describes a recurrence of a TBC treated via curettage and was not observed clinically or radiographically for eight years.

CASE REPORT

The patient is a seventeen-year-old white male, who was referred to my office in July 1989 with an impressive osteolytic lesion of the right mandible. The patient's history dates back to May 1981, when a 1.5 cm radiolucent lesion was noted (as an incidental finding during an orthodontic work up) in the right mandible at the central portion of the body between the permanent first molar and the second premolar (Figure 1). The area was explored and surgically curetted by an oral surgeon. There was apparently no available tissue for a biopsy. The empty bony cavity was surgically curetted to promote bleeding and the procedure was considered diagnostic and curative. A clinical diagnosis of a TBC was made. There was no clinical or radiographic follow-up for eight years, until July 1989, when a general dentist obtained a periapical radiograph of the patient's mandibular right permanent third molar before extraction, and noticed a large radiolucent lesion just anterior to the tooth he proposed to extract.

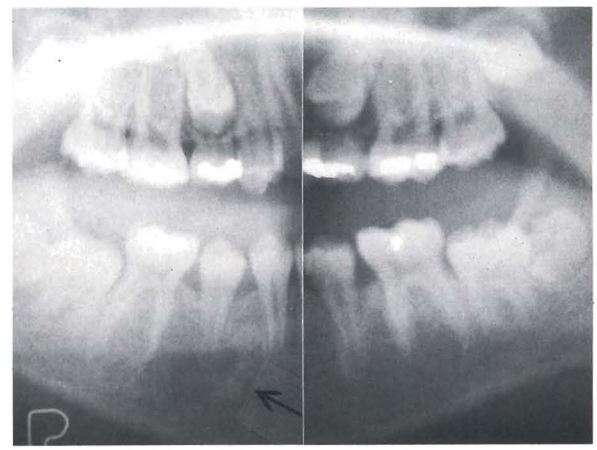

Figure 1. Initial lesion measuring 1.5 cm, July 1981.

The patient was referred to my office, where a current panoramic radiograph revealed an asymptomatic, large expanding 7 cm x 4 cm radiolucent lesion in the right posterior mandible. The lesion extended from the mandibular right permanent second molar to the parasymphysis region (Figure 2). There was no associated paresthesia. There was some clinical suggestion of bony expansion noted on the buccal plate of bone from the mandibular right permanent second molar to the mandibular right first premolar. The teeth involved with the lesion were firm and were vital to pulp testing. There was a vague history of an injury to the chin when the patient was seven or eight years of age, but nothing specific. There was no facial asymmetry or cervical lymphadenopathy noted on clinical examination. The patient had a normal range of mandibular motion.

The patient was immediately referred to an oral surgeon for a complete diagnostic work-up. A CT scan (Figure 3) disclosed internal cortical erosion of the buccal plate of bone as well as loss of bony trabeculation. The computed tomograph in Figure 4 demonstrates internal permeation of the lingual cortex of bone, but no perforation. The radiolucent area was found to involve the mandible from the angle to the symphysis including the lateral incisal area and showed complete destruction of marrow along those areas. A differential diagnosis included odontogenic and nonodontogenic cysts and tumors, eosinophilic granuloma, fibrous dysplasia, recurrent traumatic bone cyst, giant cell granuloma, a histiocytoma, or an aggressive desmoplastic

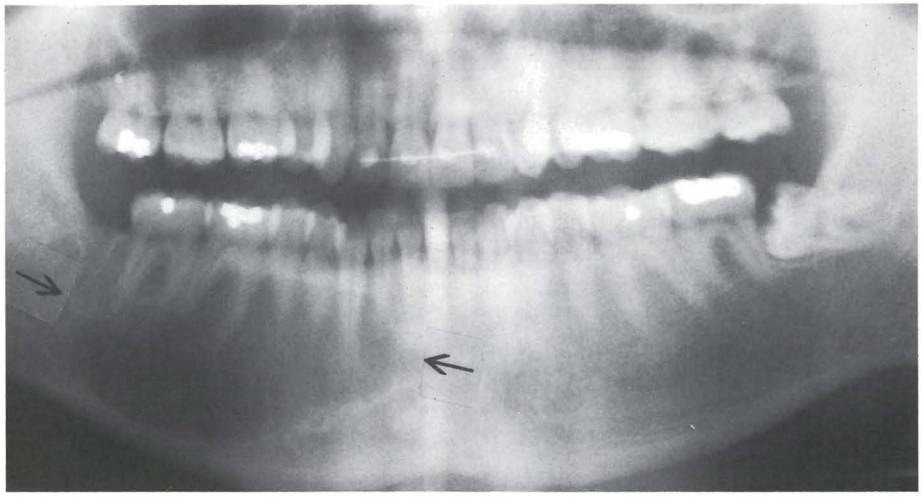

Figure 2. Recurrent lesion measuring 7 cm x 4 cm, July 1989.

Figure 3. CT scan demonstrating internal cortical erosion of the buccal plate of bone, marrow destruction, and loss of bony trabeculation.

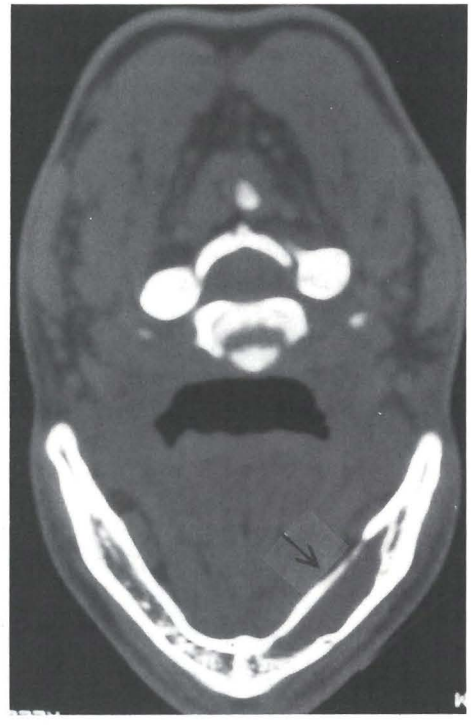

Figure 4. Another CT cut showing internal permeation of the lingual plate of bone.

fibroma. Neural tumors were an unlikely differential, because of the lack of paresthesia.

A decision was made to attempt to approach the lesion for surgical exploration through a buccal vestibular incision. After appropriate diagnostic laboratory tests, the patient was admitted to the hospital and using general anesthesia with preoperative IV antibiotics coverage, an incision was made extending from the mandibular second molar to the mandibular canine at the depth of the vestibule with extension to the man-

dibular body. The periosteum was then reflected inferiorly so that the lateral cortex of the mandible was well visualized. The mental nerve foramen was also visualized and the mental nerve branches were retracted inferiorly. With a Stryker drill a small bony entry approximately 5 mm beneath the apex of the first molar was made. An 18-gauge needle was then introduced into this opening and aspiration was negative. The Stryker drill was then again used to create a 2 cm window along the buccal aspect (Figure 5) of the bone measuring 1 cm in an inferior superior direction. The opening disclosed an area completely devoid of soft tissue, marrow or bone. The lingual cortex was easily identified. No remnant of cystic tissue was identified. The bony cavity itself was completely empty and totally consistent with a traumatic bone cyst. The bony cavity then was gently curetted in order to stimulate appropriate bleeding and the soft tissue was closed with a running suture. The patient tolerated the procedure well and postoperative healing was uneventful. The patient showed impressive radiographic healing, 1.5 years postoperatively (Figure 6); and 3.5 years, postoperatively (Figure 7).

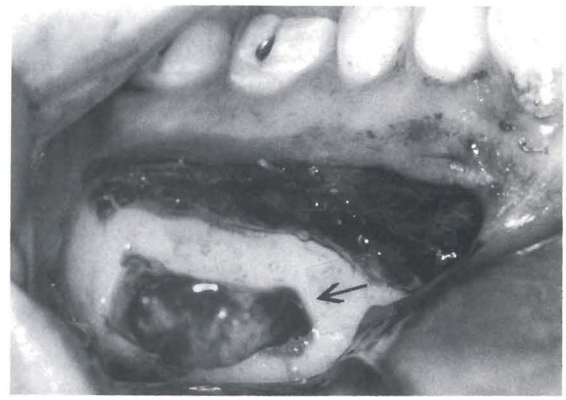

Figure 5. Surgical window created for curettage and exploration.

DISCUSSION

A review of the literature reveals that recurrences of the TBC of the extracranial skeleton are common, whereas there are only a few reports of recurrent TBCs from the jaws.[12-16] The literature clearly shows that once the TBC is surgically explored, uneventful healing takes place. Heubner states in a review of 155 treated cases that healing of the TBC took place regardless of the method of treatment.[10] Many experts believe that the TBC is a self-limiting lesion and capable of complete and spontaneous remission. This is supported clinically by the fact that TBCs are rarely observed in adults older than thirty - five years of age. Blum and Szerlip presented a series of cases that were diagnosed clinically as TBCs.[17-19] These cases were observed radiographically over a period of five years and healed very impressively without any surgical intervention. In fact Blum advocated needle aspiration as a possible treatment for the TBC.[17] It was felt that aspiration plus roughening of the bony cavity would produce mild bleeding and subsequent intraosseous clot formation. This in turn would stimulate connective tissue and capillary activity and eventual bone regeneration.

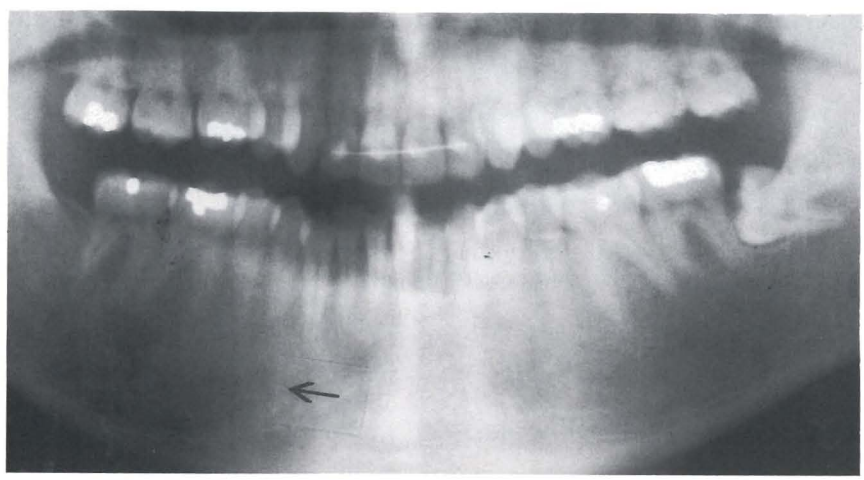

Figure 6. Bony healing, 1.5 years, postoperatively (retreatment).

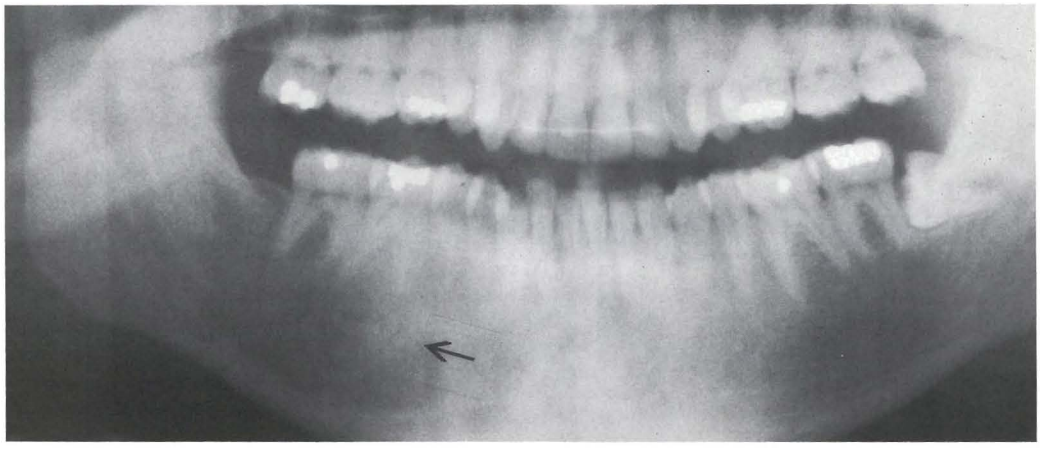

Figure 7. Healing, 3.5 years, postoperatively.

This case clearly demonstrates that the TBC is not an innocent lesion. Once treated the TBC needs careful and long-term clinical and radiographic follow-up. The potential of the TBC to recur adds another dimension to its clinical behavior.

SUMMARY

Presented is a case report of a recurrent TBC in a seventeen-year-old white male. The initial lesion was first diagnosed radiographically as an incidental finding during an orthodontic work-up. The lesion was surgically curetted and was not observed clinically or radiographically for eight years. Retreatment of the lesion eight years later via surgical exploration and curettage produced almost complete bony healing within three and a half years. Because of the possibility of recurrence, long postoperative clinical and radiographic observation is recommended for the surgically treated TBC.

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Unusual impaction of a primary lateral incisor

Michael Lambert, DMD
David L. Rothman, DDS

Impactions of primary teeth are extremely rare; most cases of unerupted or impacted teeth are found to be in the permanent dentition.[1-13] Unerupted teeth are those that have not established normal full communication with the oral cavity. Impacted teeth are those that fail to erupt to a normal position beyond the time usually expected for such appearance. It has been stated by Pindborg that failure of a primary tooth to erupt is rare, although impactions of mandibular primary second molars are numerous in relationship to other primary impactions.[14]

All of the studies discussed in the literature describe submerged primary molars as either impactions or unerupted.[2,3,5-8,10-13] This review reveals that most of the articles regarding unerupted primary teeth involve the primary second molars and only a single study discusses an impacted first molar.[6] Most of these cases were discovered in young adult patients who were asymptomatic and often involved transposition between a second premolar and a primary second molar. There are no reports of impacted anterior teeth. The etiology of a primary tooth impaction could involve abnormal development of the primary molar germ before one year, malposition of the second premolar molar anlage before one year, or a local traumatic developmental event that could have contributed to ankylosis of the primary tooth and disturbed the development of the permanent tooth.[1,2,11] An excellent review of the cases is found in the work of Amir and Duperon.[11]

Damage to the anterior maxillary alveolar ridge and developing tooth buds could occur during intubation for incomplete lung development in low-birth-weight, preterm babies. Results of such damage included palatal groove formation, defective incisors and acquired clefts.[15,16]

CASE REPORT

S.H., a four-year-old Caucasian male, presented to the office for his first dental visit. The chief complaint was that of asymptomatic, discolored maxillary right and left central incisors. The maxillary right primary central incisor (E) had exhibited discoloration for approximately nine to ten months and the maxillary left primary central incisor (F) had been discolored for approximately two months. There was an absence of history of fistula, swelling, bleeding, or purulence. The patient's medical history was significant only for birth, seven weeks prematurely. He did not require intubation and was discharged without complications. His medical history was otherwise benign and noncontributory. He was taking no medications. The dental history was noncontributory. The parent was unable to recall any trauma to the oral cavity or head and neck region. Family medical and dental histories were be-

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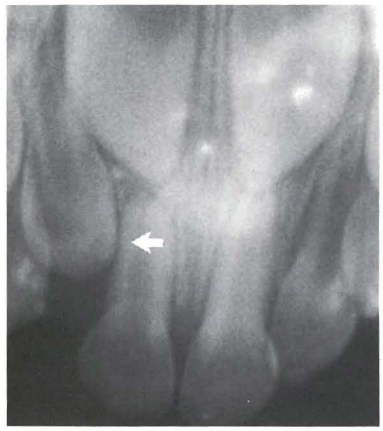

Figure 1. Note the position of the impacted primary maxillary right lateral incisor (arrow).

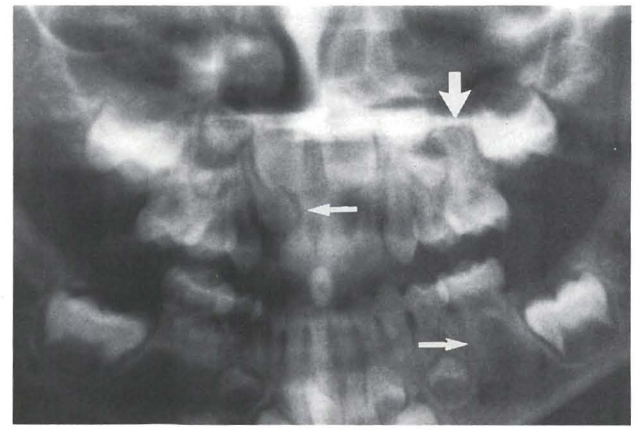

Figure 2. Panoramic radiograph shows several anomalies (arrows).

nign and noncontributory.

The clinical examination revealed no evidence of gross pathosis in the anterior maxilla. There was an absence of swelling, erythema, or pain. Tooth F exhibited slight mobility; E was stable. A space existed between teeth C and E. Tooth D was not clinically present. The remaining intraoral and extraoral examinations were within normal limits. Radiographic examination showed that Tooth D was present and impacted. (Figures 1 and 2) No other oral pathosis was noted. A panoramic radiograph showed Tooth D fully covered by bone. In addition the patient was missing both permanent maxillary lateral incisors, and the four second premolars. Radiographs at six months showed no changes in the impaction from the previous survey and that apart from the anomalies normal growth and development were occurring.

DISCUSSION

This highly unusual condition of primary impaction, also known as genuine or true impaction of a primary anterior tooth, has not been discussed in the dental literature. None of the etiologies or predispositions for this condition identified in the literature appears to apply in this case.

Reports of injury to the maxilla because of intubation following premature birth have been recorded and discussed, but are not a factor in this case. In addition the family is unable to recall any relative who has oligodontia in the primary or permanent dentition.

The child is otherwise physically normal, thus ruling out the ectodermal dysplasia and cleidocranial dysplasias, as well as other syndromes that exhibit impactions, delayed eruptions, or partial oligodontia. Cleft lip and palate and submucous cleft palate may also be associated with impacted primary and permanent teeth, although radiographic and clinical examinations of this child do not support these as possible etiologies. The parents reported that Tooth E had been dark for about nine to ten months, approximately age three years three months; and that Tooth F had been dark for about two months, approximately age three years ten months. Thus it is unlikely that trauma is the etiology for the impaction of Tooth D.

There is controversy regarding causal relationships between ankylosis and impaction. Due to the great difficulty in tracing periodontal ligaments around primary roots we cannot determine whether this tooth is ankylosed.

It is surmised that malposition of the tooth germ could be the cause of the impaction in this case. The tooth is impacted in a mesial angular direction, such as one sees with impacted premolars and third molars. Bianchi and Roccuzzo reported they could find only one case in the literature that describes a primary unerupted tooth not in its correct upright position. This case, then, would be only the second such case and the first involving an anterior tooth.

The case will be observed carefully to insure that there are no adverse sequelae such as cyst formation, or interference with developing succedaneous teeth. At the time of eruption of the maxillary permanent incisors, it will be determined what course needs to be taken with regards to the impacted primary lateral incisor. It is not expected that this tooth will erupt any

further because of its full-root development. It will most probably, at that point, be surgically removed in conjunction with the contralateral incisor as part of comprehensive treatment requiring orthodontic and prosthetic consultations.

CONCLUSION

An isolated case of an impacted primary incisor with agenesis of permanent lateral incisors and second premolars in a healthy four-year-old male is presented that does not correspond with any recorded syndromes described in the literature. Comprehensive treatment involving orthodontic and prosthetic management is planned.

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PRENATAL SMOKING AND CHILDREN'S INTELLIGENCE

If this association does represent a causal relationship, what specifically are the physiologic mechanisms through which smoking during pregnancy might lead to intellectual impairment? Tobacco smoke could influence the developing fetal nervous system by reducing oxygen and nutrient flow to the fetus. The vasoconstrictive effect of nicotine reduces uteroplacental circulation, which can lead to fetal hypoxia and reduced access to nutrients. Smoking also leads to fetal carboxyhemoglobin, which can contribute to fetal hypoxia. Cigarette smoke contains 2000 to 4000 chemical components that also may directly damage the developing nervous system.

Finally, cigarette smoking may affect maternal/fetal nutrition by increasing iron requirements and decreasing the availability of other nutrients such as vitamins B_{12} and C, folate, zinc, and amino acids.

The results of the current study add to the increasingly consistent evidence that maternal cigarette smoking during pregnancy poses a unique risk for neurodevelopmental impairment among children, and provide an additional reason for pregnant women not to smoke. A major public health question is whether it is possible to prevent this decline in children's intellectual functioning by helping women reduce their smoking and improve other health-related behaviors during pregnancy.

Olds, David L. *et al*: Intellectual impairment in children of women who smoke cigarettes during pregnancy. Pediatrics, 93:221-227, February 1994.

ABSTRACTS

Klingberg, Gunilla and Hwang, C. Philip: Children's dental fear picture test (CDFP) - a projective test for the assessment of child dental fear. J Dent Child, 61:89-96, March-April 1994.

A projective method, the Children's Dental Fear Picture test (CDFP), for measuring child dental fear was developed and tested for reliability in 146 Swedish children aged 5 to 12-years-old. The CDFP consists of three subtests: the Dental Setting Pictures (CDFP-DS), the Pointing Pictures (CDFP-PP), and a Sentence Completion test (CDFP-SC). Assessments of dental fear were made in each of the subtests as well as for the complete test (CDFP). Based on the assessments, the children were grouped into three categories: "fearful", "non fearful" and "uncertain". The proportion of agreements between assessments of subtests and final assessment (CDFP) varied from 77.4 percent to 89.0 percent. Interexaminer reliability was computed from 27 testings assessed separately by two trained dentists. Full agreement in the final assessments (CDFP) was found between the dentists in 88.9 percent of the testings, indicating that the CDFP is a reliable method for measuring child dental fear.

Dental fear, measurement; Projective method for measurement

Skinner, Mark F.; Hadaway, William; Dickie, Jeannie: Effects of ethnicity and birth month on localized enamel hypoplasia of the primary canine. J Dent Child, 61:109-113, March-April 1994.

Localized enamel hypoplasia of the primary canine (LHPC) is produced by a different mechanism from that causing linear enamel hypoplasia, and yet contributes disproportionately to epidemiological studies of enamel hypoplasia in childhood that do not separate the two etiological types. LHPC results from impact, probably self-inflicted by infants mouthing objects, to the unerupted primary canine crown through abnormally fenestrated cortical bone overlying the crypt. Examination of the primary teeth of ninety-six children whose mothers were enrolled in the Healthiest Babies Possible Program in Vancouver showed an average prevalence of 31 percent with LHPC (ranging from 19 percent in Vietnamese Canadians to 56 percent among Indocanadians). This is much higher than previously reported for unselected samples from Vancouver, but equivalent to studies in the USA. Mean hours of sunshine in the birth month of children with LHPC is 141.7 hours and those without is 169.4 hours; the difference is statistically significant ($p = .0383$). Seasonal increase in food costs and reduced availability of fresh foods containing vitamin A are thought to contribute to facial osteopenia predisposing the infant to LHPC.

Enamel hypoplasia, canines; Bone metabolism; Vitamin A; Ethnicity; Infants

Valdez, Ingrid H.; Pizzo, Philip A.; Atkinson, Jane C.: Oral health of pediatric AIDS patients: A hospital-based study. J Dent Child, 61:114-118, March-April 1994.

The prevalence of acquired immunodeficiency syndrome (AIDS) is steadily increasing among American children. The dental needs of these patients are significant. This study evaluated the oral health of forty children being treated for HIV-infection at the National Institutes of Health (NIH). Eight of twenty-two patients in primary dentition (36 percent) had baby bottle tooth decay (BBTD). These cases required extensive dental restoration usually under general anesthesia. Tooth development was delayed in 31 percent of patients. Candidiasis was the most common soft tissue abnormality, found in 35 percent of children. Preventive and therapeutic dental programs should be instituted to meet the special needs of pediatric AIDS patients.

Pediatric AIDS; HIV infection; Oral health; Candidiasis

Melamed, Yair; Harnik, Joel; Becker, Adrian; Shapira, Joseph: Conservative multidisciplinary treatment approach in an unusual odontodysplasia. J Dent Child, 61:119-124, March-April 1994.

An unusual case of odontodysplasia is presented, involving both primary and permanent dentition, with oligodontia of permanent teeth and hypoplasia, taurodontism and incomplete eruption of a first permanent molar. In order to improve the patient's appearance, occlusion and function, his intra- and inter-arch relationships were altered. To accomplish this, a multidisciplinary treatment approach was adopted, involving restorative and prosthetic treatments by a pediatric dentist, accompanied by periodontal surgery, endodontics and orthodontics.

Odontodysplasia; Treatment; Rapid maxillary expansion

Bimstein, Enrique and Garcia-Godoy, Franklin: The significance of age, proximal caries, gingival inflammation, probing depths and the loss of lamina dura in the diagnosis of alveolar bone loss in the primary molars. J Dent Child, 61:125-128, March-April 1994.

This study examined the significance of age and clinical factors on the diagnosis of alveolar bone loss (ABL) as evidenced by increased cementoenamel junction (CEJ) - alveolar bone crest (ABC) distances. The CEJ-ABC for the first and second primary molars were 0.97 ± 0.3 mm and 0.78 ± 0.3 mm, respectively. Age correlated significantly with the means CEJ-ABC per patient and second primary molars. Correlations between probing depths and CEJ-ABC were not significant. Analysis of variance indicated significant differ-

continued on page 149

ABSTRACTS *continued from page 82*

ences between CEJ-ABC grouped by presence/absence of proximal contact, presence/absence of lamina dura and proximal contact, presence/absence of lamina dura and proximal caries severity (PCS). Differences in the CEJ-ABC grouped by gender and gingival index (GI) were not significant. When considering the effect of age PCS or GI when controlling for the other factors (Multiple regression analysis) age and PCS had a significant effect on the CEJ-ABC. Proximal contact loss or lack of lamina dura may relate to ABL in the primary molars.

Alveolar bone loss; Patient age; Proximal caries; Gingival inflammation; Lamina dura

Waldman, H. Barry: Almost twenty million chronically ill children. J Dent Child, 61:129-133, March-April 1994.

Almost one-third of all children are affected by chronic conditions. National Health Interview Survey reports provide a general overview for pediatric dental practitioners. A summary of many of the findings is provided.

Chronic illness in children; National Health Interview Survey

Waldman, H. Barry: Only a small fraction of our health care dollar is spent on children. J Dent Child, 61:134-140, March-April 1994.

A review is provided of various federal agency and child interest group studies, which report that compared to the older age population, there are limited expenditures for the general and dental health services for our children.

Health care expenditures; Children

Breen, Gary H. and Addante, Rocco: A recurrent traumatic bone cyst: Report of case. J Dent Child, 61:141-145, March-April 1994.

The traumatic bone cyst (TBC) is commonly reported on in the dental and medical literature. The lesion is discovered most often, as an incidental finding during intraoral or panoramic radiographic examination. Conservative treatment in the form of needle aspiration or surgical exploration and curettage is generally considered curative as well as diagnostic for the TBC. Some authors suggest that the TBC is a self-limiting entity, as it is rarely seen in patients older than thirty-five years of age.

There are very few reports in the literature documenting recurrent TBCs. The patient reported on had a TBC measuring 1.5 cm. treated by surgical curettage in July 1981. There was no clinical or radiographic follow-up for eight years. When the patient presented for an initial examination in July of 1989, the recurrent lesion increased in size to 7cm x 4cm. Retreatment by surgical curettage established a diagnosis consistent with a TBC, and also produced impressive radiographic healing 3.5 years postoperatively. Because of the ability of the TBC to recur, long clinical and radiographic follow-up is recommended.

Traumatic bone cyst; Aspiration; Curettage; Retreatment

Lambert, Michael and Rothman, David L.: Unusual impaction of a primary lateral incisor. J Dent Child, 61:146-148, March-April 1994.

Impactions in the primary dentition are rare and usually are found in the posterior regions. They tend to be asymptomatic and are found on routine radiographic examination when the patient is in the mixed dentition or permanent dentition stage. A literature review shows no reports of impactions of primary incisors, but there is mention of possible etiologies for anterior impactions.

An impacted lateral primary maxillary incisor was identified during routine radiographic examination of a young child. There is no known etiology for this particular case. Treatment options are discussed.

Impacted primary incisor; Treatment options

Thomas, George P. and Grimm, Stephen E.: Lowe's syndrome: Review of literature and report of case. J Dent Child, 61:68-70, January-February 1994.

A report of a ten-year-old child with Lowe's syndrome is presented. The oral findings include crowding, delay of eruption, over-retained primary teeth, constricted palate and taurodontism of the molars. Although there are several cases in the medical literature, this is the first case in which the dental features are described in detail.

Lowe's syndrome; Literature review

Dental electronic anesthesia for children: Technique and report of 45 cases

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Electronic anesthesia in dentistry has created much interest in the last few years.[1-8] The concept is not new. Known also as transcutaneous electronic nerve stimulation, electronic anesthesia has been used in medicine and dentistry for years, to alter sensory perception of pain stimulation.

Electronic anesthesia involves application of electric current that loads the nerve stimulation pathways to the extent that pain stimulus is blocked. This is known as the "Gate Control Theory" and was introduced by Melzack and Wall.[9] Other theories of the cause of pain-control with electronic anesthesia include the release of endorphins and serotonin. The complete mechanism of pain reduction using electronic anesthesia is not completely understood, but multiple factors undoubtedly play roles in the phenomenon.

3M Company, Dental Products Division, has introduced an electronic anesthesia device that simplifies application of electronic anesthesia for pain control during dental procedures. The 3M Dental Electronic Anesthesia System (8670) is slightly larger than a deck of playing cards, and is powered by a standard 9-volt battery (Figure 1). The electronic pulse generator has variable pulse width and rate controls, and a large knob with which the dentist, assistant, or patient can control the pulse amplitude. For standard operation in children the mode switch is set at "C" (Conventional) the wave rate (R) is set at 140, and wave width (W) at 250.

Unlike some other dental electronic anesthesia systems that used intraoral electrodes, the 3M device uses external electrode pads, that adhere to the skin surface

Figure 1. The 3M Dental Electronic Anesthesia System (8670) is shown. The large outside knobs are amplitude controls, and the small inside knobs control pulse rate and pulse width. Lead wires are connected to the unit on the left. Manufacturer's description of all controls should be studied carefully before use.

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Figure 2. This four-year old demonstrates bilateral infraorbital electrode pad placement.

Figure 3. Unilateral maxillary pad placement is shown. The pads should be placed at least 1 cm apart.

Figure 4. Bilateral mental (mandibular) pad placement is shown.

Figure 5. Unilateral mandibular pad placement is shown, with No. 8A rubber dam retainer placed on a permanent first molar.

Figure 6. This four-year old girl had primary molar restorations using electronic anesthesia supplemented with N_2O-O_2 inhalation and music with earphones from a cassette player. Treatment was completed with no complaints and the patient fell asleep.

Figure 7. The dental assistant explains electronic anesthesia to a young patient, using a pleasant photograph of a smiling face with electrode pads in place.

of the face. Various pad placements are shown in Figures 2-6.

One purpose of this paper is to describe a step-by-step procedure for using electronic anesthesia for dental treatment in children. In some instances, electronic anesthesia can be combined with the use of nitrous-oxide/oxygen inhalation-relaxation methods, auditory diversion via music and earphones, or low dosage local anesthetic injection for best results. In this regard, it is noted that electronic anesthesia need not be used alone; it can be used as an adjunct to other pain control methods.

Our other purpose is to report our experiences treating forty-five youngsters with electronic anesthesia for various dental procedures.

TECHNIQUE

Electronic anesthesia using the 3M Dental Electronic Anesthesia System 8670 is used as follows:

- ☐ After explaining the procedure to the parent or guardian and obtaining consent for treatment, the child is shown a photograph of a patient with the electrode pads adhering to the face (Figure 7). A brief and simple explanation then follows about how the pictured person "has stickers on her face, which make the skin tingle when the little battery is turned on. The feeling is sort of like when your foot goes to sleep." This approach is variable and can be altered depending on the personal approach of the dentist and assistant treating the patient.
- ☐ Determination of electrode pad placement is then made, depending on treatment to be performed. In the pictured example (Figures 8-16), bilateral mental pads will be placed.
- ☐ The site of pad placement is gently swabbed with isopropyl alcohol to remove any skin oils or substance that may interfere with current flow (Figure 8).

Figure 8. Electrode pad site is cleaned of skin oil with an isopropyl alcohol sponge.

Figure 9. With the mouth open, to simulate treatment position, the pad is placed.

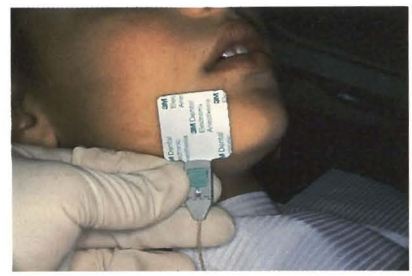

Figure 10. The main slide-connector (green) is slid into place and locked in position.

Figure 11. The contralateral electrode pad is placed in the same manner, and the brown slide-connector is attached.

Figure 12. The dental assistant explains the amplitude control knob to this nine-year old. Younger patients should be assisted with the amplitude control or the dentist or assistant should operate the knob.

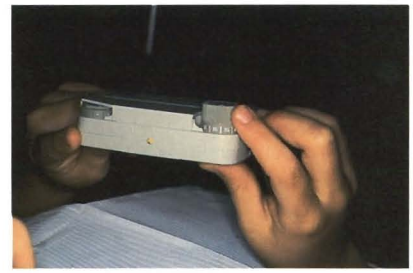

Figure 13. For most dental restorative procedures, the amplitude control knob reaches a setting of between 10 and 20. Some treatment, with some patients, can be performed with a setting as low as 10, but muscular fasciculation should be seen, as a sign of reaching minimum therapeutic dose level.

☐ The patient is instructed to open the mouth wide. This mouth opening will approximate the skin position during the dental procedure (Figure 9). The pad is then placed with the projection for lead attachment angled toward the posterior (Figure 9).

☐ The green slide-connector is then attached and locked into position on the treatment side of the face, if bilateral pads are used (Figure 10). If pads are placed unilaterally, the green lead is attached to the pad over the infraorbital nerve region or the mental nerve region, depending on whether maxillary or mandibular procedures are to be performed. The second pad is then placed contralaterally, or in the case of unilateral pad placement, the second pad is placed on the skin surface over the tooth to be treated. The brown slide-connector is then attached and locked into place on the second pad (Figure 11).

☐ The dental assistant or the dentist then describes to the patient the use of the amplitude knob and the effect the current will have in the region of pad placement (Figure 12). For younger children, and children who cannot reliably manipulate the amplitude knob, the dentist or assistant should make adjustments while discussing with the patient the sensation being experienced.

☐ It is our experience that facial muscular fasciculation starts to occur in most children at an amplitude knob setting of about 10. Muscle fasciculation is a sign of reaching the minimal therapeutic level. After reaching this level, the patient or patient/operator can increase the amplitude to "dial out" any discomfort. Most children attain enough electronic anesthesia for restorative procedures at setting between 10 and 20 (Figure 13), within 3-5 minutes.

Figure 14. The assistant is monitoring the patient's use of the amplitude control and explaining muscular fasciculation to the child. Many children are amused by the tingling sensation and the muscular fasciculations.

Figure 15. A patient mirror can be used to show the patient how electronic anesthesia affects some of the facial muscles.

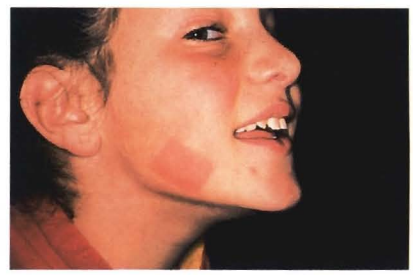

Figure 16. A transient red mark at the site of electrode pad placement is seen after removal of the pad. It is important to explain to children and their parents that this harmless red mark results from increased blood circulation and will disappear within fifteen to twenty minutes.

- ☐ With children who adjust the amplitude knob, care must be taken to assure that the assistant or dentist's instructions are followed. Rapid increase in the amplitude knob setting will not cause tissue damage, but can cause acute discomfort. Some children find the tingling sensation of the current, and the resultant muscular fasciculation, amusing (Figure 14).
- ☐ A facial mirror is helpful to permit the child to observe muscular fasciculation and their own facial appearance during electronic anesthesia procedures (Figure 15). After treatment is completed, the amplitude knob is turned off completely, electrode leads are detached and the pads removed from the face.
- ☐ Because the electric current increases blood circulation transiently in the region of electrode placement, red skin marking appears at the site of pad placement. The redness is of no consequence and disappears within fifteen minutes (Figure 16).

OBSERVATIONS IN FORTY-FIVE CASES OF ELECTRONIC ANESTHESIA FOR CHILDREN

The table summarizes treatment for forty-five young dental patients all of whom had electronic anesthesia as their primary source of pain control. Because there are so many variables pertaining to behavior management and pain control during dental procedures, our observations are presented without subjection to statistical analysis. We feel that the personality of the dentist and the personality of the patient, use of nitrous-oxide/oxygen relaxation methods, use of auditory diversion by music with personal earphones for the patient, individual pain threshold, and numerous other factors make analysis of the efficacy of electronic anesthesia somewhat subjective. Even a decision as to when electronic anesthesia should be abandoned, and local anesthetic injections should be used is left to the judgment and experience of the treating dentist. Electronic anesthesia doesn't actually fail, it is just abandoned when the clinician decides to resort to additional pain control methods. It is interesting to consider that in our cases in which local anesthetic was eventually used, the electronic anesthesia did serve as a pain controlling mechanism for the injections.

DISCUSSION

We have used electronic anesthesia with the 3M Dental Electronic Anesthesia System (8670) for the following procedures:

- ☐ To decrease discomfort from local anesthetic injections.
- ☐ Placement of bonded resin sealants on permanent first molars in which a rubber dam retainer was placed on the treated tooth and rubber dam isolation was used.
- ☐ Class I, Class II, Class III, Class V light-hardened glass ionomer/resin restorations of primary teeth.
- ☐ Preventive resin restorations in permanent molars, premolars, and lateral incisors.
- ☐ Class I, Class II, Class III, Class IV, and Class V composite resin and light-hardened glass ionomer/resin restorations in permanent teeth.

Table ☐ The treatment histories of forty-five patients, using electronic anesthesia.

322 Patient	Age	Procedure	Electrode Pad Placement	Amplitude Control	Contributing Factors	Result
1-JR	8-11/12	occlusal LHGI/R* restorations, teeth K and L	bilateral mental	dentist	Anxious patient who "hated shots." Rubber dam retainer on tooth K.	treatment completed, no patient complaints
2-EH	3-11/12	occlusal LHGI/R restoration, tooth A	bilateral mental	dentist	No rubber danm used. Patient was afraid of noise from dental handpiece.	treatment completed, no patient complaints
3-RM	4-2/12	occlusal LHGI/R restorations, teeth S and T	bilateral mental	dentist/ assistant	Patient anxious and fidgety. Rubber dam with retainer used. Patient reacted to noise of handpiece, placement of dam retainer, and tooth preparation.	treatment completed, patient somewhat uncomfortable
4-SA	6-6/12	buccal LHGI/R restoration, tooth T; stainless steel crown, tooth S	bilateral mental	dentist	Very anxious patient. Retraction cord for tooth T was uncomfortable. Patient fidgety in chair.	EA abandoned, used N_2O-O_2 and local anesthesia
5-GG	8	mesial and distal trimming of teeth M and R (enamel and dentin cutting)	bilateral mental	patient	Cooperative patient, no anxiety.	Treatment completed, no patient complaints
6-JF	4-6/12	facial composite resin, teeth E & F	bilateral infraorbital	dentist	Patient was very apprehensive and fidgety throughout treatment session.	treatment completed, young patient could not report if he had any discomfort
7-AH	3-7/12	facial LHGI/R restoration, tooth M	bilateral mental	dentist	Excellent cooperation.	treatment completed, no patient complaints
8-RK	6-3/12	occlusal LHGI/R restoration, tooth K	bilateral mental	dentist	Patient became very anxious, handpiece noise scared her.	EA abandoned, required N_2O-O_2 and local anesthesia for treatment
9-VK	10-11/12	occlusal and buccal composite resin restoration, tooth No. 19	unilateral mandibular	dentist/ patient	No. 8A rubber dam retainer used on tooth No. 19. Patient said, "Much better than being numb."	treatment completed, no patient complaints
10-AF	6-8/12	occlusal preventive resin restorations teeth 19 and 30 and occlusal LHGI/R restoration tooth K	unilateral mandibular	dentist/ patient	No. 8A rubber dam retainer used on treated teeth.	treatment completed, no patient complaints
11-JW	17-11/12	LHGI/R restorations, Class V teeth No. 20 and No. 28	bilateral mental	patient	Retraction cord placed for both restorations. Patient had past experience with anesthetic injections, enthusiastically preferred EA.	treatment completed, no patient complaints
12-TH	7-1/12	bonded resin sealant, tooth No. 19	unilateral mandibular	dentist/ patient	No. 8A rubber dam retainer placed on tooth No. 19. Copious salivary flow, controlled with rubber dam and cotton rolls.	treatment completed, no patient complaints
13-DD	7-4/12	occlusal and buccal preventive resin restorations, tooth No. 30	unilateral mandibular	dentist/ patient	No. 8A rubber dam retainer placed on treated tooth. Child was fidgety but enjoyed the novelty of EA. Dentist was surprised by good results from this case.	treatment completed, no patient complaints
14-PS	11-5/12	buccal LHGI/R restoration, tooth No. 18	unilateral mandibular	patient	No rubber dam used. Patient was anxious, but cooperative and has used N_2O-O_2 and xylocane in the past. Stated preference for EA.	treatment completed, no patient complaints
15-BB	7-1/12	occlusal and buccal preventive resin restorations, tooth No. 30	unilateral mandibular	dentist	N_2O-O_2 was used with EA. Patient had much anxiety and could not tolerate placement of the rubber dam retainer.	EA abandoned, local anesthetic and N_2O-O_2 used successfully
16-RR	7-5/12	occlusal preventive resin restoration, tooth No. 19	bilateral mental	dentist/ patient	No. 8A rubber dam retainer used on treated tooth. Patient stated preference for EA, after treatment was completed.	treatment completed, no patient complaints
17-SG	6-6/12	occlusal preventive resin restoration, tooth No. 19	bilateral mental	dentist	Patient could not tolerate placement of rubber dam retainer and became upset over the tingling sensation of EA.	EA abandoned, local anesthetic used successfully
18-MH	12-7/12	occlusal preventive resin restoration, tooth No. 2	unilateral infraorbital	patient	Partially erupted tooth, rubber dam could not be used. Patient tolerated preparation well until deep dentinal penetration.	EA abandoned, local anesthetic used successfully
19-CD	5-5/12	occlusal LHGI/R restoration, tooth L	bilateral mental	dentist	Patient could not tolerate rubber dam retainer placement, but tooth L was restored comfortably without the rubber dam.	treatment completed, no patient complaints
20-AK	8-6/12	disto-occlusal LHGI/R restorations, teeth B and S	bilateral mental and bilateral infraorbital	dentist	No. 8A rubber dam retainer used on primary second molars adjacent to treated teeth. No discomfort noted during rubber dam placement, or placement of matrix strips or wooden wedges.	treatment completed, no patient complaints
21-KW	7-11/12	dentin and enamel axial disking, teeth M and R	bilateral mental	patient	Teeth M and R disked subgingivally with no observable discomfort.	treatment completed, no patient complaints
22-AD	6-3/12	occlusal preventive resin restorations, teeth No. 19 and No. 30	bilateral mental	dentist/ patient	No. 8A rubber dam retainer used on tooth No. 30 with no discomfort noted, but patient could not tolerate the rubber dam placement for tooth No. 19.	treatment completed for tooth No. 30 with no complaints, but tooth No. 19 required local anesthetic with N_2O-O_2
23-AD	7-10/12	extraction of resorbing teeth N and Q	bilateral mental	dentist	Roots of teeth N and Q half resorbed. Patient could not tolerate forceps manipulation of the teeth.	EA abandoned, local anesthesia used successfully

Table ☐ Continued.

322 Patient	Age	Procedure	Electrode Pad Placement	Amplitude Control	Contributing Factors	Result
24-SC	5-11/12	lingual Class V LHGI/R restoration, tooth A	unilateral infraorbital	dentist	Retraction cord placed to expose lingual lesion, tooth A. Very anxious patient, but enjoyed the tingling sensation of EA. Patient very pleased that no injections were required.	treatment completed, no patient complaints
25-RL	4-4/12	buccal LHGI/R restorations teeth K and T and occlusal LHGI/R restorations teeth A and J	bilateral mental	dentist	No rubber dam used in hopes of avoiding patient's active gag reflex.	treatment completed, no patient complaints
26-RR	11-10/12	lingual LHGI/R restoration, tooth No. 7	bilateral infraorbital	patient	Very anxious patient who reportedly "hated needles." Carious lesion penetrated deeply into dentin. Surprising result for the dentist.	treatment completed, no patient complaints
27-TG	8-8/12	occlusal preventive resin restorations, teeth No. 19 and 30	unilateral for each tooth treated	dentist/ patient	No. 8A rubber dam retainer used on treated teeth. Patient extremely anxious. Patient could not tolerate rubber dam clamp on tooth No. 30.	treatment completed for tooth No. 19, no patient complaints; EA abandoned for tooth No. 30
28-LP	4-4/12	occlusal LHGI/R restorations teeth K, T, S and L	bilateral mental	dentist	No. 8A rubber dam retainer used on teeth K and T. Patient also had N_2O-O_2 and music diversion by earphones.	treatment completed, no patient complaints, patient fell asleep
29-AB	6-4/12	disto-occlusal LHGI/R restorations teeth B and I	bilateral infraorbital	dentist/ patient	Patient anxious and fidgety, could not tolerate noise from handpiece or bur cutting of the teeth.	EA abandoned, local anesthetic used
30-KR	8	extractions, teeth N and Q (roots one half resorbed, but neither tooth mobile)	bilateral mental	patient	Patient said she enjoyed the tingling sensation (investigators' note: more bleeding was evident from sockets than if local anesthetic with vasoconstrictor had been used).	treatment completed, no patient complaints
31-DT	7-11/12	occlusal preventive resin restorations teeth No. 19 and 30	bilateral mental	dentist/ patient	No. 8A rubber dam retainer used on treated teeth. Investigator was surprised at result because bilateral mental pad placement was used rather than unilateral.	treatment completed, no patient complaints
32-BS	13	lingual pit preventive resin restoration tooth No. 10	bilateral infraorbital	patient	patient eager to avoid injection.	treatment completed, no patient complaints
33-ER	7-10/12	facial Class V LHGI/R restoration tooth R	bilateral mental	dentist/ patient	Retraction cord placed in sulcus. No reaction from patient.	treatment completed, no patient complaints
34-KR	4-2/12	large bucco-occlusal LHGI/R restoration tooth T	bilateral mental	dentist	No. 8A rubber dam retainer used on treated teeth.	treatment completed, no patient complaints
35-SL	5-11/12	extraction of tooth N	bilateral mental	dentist	Root of tooth one half resorbed but tooth not mobile, patient bled more than with local anesthesia but bleeding controlled with cotton gauze within 5 minutes.	treatment completed, no patient complaints
36-AH	12-7/12	extraction of tooth C	bilateral infraorbital	patient	Root of tooth C one half resorbed.	treatment completed, no patient complaints
37-MS	5-1/12	occlusal LHGI/R restoration tooth K		dentist	No. 8A rubber dam retainer placed on treated tooth.	treatment completed, no patient complaints
38-SP	11-4/12	extraction of tooth J	bilateral infraorbital	patient	Tooth J not mobile, but root about 3/4 resorbed. Underlying premolar erupting into position.	treatment completed, no patient complaints
39-SB	7-5/12	tooth Q extracted	bilateral mental	dentist	Root of tooth Q one half resorbed but tooth not mobile.	treatment completed, no patient complaints
40-CC	3-8/12	occlusal and buccal LHGI/R restorations tooth K	bilateral mental	dentist	Patient could not tolerate placement of No. 8A rubber dam retainer. However, tooth treated without rubber dam and with the use of N_2O-O_2 relaxation.	treatment completed, using EA and N_2O-O_2
41-ME	6-6/12	extraction of teeth N & Q	bilateral mental	dentist	Roots of teeth N & Q half resorbed. Patient disliked tingling sensation and had acute pain on manipulation of extraction forceps. EA used to give local anesthetic injection.	EA abandoned, local anesthetic used
42-BG	7-8/12	occlusal and buccal preventive resin restoration tooth No. 30	unilateral right mandibular	patient	No. 8A rubber dam retainer used on treated tooth.	treatment completed, no patient complaints
43-LM	9-11/12	extraction of teeth C & H facial composite resin restoration tooth No. 10	bilateral infraorbital	patient	Patient extremely anxious but eager to avoid injection. She took to EA method very quickly and both patient and investigator were surprised at the result.	treatment completed, no patient complaints
44-ET	7-9/12	bonded resin sealant tooth No. 19 and occlusal preventive resin restorations teeth T and No. 30	unilateral mandibular on each side	patient	No. 8A rubber dam retainer used on both sides of the mouth. Patient was both calmed and amused by tingling sensation.	treatment completed, no patient complaints
45-DW	6-4/12	occlusal LHGI/R restoration tooth T and disto-occlusal LHGI/R tooth S	bilateral mental	dentist/ patient	Patient tolerated placement of No. 8A rubber dam retainer, but could not tolerate bur cutting with the handpiece.	EA abandoned, N_2O-O_2 and local anesthetic used

*Light-hardened glass ionomer/resin cement restoration[10,11]

- ☐ Extraction of primary teeth with at least one half root resorption.
- ☐ Disking enamel and dentin of primary teeth to assist in dental arch alignment. This includes subgingival cutting.
- ☐ Orthodontic band seating and space maintainer cementation.
- ☐ Placement of retraction cord to aid in placing Class V restorations.

The senior author has not attempted electronic anesthesia alone, for primary molar pulpotomy or restoration with preformed stainless steel crowns. Nor has an attempt been made to extract the primary teeth with minimal or no root resorption. Along with some doubt as to whether the anesthesia produced with the electronic anesthesia unit would be sufficient for such procedures, there is concern about hemostasis which is greatly augmented with the vasoconstrictors contained in local anesthetic solutions.

Based on our success with electronic anesthesia in thirty-eight out of forty-five children in our clinical study, we have continued our clinical use of the method with approximately 300 other children. Based on all of this work we are able to make the following general observations:

- ☐ Electronic anesthesia can be used for the cooperative child and the anxious, but cooperative patient as young as three years of age. It is not a workable method for uncooperative children or uncooperative anxious children.
- ☐ In anxious, but cooperative children, electronic anesthesia can be supplemented with nitrous oxide/oxygen inhalation relaxation and/or auditory diversion methods, using a tape cassette and earphones and music of the patient's choice. In patients for whom the tingling sensation of the electrical current is uncomfortable or annoying, or for those for whom the electronic anesthesia current does not provide sufficient anesthesia for the particular procedure, the electronic anesthesia does provide an excellent means of decreasing the pain of a local anesthetic needle injection.
- ☐ Bilateral pad placement over either the respective mental foramina or the two infraorbital regions usually supplies enough anesthetic reaction for restorative procedures on primary teeth. If one wishes to place a rubber dam retainer and do a bur-cut preparation on a first permanent molar, however, electrode pad placement should be the green slide-connector placed over the infraorbital region or mental foramen of the side being treated, with the brown slide-connector in the region of the ipsilateral first permanent molar (Figures 3 and 5). Premolar teeth can be restored with bilateral electrode pad placement.
- ☐ Both parents and children who are doubtful about this "new" method for dental treatment are relieved and much more trusting once they visualize a photograph of a smiling patient with the leads and electrode pads adhering to the face. Further assurance can be given such patients by opening the electronic anesthesia device and showing them the relatively innocuous 9-volt "radio" battery within. The manufacturer's pamphlet picturing a pleasant face with electronic anesthesia pads and leads attached has proved to be quite useful. Another such pamphlet with a child's picture should be produced.
- ☐ It is important for the dentist or assistant to explain to the patient and parent that the red marks left on the face after removal of the electrode pad are due to a transient increase in blood flow, and are not electrical burns. Several parents queried us in that regard.
- ☐ Most children eight years old and under should not be permitted to use the amplitude control without assistance from the dentist or chairside dental assistant. Some younger children out of curiosity may increase the amplitude control at a rapid rate causing a painful, although harmless, electrical shock. The senior author (TPC) had two episodes such as this with children treated subsequently to the study.
- ☐ Electronic anesthesia used as described in this paper is not to be considered a substitute for all other methods of pain modification and pain control. Electronic anesthesia should be viewed for use in children as an adjunctive option, which in certain cases can be used alone, and in other cases in conjunction with nitrous oxide/oxygen relaxation methods, auditory diversion with music, or to complement traditional local anesthetic needle injection procedures.
- ☐ Some patients receiving electronic anesthesia for treatment of teeth in the mandibular arch appear to have increased salivary flow. We have found that even using a rubber dam with such patients, additional aspiration procedures are needed to control the moisture. Use of cotton rolls in the vestibular region and sublingually are also helpful. The effect of electronic anesthesia on salivary flow should be investigated. Even if electronic

anesthesia is used, the clinician can consider using some amount of local anesthetic with vasoconstrictor for dental treatment that will cause bleeding. For patient comfort and practicality, hemostasis is much better achieved with vasoconstrictor in the tissues for certain procedures.

- ☐ Nonmetallic instruments should be used when contacting mucosa internal to electrode pad placement. Contact of a metal instrument in those regions can result in a shock to the patient.

Besides our observations, the manufacturer has noted that there are medical contraindications to the use of electronic anesthesia. According to 3M Company, electronic anesthesia should not be used for patients with any of the following medical conditions:

- ☐ Patients with a demand pacemaker or cochlear implant.
- ☐ Heart disease.
- ☐ Seizure disorders or cerebrovascular disease.
- ☐ Pregnancy.
- ☐ Undiagnosed dental pain.
- ☐ Brain tumor.
- ☐ Neurological disorders involving the head and neck (For example Bell's Palsy, Trigeminal and Postherpetic Neuralgia, Multiple Sclerosis, or Tourette's syndrome).
- ☐ Patients with skin lesions or abrasions of the face.
- ☐ Patients with abnormal bruising or bleeding disorder.

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COMPARISON OF GLASS-IONOMER AND RESIN-BASED FISSURE SEALANTS

In recent years, the interest in the use of glass-ionomer materials as fissure sealants has increased. The aim of this study was to compare the retention and caries-preventive effect of glass-ionomer (Fuji III) and resin-based light-cured (Delton) fissure sealants. Three health center dentists applied the sealants to 166 children; glass-ionomer sealants on one side and resin-based sealants on the contralateral side of the mouth. After 2 yr, one pair of molar teeth in the mouths of 151 children was compared. Twenty-six percent of glass-ionomer and 82% of resin-based sealants were totally present ($P<0.001$). During the 2 yr, in both groups 4.6% of the sealed surfaces became carious. The results show that the retention of glass-ionomer sealants is markedly inferior to the resin-based sealants. In this study, however, no difference in caries increment on the sealed surfaces was observed. This may be due to the different mechanism of caries prevention for the sealant materials, or to the overall low caries activity of the participants.

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Community Dent Oral Epidemiol, 22:21–24, February 1994.

Treating fearful children: Does a parent's view of the child's fear change?

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Much research has been conducted on the relation between children's fear of the dentist and their parents' attitude toward dental care. The results of this research are well known.[1-3] The studies involve reports by parents (generally mothers) indicating that the mother's opinion about the degree of her child's fear of dental treatment has a correlation with the behavior of the child during treatment; and indicating, furthermore, that the child shows more anxiety, if the mother herself fears dental treatment.[4-6] This finding is supported by other studies: surveys conducted among adults with dental anxiety reveal that these people often recall that their mothers were afraid of the dentist.[5,7] A causal link does not necessarily follow from these relationships, but it can be assumed, nevertheless, that parents, or at least mothers, are among the determinants of their child's dental anxiety.[8] Recent research shows that the parents of highly anxious children, who have been referred to specialists because they are unmanageable, do not describe themselves as fearful of the dentist, but personally are unable to do anything about the child's anxiety.

Consequently, they view the dentist as the principle provocation of their child's anxiety.[2] These results support those of previous research involving younger children (four to six years old), in which parents ascribe the source of their child's anxiety to the dentist, while the dentist ascribes the source to the parents.[3]

The extent to which the attitude of parents is likely to change when a child is treated for his or her anxiety has not yet been researched: do parents recognize that their child has become less fearful of the dentist after a period of treatment? If the tension and frustration of an aborted treatment resulting in a referral have disappeared, do they think differently about their child's anxiety, or their own? Are they likely to be better able to prepare their child for a visit to the dentist? Lastly, to what extent can a connection be made between parents' own views and expectations and the actual, measured degree of anxiety the child experiences during treatment? This article, based on research among parents of a group of highly anxious children two years after their first referral and after their course of treatment ended, attempts to pass judgement on these issues.

MATERIALS AND METHODS

The survey was conducted among the parents of fifty-two children, ages between six and eleven years old, who were referred to the Department of Paediatric Dentistry of the Academic Centre for Dentistry in Amsterdam (ACTA), because regular treatment was not

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possible.[2,9,10] The children were selected during a screening visit by a dentist who did not take part in the actual treatment. Selection criteria included a sufficiently high degree of anxiety and stage of mental development. The survey was part of a larger project on the fear of dental treatment in children.[10,11] For a further description of this study, we refer to articles published earlier.[2,9] Before beginning the first treatment, the parents were asked to fill in a questionnaire (Q1), which was anonymous and consisted of thirty-eight statements. Aside from basic information, questions were asked about the child's disposition to anxiety, causes of dental anxiety and the nature and character of the child. For each, the respondent could choose a number between 1 and 5, according to the extent of his/her agreement with the statement.

After the treatment was completed, the child was seen for regular (six-month) check-ups. In cases where curative work was necessary, the child was treated. Curative work was usually necessary one year after the first course of treatment had been ended. After this treatment session(s) the study ended and the patient was referred once again to the private dentist. In the end, all the parents were sent a second questionnaire (Q2), containing the same thirty-eight items. Of the fifty-two questionnaires, thirty-seven were returned. Some of the children's patient records were inactive for a period of time, decreasing, therefore, the chances for contacting their parents through existing addresses.

Of the surveys returned, thirty could be paired with the first questionnaire, based on personal information provided on the first page. By comparing the thirty questions from Q2 with the corresponding questionnaires from Q1, it was possible to examine the differences in opinion among parents more closely.

Finally, anxious behavior by children as monitored by video and scored according to Venham's scale was linked with the answers on the item level from these thirty first and second questionnaires.[2,10,11] The questions were compared with the anxiety scores from the first treatment session as well as average anxiety scores.

In order to assess possible connections between the children's anxiety levels during treatment and their parents' responses on the questionnaires, correlations were calculated according to item level. The correlations were calculated using the first questionnaire before the treatment, as well as with the second questionnaire, after treatment. The results were analyzed using SPSS.[12]

RESULTS

Comparison of the results on the item level of the identified thirty questionnaires from Q1 with the remaining twenty-two from Q1 showed no significant differences (t-test, $p \leq 0.05$). In addition the scored behavior from the video of the thirty children from whom questionnaires had been returned was compared to the remaining twenty-two. No significant differences in anxiety scores between the two groups were found (t-test, $p \leq 0.05$). The thirty linked lists of questions are, therefore, a representative sample of the original group. The number of replies (thirty) represents a unique group from which conclusions can be drawn.

As shown in Table 1, parents recognize that their child's anxiety about dental treatment has changed. The parents indicate that a significant decrease has become evident in:

- ☐ The fear for the dental treatment itself.
- ☐ The comparison of this fear with a fear of the doctor.
- ☐ Comparison to the fear felt by other children of the same age.

The correlation between measurements taken before and after treatment, however, appeared low (.19, .21, and .50 respectively). No change in the parents' personal anxiety about dental treatment has been registered.

Tables 2 and 3 show the extent to which other changes in the child are recognizable. The parents report nothing remarkable, however, beyond the decrease in anxiety for the dentist: no more natural fear, not easily

Table 1. ☐ Fear of the dentist. Shown are the mean scores (1 = not at all, 5 = very much) before initial treatment (BT) and after the second curative period, approximately two years later (AT).

	BT		AT		
	X	s.d.	X	s.d.	p*
Child afraid of the dentist	4.3	1.1	2.5	1.4	.000
Child more afraid of the dentist than of the doctor?	3.9	1.4	2.9	1.6	.001
Child more afraid of the dentist than other children of same age?	3.7	1.1	2.8	1.4	.005
Parent afraid of the dentist?	2.2	1.3	2.5	1.7	n.s.

* significant if $p \leq 0.05$ (paired t-test).

Table 2. □ Anxious disposition: mean scores (1 = not at all, 5 = very much) before initial treatment (BT) and after the second curative period, approximately two years later (AT).

	B.T.		A.T.		
My child...	X	s.d.	X	s.d.	p*
is nervous.	1.9	1.0	1.9	1.3	n.s.
is easily frightened	2.4	1.5	2.3	1.4	n.s.
is more frightened than other children of same age.	2.2	1.2	2.1	1.3	n.s.
often has nightmares	1.2	0.6	1.4	0.7	n.s.

* significant if $p \leq 0.05$ (paired t-test)

Table 3. □ Description of the nature and character of the child: mean scores (1 = not at all, 5 = very much) before initial treatment (BT) and after the second curative period, approximately two years later (AT).

	B.T.		A.T.		
My child...	X	s.d.	X	s.d.	p*
Gets along well at school	4.3	1.1	4.2	1.1	n.s.
Is socially skilled	4.1	1.3	3.6	1.5	0.02
Is affectionate	3.9	1.3	3.1	1.4	0.01
Is independent	3.8	1.1	4.5	1.0	0.01
Wants to be the boss	2.9	1.6	2.7	1.4	n.s.
Is shy by nature	2.5	1.1	2.8	1.0	n.s.
Is reserved by nature	3.2	1.6	3.5	1.5	n.s.
Is spoiled:					
—at home	2.1	1.5	1.8	1.2	n.s.
—by others	1.9	1.5	2.1	1.6	n.s.
Is submissive	1.4	0.7	1.5	0.8	n.s.

* significant if $p \leq 0.05$ (paired t-test)

Table 4. □ Reported effectiveness of the parents strategies in preparing their child for a visit to the dentist (1 = no effect, 5 = strong effect): mean scores before initial treatment (BT) and after the second curative period, approximately two years later (AT).

	B.T.		A.T.		
Strategy	X	s.d.	X	s.d.	p*
Try to distract the child (20)	2.2	1.2	2.6	1.7	n.s.
Try to calm the child (26)	2.6	1.2	2.8	1.8	n.s.
Explain what is going to happen (25)	2.5	1.3	2.7	1.5	n.s.
Tell the child that it is necessary (26)	2.5	1.1	3.2	1.3	0.01
Promise something (reward) (22)	2.5	1.3	1.6	1.9	0.02
Promise to stay with the child (19)	2.6	1.7	2.4	2.2	n.s.

In parenthesis: the number of parents who chose each strategy. More than one option may have been chosen.
* significant if $p \leq 0.05$ (paired t-test)

frightened or troubled by nightmares. Achievement at school, shyness, domineering behavior and subjection to overindulgence are factors that have not changed. Only the attachment to parents and the social skills of the child decrease significantly, while the level of independence increases significantly. In addition, the scores for social skills show a clear correlation (.68) between the responses to the first and second questions.

As Table 4 shows, the parents have changed the way in which they prepare their children for a visit to the dentist. Rewards are offered significantly less often and the necessity of the treatment is pointed out significantly more often. Other strategies such as calming, diverting the child's attention, promising to stay with the child or explain what is going to happen are just as frequent and are just as ineffective as before the initial treatment.

No strong correlations were found between the child's anxiety level during treatment and the answers to both questionnaires. All questions, such as shown in Tables 1 through 4 had a very low correlation with the degree of the child's anxiety. Systematic connections were not found.

DISCUSSION

The research presented here is part of a more complex longitudinal study concerning children's dental fear. After the first course of dental treatment was completed, the research continued until curative work was again necessary. The variation in the length of treatment that was a result of this is just one of the reasons why the data from a number of patients were no longer current. The questionnaire was sent to the parents after the child had again been under the care of a private dentist for some time, in effect meaning that the bond with our Child Dentistry section had been broken. Answering the second questionnaire was dependent on the good will of the parents. In the end, thirty questionnaires were usable. These were then coupled with the original questionnaire, completed before the treatment. Since each questionnaire thus had its own control, any change of opinion could be monitored.

It was necessary to learn whether the thirty questionnaires that had been returned, both at the beginning and in the more advanced stage of research, were an adequate representation of the total group. In order to learn this, the first set of questionnaires was compared with the remaining twenty-two. The comparison showed that at the beginning of the research, there was a homogenous group. Moreover, the video-registered behavior of the thirty children could be compared with the registered behavior of the rest of the group. It could be concluded that during the research no selection took place on the basis of the anxiety of the child or the opinion of the parents.

The lessened degree of anxiety for dental treatment indicated by parents (Table 1) is obvious. After referral the children were made manageable and were sent back to their private dentists. There had been intervention in a process that had moved beyond the parents' power

to influence it and a problem (namely their child's stagnating dental treatment) had been solved. Pointing out the decrease in anxiety on the part of the child is obvious in such cases. The successful management of the child's anxiety can be seen from the course of the anxiety scores. Even though return referral was not dependent on the degree of anxiety reached, but rather on the duration of the treatment, a lessening in the degree of anxiety has actually been achieved.[10] The low level of correlation between the measurements taken before and after indicate that there is no question of a homogenous decrease in the anxiety registered by the parents.

In general the attitude of parents remains quite constant. They consistently describe themselves as being unafraid of the dentist. The literature shows, however, that there is a clear link between the anxiety of parents and children.[13] It is possible that parents underestimate their own anxiety for the dentist compared to their child's, which they so recently witnessed. In answering questions concerning their child, the parents make it clear that they still regard them as normal, average children.[2] In their view the lessened degree of anxiety for the dentist has not changed the propensity of the children to be anxious (Table 2). It was not evident that the child would clearly begin to behave differently: if the positive experience of successful dental treatment is to be used as a stimulus for other, more general matters, it is primarily up to the parents to encourage the child in that direction. It must be regarded as improbable that positive effects of a dental experience will enable parents, who were unable to solve behavioral problems in the dental office, to act effectively on their own initiative in other situations.

Parents report that their children in every sense fit into the profile of children their age. The three aspects of the child's nature that have changed (less socially skilled, less affectionate, more independent), can probably be ascribed to the fact that they have grown older. Parental preparations for a visit to the dentist have not changed much at all. They still try out a bit of everything, using the same number of strategies. The strategies they choose are equally (nominally) effective. The child's reactions, however, have changed. The child is apparently resigned to the fact that the treatment is necessary and an extrinsic motivation (a reward), therefore, has become less effective. Extinction of the effect will also play a role. The absence of correlations between the answers of parents and the behavior of children is clear.[10,11] Here too it seems that parents are unable to make an objective estimate of the anxiety of their children after a longer period of time. Possibly they revisualize their own or their child's experiences with the dentist and are not judging their child's behavior during treatment strictly on its own.

CONCLUSIONS

- ☐ When a child becomes less afraid of the dentist, the parents realize this. There is no specific connection between this realization and the actual degree of their child's anxiety, measured at a behavioral level.
- ☐ In the parents' view, a child's lessened degree of anxiety for the dentist does not necessarily lead to a reduction of anxiety in other areas, or to changes in character.
- ☐ When a child has become less afraid of dental treatment, parents do not change the way they prepare the child for a visit to the dentist. The child does react differently, however, to the preparation.

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DEVELOPMENT

Effects of ethnicity and birth month on localized enamel hypoplasia of the primary canine

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Enamel hypoplasia of the primary dentition is a valuable clue for dentists and anthropologists to a child's well-being before birth and in early infancy.[1] A newly recognized developmental defect of enamel, termed localized hypoplasia of the primary canine (LHPC) is responsible, however, for the majority of enamel hypoplasias in the primary dentition and yet has its own separate etiology.[2-5] Our present task is to determine the factors that produce LHPC and separate its prevalence from that of the other primary teeth. Our previous work has implicated two linked factors in the production of localized hypoplasia of the primary canine:

- ☐ Thinning and/or fenestration of the cortical bone forming the anterior wall of the primary canine crypt by around age six months after birth.
- ☐ Exposure thereby of the incompletely formed labial surface of the unerupted canine crown to trauma by impact as the baby attempts to put objects in its mouth*.

This produces a small shallow pit, ranging from pin prick size to a millimeter or more in diameter, visible on the mesiofacial aspect of the erupted primary canine. The significance of the pit among contemporary children is two fold:

- ☐ It can become carious and require restoration.
- ☐ It is the commonest form of enamel hypoplasia among primary teeth and may, in our opinion, come to serve as an easily observed marker of nutritional inadequacy for epidemiologists and health workers.

Consequently, we have commenced a study of LHPC among Vancouver children so as to isolate the nutritional and maternal factors implicated in the thinning of facial bone, which predisposes infants to the lesions.

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*While the majority of cases of LHPC probably involve complete fenestration of cortical bone with exposure of the enamel epithelium, an alternative proximate mechanism for production of the lesion is suggested by the observation that inflammation of permanent crowns by intrusion of the root of a primary tooth can produce an accumulation of neutrophilic leukocytes that die naturally and disintegrate to produce enzymes capable of dissolving tissue.[6] Conceivably impact trauma transmitted through thinned, but intact, cortical bone could, similarly, induce a local accumulation of leukocytes.

METHODS AND MATERIALS

Since 1985, the City of Vancouver has encouraged mothers who are at risk for having low birthweight babies to participate in the Healthiest Babies Possible (HBP) Program, which promotes good prenatal nutrition, through home counselling, among expectant mothers. Diet quality is assessed from twenty-four-hour dietary recalls administered by registered dietitians at the time of referral to the program and at term. We approached the administrators of the program with a proposal to invite parents to return for dental checkups of the children among whom the presence or absence of LHPC could be correlated with the nutritional profile during pregnancy. We recognized at the outset that there is a gap of about six months between the time when the diet composition was recorded and a pit may have been produced in an infant's tooth, although we reasoned that after giving birth mothers would tend to revert to their habitual diet recorded at referral. We chose to examine children whose mothers were in the program from 1986 through 1988; although several other years were sampled as well, since many mothers brought all their children in for this paid examination. From an original target population of 930 mothers for whom good nutritional records were available, we managed to contact by phone approximately 150; of whom sixty-three participated. Chinese speaking mothers were disinclined to participate in our study and hence are poorly represented (Table 1). Otherwise the proportion of different ethnic groups from the original target population is reasonably well-mirrored in the sample of mothers who brought in children for examination .

Parents were provided with a typed description of the research, plus a consent form, in the appropriate language, which they signed to indicate they understood the nature of the examination and to acknowledge receipt of payment. Examination was performed by one of the authors as part of his normal public health dental practice in a customary dental setting with dental probe and mirror. Presence and severity of the pit were noted, on a scale from 0 to 3 (most severe) on previously prepared charts. Replicability of scoring was not performed, but the examiner was provided with a photograph of LHPC and examples of the severity gradient even though he was familiar with the appearance and variation in LHPC. Observations were also made of gross carious teeth, restorations, and the possible presence of enamel hypoplasia on the other teeth. Hypocalcification was not recorded. Due to the very young age of most of the children and to other considerations we concentrated our attention on the primary canines. Here we shall report simply the distribution of LHPC within the dentition of children whose ethnicity, sex, place and date of birth are known. Maternal diet at referral was analyzed with computer software: The Food Processor II (including the 10th revision of the Recommended Dietary Allowances) for correlation with presence or absence of LHPC in their infants.

Table 1. ☐ Occurrence of localized enamel hypoplasia of the primary canine among children enrolled in Healthiest Babies Possible Program (Vancouver).

Ethnic group	Proportion affected with LHPC Male	Female	Individuals	Teeth	
	n	n	%	%	n
Vietnamese	4/23	4/20	18.6	5.7	(9/159)
Indocanadian	10/14	5/13	55.6	22.9	(24/105)
Spanish	2/11	1/3	21.4	7.1	(4/56)
English	1/4	1/3	28.6	7.4	(2/27)
Chinese	1/4	1/1	40.0	15.0	(3/20)
Total	18/56	12/40	31.2	11.4	(42/367)

RESULTS

A total of 379 teeth from ninety-six children representing five ethnic groups are reported. All teeth were examined, although attention was focussed on the primary canine due to the young age of the subjects who were not prepared to sit still for a long time. Consequently, some minor instances of enamel hypoplasia on teeth other than the primary canine may have been missed. We observed none. It is clear that LHPC is the dominant form of enamel hypoplasia among the primary teeth of HBP infants. Our basic results are shown in Table 1. Among those children with LHPC, prevalence is similar on both sides of the mouth (left: 20/60 = 33.3 percent, right = 22/60 = 36.7 percent) but is more common in the mandibular than the maxillary dentition (maxillary: 17/60 = 28.3 percent, mandibular: 25/60 = 41.7 percent) The predilection of LHPC for the mandibular teeth has been found in all previous studies.[2-4,7-9] A total of twelve primary canines out of 379 teeth (3.1 percent) showed restorations, but we are unsure whether this reflects posteruptive gingival caries formation or pre-existing LHPC. Brown and Smith reported that 7 percent of their sample had restorations in this area.[8]

Our previous work had shown that among Vancouver children in general, LHPC occurred in about 2.4 percent, although disproportionately among some groups such as Indocanadian and Chinese; while in this study,

among children whose mothers were enrolled in a program designed to improve maternal and infant nutrition, the prevalence is over 30 percent.[5] This confirms that LHPC occurs more often among children who are thought to be nutritionally disadvantaged. Indocanadians, particularly, show more cases of LHPC; an observation confirmed by the fact that, in terms of severity (size) of the pit, Indocanadian teeth (usually four per individual) with scores of 2 or 3 (most severe) formed 45.8 percent of affected teeth from Indocanadian children. This can be compared to an average of only 9.7 percent of affected teeth with such scores among teeth from the other ethnic groups combined. In other words, Indocanadians show more and larger instances of LHPC compared to other Vancouver infants of various ethnic origin.

Further results reported here concern the relationship between LHPC and mean hours of sunshine in month of birth. To obtain a sufficiently large sample we have combined data from this study with that from fifty-two children reported in part in an earlier study of LHPC among children from Burnaby, B.C. involving a different examiner.[5] The results are shown in Figure 1 and Table 2.

As may be seen in Figure 1, there is a marked tendency for children with LHPC to be born in the winter months with a trough in occurrence in mid-summer. Children without the pit were usually born in months with more sunshine. This suggests that vitamin D synthesis may be a factor in occurrence of the condition.

We have undertaken a preliminary analysis of the intake of select nutrients (those with known effects on bone metabolism) among mothers of children with and without LHPC at the time the mother was referred to the Healthiest Babies Possible Program. The results are shown in Table 3. A more detailed analysis is forthcoming. The intake of vitamin D is not calculated by Food Finder II because of the potentially over-riding effects of endogenous production. Calcium intake does not differ significantly between the samples. Similarly, protein, energy, and folic acid are not correlates of LHPC. Clearly it is only the intake of Vitamin A from fortified milk and fresh fruit and vegetables, which is markedly low in mothers of children with LHPC.

DISCUSSION

The average prevalence of LHPC among five 'nutritionally-at-risk' ethnic groups from Vancouver (30 percent) is similar to those reported from routine clinical practices of unspecified racial origin in Kentucky (45

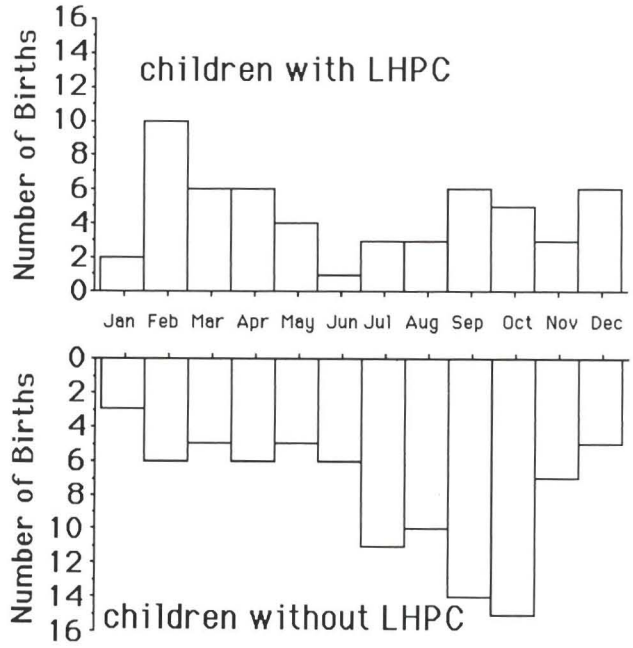

Figure. Association between month of birth and occurrence of LHPC.

Table 2. ☐ Relationship between mean monthly hours of sunshine and occurrence of localized enamel hypoplasia of the primary canine among Vancouver children[a].

	LHPC	Mean hours of sunshine[b] in birth month	SD	SE	t value	Probability 2 tail	1 tail
Present	55	141.7	75.7	10.2			
Absent	93	169.4	79.1	8.2	−2.09	0.383	0.191

[a] Combined data from this study and ref. 5
[b] From ref. 9

Table 3. ☐ Intake of select nutrients among mothers from Healthiest Babies Possible Program 1986-88 (Vancouver).

Nutrient	LHPC	Mean	SE	Prob. (2-tail)	RN*
KCalories	Yes	1819.4	141.3	NS	2203
	No	1832.6	82.6		
Protein (gm)	Yes	61.8	4.9	NS	60
	No	76.1	5.3		
Number milk tickets	Yes	18.82	2.91	0.348	
	No	28.38	2.44		
Calcium(mg)	Yes	844.91	69.36	NS	1300
	No	1045.90	75.98		
Servings fruit/veg	Yes	3.46	.427	0.525	
	No	4.98	.522		
B-Carotene(RE)	Yes	352.89	76.0	0.474	?
	No	735.54	134.7		
Retinol(RE)	Yes	825.22	104.07	0.433	8-900
	No	1300.55	161.91		
Folic acid (μg)	Yes	343.0	44.4	NS	432
	No	297.5	28.2		

* RNI = Recommended Nutrient Intake for a pregnant female, age 28 years, weight 54 kg, height 1.57m at referral with light activity level (mean values of subjects in this study (after Food Processor II))

percent, Indianapolis (36 percent), and multirace samples from California (19 percent) and Mississippi (35 percent).[4,7,8,10] All these values are much higher, however, than the proportion affected by LHPC among Canadian kindergarten children from Burnaby (0.6 to 2.4 percent).[3,5] At the moment, we are uncertain why these American studies and that reported here on children from nutritionally-compromised mothers share such high prevalences of LHPC.

Our earlier studies of the prevalence of LHPC implicated ethnicity, lower family income, and maternal milk consumption combined with shortened duration of breast feeding.[5] It was provisionally suggested that these factors interacted nutritionally to produce thinned facial bone overlying the primary canine crypt so that normal mouthing of objects by infants damaged ameloblasts unprotected by bone, which resulted in an impact crater on the labial aspect of the unerupted tooth. The current study supports the previous conclusions, particularly in regard to relevance of ethnic background.

Our demonstration that LHPC, and, by inference, facial osteopenia, are more common in winter months can be interpreted in two basic ways: reduced vitamin D synthesis or seasonal variation in availability of important nutrients.

There is considerable discussion of calcium metabolism and vitamin D among infants and their effects on bone growth. While a complete review will not be attempted here it is important to emphasize the following observations as they may relate to our results. Vitamin D is derived from the diet and from synthesis in the skin and is transported in blood serum by D-binding protein to the liver and kidney, where it is transformed to the biologically active metabolite $1,25(OH)_2D$ which acts as a hormone to induce absorption of dietary calcium by the small intestine, enhance mobilization of calcium from bone, and influence the kidney to retain calcium.[11,12] There are numerous studies which demonstrate a link between winter months and reduced vitamin D status in mothers and infants.[12-14] Contradictory results are reported among infants supplemented with vitamin D, in that bone density did not change in two studies of four and six month old infants, respectively, while it increased in a study of three-month-old infants.[15] Recently it has been shown that winter sunlight is so attenuated at the latitudes of Edmonton and Boston as to be unable to induce vitamin D synthesis.[16] Vitamin D deficiency has been shown in East Indians (Asians) in Britain with a vegetarian diet and little exposure to summer sunlight.[17] Similarly, Asian infants from Birmingham show disproportionate frequency of neonatal hypocalcemia, with strong seasonal variation.[18] While vitamin D_3 strongly affects calcium balance, it is important to note that calcium deprivation in rats inactivates vitamin D, a phenomenon that the authors suggest may explain the anomaly of rickets among low latitude peoples.[19] LHPC has been reported at relatively high levels ($\geq$35 percent) among relatively low latitude populations from Kentucky, Mississippi and California, including both light and dark-skinned children.[4,7-10] Thus vitamin D synthesis and pigmentation are unlikely to be prime variables in the production of LHPC.

As shown in Table 3, intake of most nutrients commonly reported to affect bone mass (protein, calories, folic acid and calcium) were not correlated with presence of LHPC. Retinol status, however, was markedly different. Indeed, the total intake of vitamin A in mothers of affected children at referral was barely adequate in terms of recommended intake (mean = 825 RE). The USA recommended dietary allowance (RDA) for vitamin A in pregnancy is 800 RE compared to 900 RE in the Canadian Recommended Nutrient Intake (RNI).[20]

In that nutrient intakes are often positively skewed, it is appropriate to compare median, rather than mean intakes for mothers of affected versus unaffected children: beta-carotene median values are 270 (affected) versus 427 RE (unaffected), and total Vitamin A values are 694 versus 844 RE.[21] While the pattern has not changed, it becomes even more obvious that mothers whose children showed LHPC are suboptimal in their retinol intake.

That retinol plays a role in bone growth is not widely appreciated. Vitamin A and its metabolite, retinoic acid, have potent effects on osteogenesis both in cultured mouse calvaria and transplacentally.[22,23] A mechanism for the action of vitamin A on human skeletal growth is provided by recent observations that vitamin A plays a direct role in cell replication and enhances mucopolysaccharide formation in cartilage through its effect on growth-promoting somatomedin (insulin-like growth factor 1)[24-26] IGF-I is a mitogen for bone cells and independently stimulates type I collagen synthesis, the major constituent of bone matrix.[27] Osteopenia is reported in the metacarpals of infants from nonsupplemented Guatemalan mothers among whom a relative lack of vitamin A was thought to be most critical in producing the bone deficit.[28]

In conclusion the present study of Vancouver infants from mothers enrolled in the Healthiest Babies Possible Program has shown that localized enamel hypopla-

sia of the primary canine is a remarkably common finding among several ethnic groups, particularly Indocanadians, and that winter birth is implicated in reduced cortical thickness of facial bone as the infant matures. Reduced availability of vitamin A sources, particularly fresh fruit and vegetables, in the wintertime is implicated in the development of facial osteopenia in infancy.

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EFFECT OF POSTBRUSHING ACTIVITIES ON SALIVARY FLUORIDE

Chesters et al (1992) recently found that thorough water-rinsing after toothbrushing decreased the caries-preventive effect of an F dentifrice. Others have also pointed out that extensive use of water after brushing can negatively affect the oral F retention, leaving less F in the mouth, and thereby diminish the anticaries benefit (Collins et al, 1984; Richards et al, 1988; Sjögren and Birkhed, 1993).

Sjögren, K. and Birkhed, D.: Effect of various post-brushing activities on salivary fluoride concentration after toothbrushing with a sodium fluoride dentifrice.
Caries Res, 28:127–131, March-April 1994.

CLINIC

Oral health of pediatric AIDS patients: A hospital-based study

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The number of American children infected with the human immunodeficiency virus (HIV) is increasing at an alarming rate. The total reported pediatric AIDS cases were in the dozens in 1983, reached the hundreds by 1985, and now exceed 4,400.[1,2] The Centers for Disease Control and Prevention (CDC) estimates that 2,000 HIV-infected infants are being born annually.[3] HIV prevalence among children will continue to rise because of increasing numbers of HIV-infected women of childbearing age.[4]

AIDS patients experience numerous problems that demand attention from the health care community. To begin addressing these problems effectively, they must first be identified and characterized. The purpose of this study was to assess the oral health of a group of HIV-infected children being treated at the National Institutes of Health (NIH).

MATERIALS AND METHODS

Forty HIV-infected children were included in this study. Their mean age was 6.7 years ± 0.41 (SEM) ranging from 2.1 to 11.3 years. In accordance with the CDC definition of pediatric HIV infection, children over twelve were excluded.[5] Twenty-two were male, eighteen female. Twenty-two were Caucasian, twelve African American, and six Hispanic or mixed racial heritage.

The mode of HIV transmission was vertical (perinatal) in twenty-eight cases. The remaining twelve patients acquired the virus before the age of eighteen months from blood transfusions, between 1979 and 1986. Seven of these twelve required blood for complications of prematurity.

All patients were enrolled in treatment protocols of the Pediatrics Branch, National Cancer Institute, NIH. Children included in this report had symptomatic HIV infection, class P-2.[5] All were being treated with antiretroviral agents: zidovudine (AZT); dideoxyinosine (ddI); AZT and ddI; AZT and dideoxycytidine (ddC); or 2-deoxy-3-thiacytidine (3TC). Ninety-eight percent had a history of antibiotic use, and 70 percent received previous or current antifungal therapy for oral candidiasis.

Medical staff referred patients to the Dental Clinic for routine evaluation between August 1989 and March 1993. The parents or guardians of all children consented to accepted diagnostic procedures for research purposes. Standardized oral examinations were performed, including panoramic radiographs when possible. Caregivers were briefly interviewed as to dental history. Medical history was obtained from hospital records.

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Dental caries was scored clinically, using the NIDR Diagnostic Criteria and Procedures.[6] Twenty-two patients were in primary dentition, seventeen in mixed dentition, and one permanent. The dft index was used for primary teeth, indicating the decayed and filled primary teeth per child. Permanent teeth were scored by DMFT, the number of decayed, missing, and filled permanent teeth per child. Teeth were also inspected for developmental anomalies.

Dental age was determined from tooth formation, considering the dentition in toto. Each panoramic radiograph was compared with a widely used developmental chart.[7] Since this method provides a general assessment, tooth development was considered to be delayed or advanced, if chronologic age was more than six months outside the dental age-range. Radiographs were additionally inspected for osseous morbidity.

Extraoral and intraoral soft tissues were palpated and inspected, and pathologic changes recorded. Gingivitis was scored using a modified gingival index: 0 (health; no inflammation); 1 (mild; slight erythema); 2 (moderate; erythema, edema, glazing); 3 (severe; marked enlargement and erythema).

Categorical data were analyzed statistically using Fisher's exact test. Results are reported as means ± SEM, and medians. An alpha level of 0.05 was considered statistically significant.

RESULTS

Hard Tissue

Twenty-four children (60 percent) had clinical evidence of current or past caries and 40 percent of patients were caries-free. The group was then divided by stage of dentition for analysis.

The caries distribution of twenty-two children in primary dentition is illustrated in the figure. The overall score for this group was 4.4 ± 1.08 dft (median = 1.0). Nine patients (40.9 percent) were caries-free. Of the remaining 13 (59.1 percent), four had a low dft (1 or 2) and nine a high dft (ranging from 8 to 12).

Eight of the nine children with high dft exhibited a caries pattern consistent with baby bottle tooth decay (BBTD).[8,9] At least three of the four maxillary incisors were clinically carious in each case. Thus 36.4 percent of patients in primary dentition had BBTD. Their average dft was 10.0 ± 0.60 (median = 10.0). This group was analyzed for common features such as mode of HIV transmission and prematurity. All but one patient with nursing bottle caries had acquired their HIV infection vertically. No other relation between BBTD and other variables was identified.

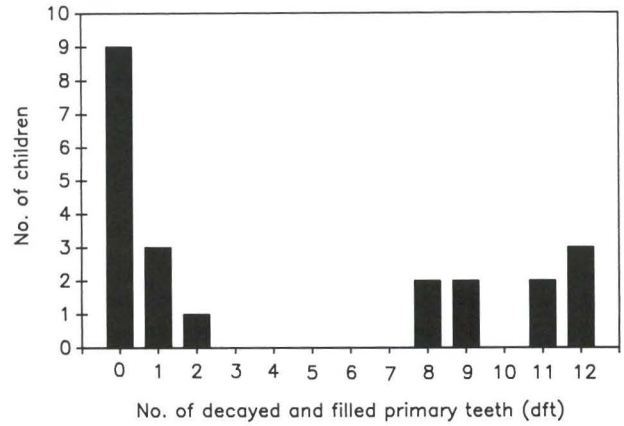

Figure. Distribution of caries experience among twenty-two HIV-infected children in primary dentition. Their average age was 4.9 ± 0.38 years. Mean dft for the group was 4.4, in contrast with the national average of 1.7 for five-year-olds. These AIDS patients tended to have either low dft (0-2) or high dft (8-12). Eight of the nine children with high dft had baby bottle tooth decay.

Among seventeen children in mixed dentition, seven were caries-free (41.2 percent) while the remaining 10 (58.8 percent) had caries. Their average age was 8.7 ± 0.35 years. Mean dft was 2.2 ± 0.61 (median = 1.0), ranging from 0 to 7. The average DMFT was 1.2 ± 0.42 (median 0), range 0 - 5. One child presented in permanent dentition, having a DMFT of 18.

Panoramic radiographs were obtained on twenty-nine children. Nine patients (31.0 percent) had delayed tooth development. Delayed development was analyzed for an association with other factors such as prematurity, failure to thrive, and mode of transmission. No significant relation, however, was found.

No congenitally missing or malformed primary teeth were noted. Two patients had isolated defects of the permanent teeth. A maxillary lateral incisor was congenitally missing in one patient; the contralateral tooth was a microdont (peg lateral). Another child had enamel hypoplasia of several teeth, thought to be associated with fevers in the first year. No osseous morbidity was noted clinically or radiographically in any case.

Soft Tissue

Oral candidiasis was the most frequent soft tissue morbidity noted (Table). Nine patients had pseudomem-

Table ☐ Oral candidiasis and sialadenitis in forty HIV-infected children.

	Frequency	History
Candidiasis	35% (14/40)	70% (28/40)
Sialadenitis	10% (4/40)	15% (6/40)

branous candidiasis. Four had angular cheilitis, three erythematous type candidiasis, and two leukoplakic (some patients had several subtypes concurrently.) There was no statistically significant relation between mode of HIV transmission and candidiasis. The second most common soft tissue finding was dry chapped lips (twelve cases).

Salivary gland enlargement was noted in four patients (Table). Two cases involved a single parotid, one a single submandibular gland, and one involved all major salivary glands. Six patients had a history of sialoadenitis, three of which were characterized by signs of infection such as fever and purulence.

Other isolated soft tissue changes included healing herpes labialis, traumatic scarring, buccal petechiae, cheekbiting, traumatic ulcer, and coating on the tongue (one patient each). One child had a history of recurrent intraoral herpes, but this was not observed at the time of study.

Gingival health was scored in thirty-four cases. Fifteen (37.5 percent) had no inflammation. Sixteen (40 percent) had mild gingivitis, and 3 (7.5 percent) moderate gingivitis.

DISCUSSION

The most striking finding of this study was the caries experience of the younger HIV-infected children. The mean dft for twenty-two children in primary dentition was 4.4. By contrast, a national survey of U.S. schoolchildren found the average dft for five-year-olds was 1.7.[10] The distribution of dft scores in our patients demonstrates a subgroup with high caries activity (Figure). Eight patients had baby bottle tooth decay (BBTD) (36.4 percent of those in primary teeth) that required extensive restoration, usually under general anesthetic. BBTD has been found in 18 percent to 40 percent of other pediatric HIV cohorts.[11,12]

The reason for the high caries activity of AIDS patients in primary dentition is difficult to establish. The caries pattern, i.e. BBTD, has been associated with bottle feeding practices.[8,13-16] It seems likely that bottle use may have contributed to caries development. HIV-infected patients often are bottle fed longer than healthy children to help maintain their caloric intake. They are at significant risk for malnutrition, due to loss of appetite, chronic or recurrent diarrhea, and malabsorption.[17] It should be noted, however, that bottle feeding practices were not assessed in this study.

Socioeconomic and medical factors also may contribute to dental disease in HIV-infected children. Most of these patients are urban dwellers with limited resources.[14,18] Disadvantaged children consistently have high BBTD prevalence.[9,14] Children with chronic illnesses are more likely to have BBTD than healthy children.[15] Long-term use of pediatric medications may increase dental caries risk, since many contain high levels of sucrose. HIV-infected children are typically treated with antivirals, antibiotics, and antifungals. We have observed several pediatric AIDS patients develop rampant decay within a period of months, while using daily antifungal troches.

Further studies are needed to clarify whether be-

The most striking finding of this study was the caries experience of the younger HIV-infected children.

havioral, nutritional, socioeconomic, medical, or other considerations are the most important risk factors for caries development in this population. Little is known about the developing mucosal immune system in children with HIV infection. The possibility exists that dental caries progression may be enhanced by their immune deficiency.

Controlling caries in high risk pediatric populations has proven to be a challenge (for review, see reference 14). Pediatricians and other health care personnel are generally well informed about BBTD, and should be engaged in screening young children for caries. A team approach in the hospital or medical center facilitates access to dental services. Intervention may then include oral hygiene instructions, restorative care, supplemental fluoride, chlorhexidine, and sealants. Parents should be taught the destructive effects of bottle feeding at bedtime. Nursing bottle use, while medically necessary, may be modified. For example, the bottle should be removed before the child falls asleep, if it is used at bedtime.[13-15] Professional recall is essential to observe the outcome of treatment, and to reinforce preventive advice.

The average caries experience of seventeen HIV-infected children in mixed dentition was similar to the national survey norms. The mean dft was 2.2 compared with 1.9 for nine-year-olds in the survey, while the mean DMFT was 1.2 vs 0.8 for nine-year-olds.[19] The proportion of caries-free patients (41 percent) was lower than expected for this age-group (65 percent).[20]

Dental development was delayed in 31 percent of patients (nine of twenty-nine), using a general assessment of tooth formation. We were unable to demonstrate, however, a significant relation between dental development and growth failure. This was surprising since dental age is closely correlated with skeletal age.

Tooth morphology and craniofacial development were grossly intact in these patients. Although primary tooth enamel hypoplasia has been associated with prematurity, it was not observed in our patients who were born prematurely.[9,21] The congenital anomalies of permanent teeth observed in one patient (missing maxillary lateral incisor; peg lateral) are common in the general population and are probably not associated with HIV infection. Another patient had enamel hypoplasia of several permanent teeth, thought due to fevers. Recurrent fevers occur frequently in HIV-positive infants and children.

Candidiasis is uniformly the most common oral manifestation of HIV-infection in children.[22-24] In this study fourteen of forty patients (35 percent) examined had oral candidiasis. Its prevalence ranges from 10 percent to 50 percent in other studies.[24-26] The predominance of pseudomembranous type candidiasis is also consistent with the literature.[22,23] Chart review revealed 70 percent had a history of oral candidiasis. This infection tends to be chronic or recurrent in pediatric AIDS patients and may be refractory to therapy.[22,23]

Palpable salivary gland enlargement was found in 10 percent (four of forty) of patients in this study. Salivary gland swelling is estimated to occur in 5 percent to 11 percent of HIV-infected children.[27-29] Such enlargement may have several possible causes, including infection and lymphocytic infiltration (for review, see reference 30). Three of six patients who had a history of sialadenitis had evidence of bacterial parotitis such as fever, tenderness, and purulence.

Gingival health was unremarkable in this patient group. Forty percent had mild gingivitis, 7.5 percent moderate gingivitis, and 37.5 percent had healthy gingiva. Based on national norms, the majority of children over seven are expected to have some gingival inflam-

Candidiasis is uniformly the most common oral manifestation of HIV-infection in children.

mation.[31] Noteworthy in our patients was the lack of HIV-associated periodontal changes such as linear gingival erythema, necrotizing ulcerative gingivitis (NUG), or necrotizing ulcerative periodontitis (NUP). Other studies also found that these specific periodontal conditions were relatively rare in children (for review, see reference 30). We have observed NUG in one HIV-infected child not included in this study.[30]

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1994—YEAR OF ORAL HEALTH

Oral health was selected as the 1994 theme in recognition of its importance to quality of life. Lack of oral health can lead to poor general health and even death. Each year, approximately 30,000 people in the United States are diagnosed with oral cancer; 8,600 die. Although Americans are living longer, eating better, and exercising more, oral health is still neglected by many segments of the population. Forty-three percent of the American people receive no dental care over a 12-month period. Over 100 million Americans do not have the benefits of fluoridated water despite its proven effectiveness in fighting dental decay. And infant tooth decay—an entirely preventable condition—is rampant in some communities.

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Conservative multidisciplinary treatment approach in an unusual odontodysplasia

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Odontodysplasia is a rare developmental anomaly, involving all tooth structures, affecting females twice as often as males. Only one jaw is usually involved, and the maxilla twice as frequently as the mandible. The condition is usually unilateral, but may also cross the midline. The lesion is more common in the anterior regions, but posterior teeth may also be affected. The lesion is consecutive, i.e. whenever a primary tooth is affected, the permanent one is affected too.[1]

Odontodysplasia commonly presents as either failure, delayed or partial eruption of teeth, or with abscesses in the oral cavity, and/or because of a poor appearance of teeth.[2] Drifting of adjacent teeth and over-eruption of the opposing teeth are frequent complications, where affected teeth have failed to erupt.[2]

Radiographically, affected teeth have been described as having a "ghostly" appearance, showing a marked reduction in radiodensity.[2,3] Both the enamel and dentin appear very thin, and the pulp chamber is exceedingly large; the roots are short with wide open apices; and pulp stones or denticles are present in the affected or normal adjacent teeth.[2,3]

At the writing of this paper Dr. Melamed was Resident, Department of Pediatric Dentistry; Dr. Harnik was Resident, Department of Orthodontics; Dr. Becker, Clinical Associate Professor, Department of Orthodontics; and Dr. Shapira, Clinical Associate Professor, Department of Pediatric Dentistry, The Hebrew University-Hadassah School of Dental Medicine, founded by the Alpha Omega Fraternity, Jerusalem, Israel.

Although several etiologic factors have been suggested for odontodysplasia, the actual cause still remains undetermined.[2] Extraction, followed by restoration with a prosthetic appliance, is usually indicated.[3]

In this report we describe a conservative multidisciplinary treatment approach in an unusual case of odontodysplasia.

CASE REPORT

R.N., an eight-year-old Caucasian boy of Arab origin, was referred to the emergency clinic of the Pediatric Dentistry Department of the Hebrew University-Hadassah School of Dental Medicine in Jerusalem, complaining of pain and swelling in his lower left mandibular area. He was the fourth child among six normal and healthy siblings, born after a normal and uneventful pregnancy and delivery to distantly-related parents. He was in good health and had never been seriously ill.

Odontodysplasia of the maxillary right primary molars, canine and incisors was diagnosed at the age of three years, when he first visited the same clinic, complaining of "strange teeth" on the right side (Figure 1). The maxillary right second primary molar was unerupted and diagnosis was made radiographically (Figure 2). Subsequently, the maxillary right first primary molar, canine and incisors were extracted, using a gen-

Figure 1. Odontodysplasia of the maxillary right primary teeth.

Figure 3. Hypoplastic, incompletely-erupted maxillary right first permanent molar. Note uneven width of edentulous ridge.

Figure 2. The x-ray appearance ("ghost teeth") of Figure 1. Note unerupted second primary molar.

Figure 4. Intra-oral appearance at age eight years, before treatment. Note absence of upper teeth and over-eruption of lower incisors.

eral anesthetic. Follow-up was discontinued until the present examination.

Current comprehensive extraoral and head-and-neck examinations were noncontributory, except for a slight depression of the right cheek, a straight profile and a slightly prominent chin and lower lip.

The intraoral examination revealed overall neglect, with many carious teeth, an abscessed tooth (which was the patient's main complaint) and poor oral hygiene with marked gingivitis. The maxillary right first permanent molar was hypoplastic, incompletely erupted with marked gingivitis and in a partial crossbite relation (Figure 3). A large edentulous ridge, uneven in width, extended from the maxillary right first permanent molar to the maxillary left permanent lateral incisor. The mandibular permanent incisors were remarkably over-erupted (Figure 4). The tongue covered the edentulous areas.

Radiographic findings revealed that the two maxillary right permanent incisors and the maxillary left permanent central incisor presented the typical appearance of "ghost teeth" (Figure 5). Oligodontia of the maxillary right permanent canine and the two premolars was also observed (Figure 6). The maxillary right first permanent molar exhibited hypoplasia and taurodontism, short and underdeveloped roots (Figure 6).

The treatment plan was divided into three stages:

- ☐ Immediate restorative and periodontal treatments including: oral hygiene instruction, prophylaxis and fluoride treatment; extraction of the abscessed tooth, restoration of decayed teeth and crown lengthening and reconstruction of the maxillary right first permanent molar with a preformed crown.

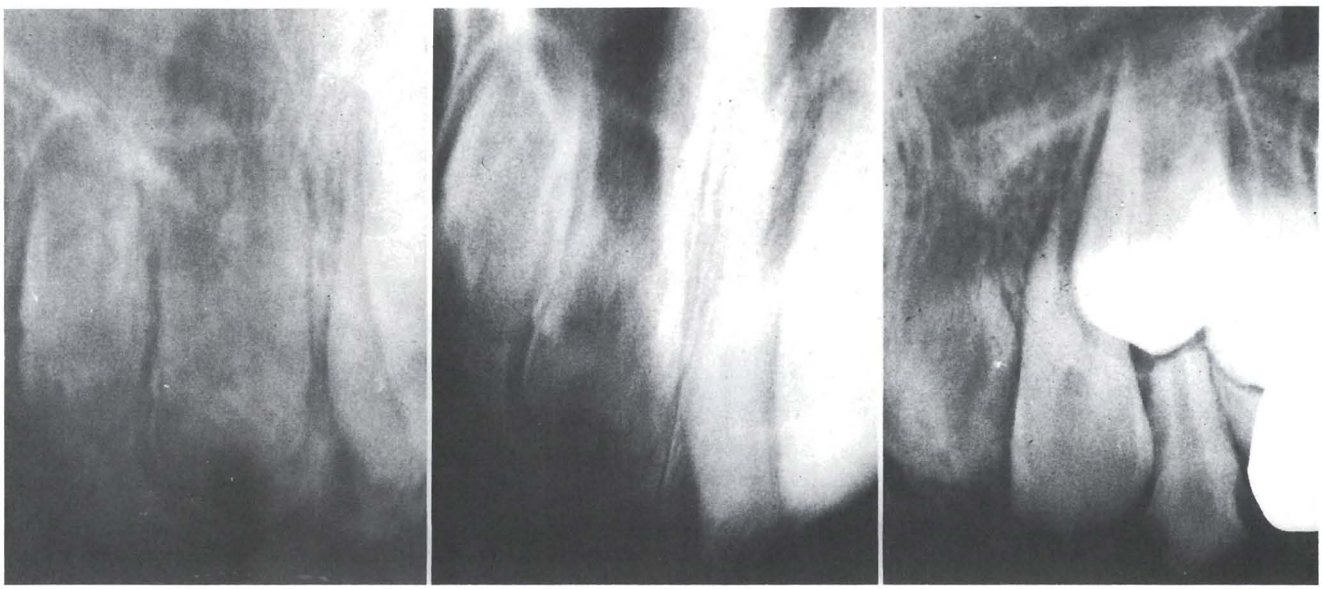

Figure 5. X-ray appearance ("ghost teeth") of maxillary permanent incisors. Note unaffected maxillary left permanent lateral incisor.

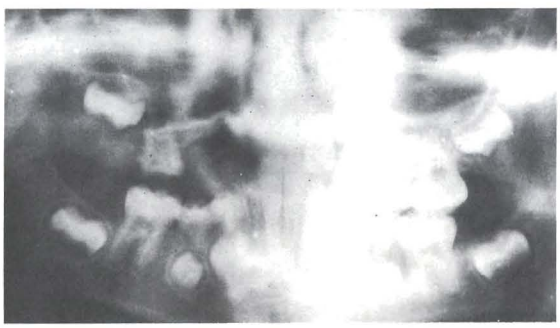

Figure 6. Oligodontia of maxillary right permanent canine and premolars. Note hypoplastic, taurodont and short-rooted maxillary right first permanent molar.

Figure 7. Stainless steel crown, covering the maxillary right first permanent molar, with buccally-welded orthodontic wire.

- ☐ Orthodontic treatment: maxillary rapid palatal expansion and mandibular intrusion of the over-erupted incisors and space maintenance.
- ☐ Oral rehabilitation: maxillary partial removable denture.

The extraction and the restorative treatment were uneventfully completed. The coverage of the hypoplastic crown of the partially erupted maxillary first permanent molar with a stainless steel crown was performed in conjunction with periodontal surgery, to achieve a longer clinical crown. A short piece of orthodontic wire was welded preoperatively on the buccal aspects of several maxillary second primary molar crowns (Figure 7), to enhance the retention of an orthodontic clasp (that would retain the future removable maxillary partial denture).

Following premedication with 7mg of diazepam (0.3 mg/kg), a flap was raised, the anatomical crown was exposed and the sulcus deepened, without osseous sacrifice. The selected preformed welded crown was measured, adapted and cemented into place, and the flap was then repositioned and sutured. Healing and repair were uneventful.

Three months later, during the orthodontic treatment, the patient developed an acute dentoalveolar abscess, associated with an erupting affected maxillary left permanent central incisor. A diagnostic radiograph

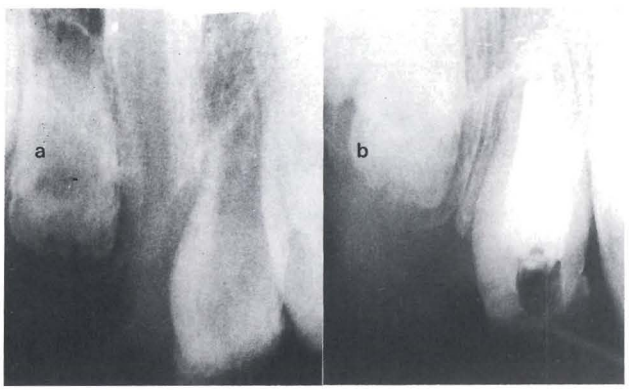

Figure 8a. X-ray appearance of erupting, abscessed "ghost tooth". Note substantial root development and wide-open apex. Figure 8b. Same tooth 3 months after apexification and completion of root canal therapy.

revealed a substantial root development (Figure 8a), encouraging a conservative treatment approach.

Since access to the palatal side of the tooth was obstructed by the swollen tissue, a palatal gingivectomy was performed, enabling debridement and drainage.[4] A few days later, improvement was noticed and a calcium hydroxide dressing, "Calxyl" (OCO PRAPARATE GmbH P.O.B. 37, D-6716 Dirmstein), was placed into the canal to initiate apexification.[5]

Following a four-month clinical and radiographic follow-up, a slight radiopacity in the apical third of the canal suggested possible calcification and canal obturation. Confirmed by the failure to pass a file through the tooth apex, the apical barrier was estimated to be complete and root canal therapy was then successfully performed (Figure 8b). The crown was then esthetically restored with a composite resin material.

When active orthodontic treatment was completed, the maxillary prosthetic appliance, retained by two Adams clasps on the maxillary first permanent molars and a single three quarters circumferential clasp on the maxillary left first primary molar, was subsequently inserted, to replace all missing maxillary teeth (Figure 9).

Orthodontic Treatment

The patient presented with an underdevelopment of the right maxilla, with absence of the alveolar ridge and with a dental crossbite in the lateral plane. A skeletal class 3 tendency, with a forward mandibular functional displacement, provided a negative overjet and overbite with vertical overclosure that produced the typical class 3 and edentulous appearance.

Figure 9. Intra-oral appearance at age 9 1/2 years, following full mouth rehabilitation.

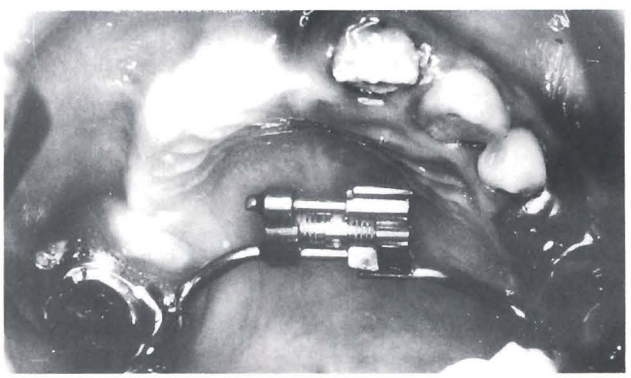

Figure 10. Two-point rapid palatal expander in place. Note abnormal odontodysplastic incisor.

The aims of the orthodontic treatments were:

- ☐ Elimination of the forward mandibular displacement.
- ☐ Elimination of the lateral maxillary narrowness.
- ☐ Establishment of a normal vertical relation.

The first stage involved rapid maxillary expansion , using only the first permanent molars for the retention of the screw appliance (Figure 10), and intrusion of the mandibular incisors with a utility arch (Figure 11). This opened up space vertically between maxillary and mandibular incisors, to allow prosthetic replacement of the missing teeth and alveolar bone, by the maxillary removable denture/retainer. A simple Hawley was used to retain the lower dentition.

DISCUSSION

In the present article a conservative multidisciplinary

Figure 11. The utility arch in place.

approach to treatment of a complicated and unusual case of odontodysplasia is reported. While the association between hypodontia and taurodontism has already been described, we have found no other studies associating odontodysplasia with oligodontia.[6,7] Other reports of odontodysplasia describing the absence of permanent buds are open to question, since the patients were too young to exclude the development of tooth buds.[8,9]

In some forms of odontodysplasia, features like "skipping" (an intact tooth between affected ones), enamel hypoplasia in adjacent teeth, and pulp stones may all represent variations in the severity of the condition.[2] In the recent report we found no "skipping" or pulp stones, but the maxillary right first permanent molar (adjacent to the edentulous area) was hypoplastic. The preservation and proper restoration of this tooth was essential to its function as a major anchor tooth/abutment for the orthodontic/prosthetic treatments. Its poor condition presented, however, a therapeutic dilemma. Although crown lengthening may cause osseous damage and loss of bony support, it was advised as the treatment of choice, limited to deepening of the sulcus.

Crawford and Aldred proposed the use of orthodontic treatment of traction as another conservative approach for the unerupted affected teeth with a reasonable root development.[2] These teeth were further exposed by gingival electrosurgery to facilitate an etch-retained composite. Orthodontic traction may, however, place short-rooted teeth at risk.

Our search revealed no report of apexification, apical closure, and endodontic treatment performed on such affected teeth, all of which were successfully completed in the case presented in this report. Though prognosis may be impaired, due to a short root and thin walls, conservative treatment is still recommended. It is our view that although extraction of odontodysplastic teeth and prosthetic replacement has been the treatment of choice, efforts should be made to retain affected teeth wherever possible.[1,3,10]

In the case presented here, odontodysplasia was accompanied by a marked unilateral underdevelopment of the maxillary affected side. Rapid palatal expansion was performed to correct the skeletal (rather than dental) narrowness of the maxilla.[11-13] In this way the molars were maintained upright, and not buccally tipped, as would be seen with conventional dentoalveolar expansion. The treatment-induced forward and downward movement of the maxilla, with a downward and backward rotation of the mandible, are very helpful in pseudo-class 3 cases with deep overbite.[14,15] The utility arch that was also used here as a mandibular space maintainer is effective in bite-opening due to intrusion of lower incisors and extrusion of permanent molars.[16]

Together these had brought about altered skeletal and dental relations and changed the facial appearance from prognathic to orthognathic, with increased vertical height of the lower third of the face. The artificial replacement of teeth and alveolar bone with the maxillary removable prosthesis also enhanced the dental appearance and function. Future use of maxillary protraction may be necessary and continued supervision is advised.

CONCLUSIONS

Odontodysplasia poses a therapeutic challenge, since no single specialty can provide the all-round best clinical solution. A multidisciplinary treatment approach can meet this challenge, because it offers the skills of several specialties and appears to be the most beneficial for the patient.

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KNOWLEDGE AND PERCEPTIONS ABOUT AIDS TRANSMISSION

Previous reports (16) have also shown that the general public's greatest misperception related to AIDS information is the overestimation of the risk of giving and receiving blood. Similarly, educational level has been shown (13) to be positively correlated to AIDS information and perceptions. This present survey affirms these findings and correlates them with fear of infection from receiving dental care.

Related to the issue of public education, it is extremely important for the health professions to maintain the confidence of the public. Respondents who were the most confident of the accuracy and completeness of the information they were receiving from medical experts were most likely to report that they would remain in the practices of infected providers and those dentists who treated infected patients. Alarmingly, approximately 40% of the respondents did not believe that experts were telling everything they knew about the transmission of AIDS and these respondents were more likely to change dentists.

Recent reports from CDC and other established health and medical groups, and in particular, apparent shifts in position among experts, may have appeared confusing and served to alarm the public. Furthermore, public concern is likely to be heightened when information about AIDS is taken out of context or sensationalized in the mass media. Resulting public confusion may result in a lack of confidence in medical information, erode expert credibility, and negate the positive effect associated with public education. It will be critical for the dental profession to maintain public confidence and trust in order to minimize public concerns about the safety of the dental office.

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The significance of age, proximal caries, gingival inflammation, probing depths and the loss of lamina dura in the diagnosis of alveolar bone loss in the primary molars

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Franklin Garcia-Godoy, DDS, MS

The need for early diagnosis and treatment of alveolar bone loss (ABL) in children has been emphasized by the facts that ABL may be evident in the primary dentition, and, that individual susceptibility to ABL may already be found in childhood.[1-4] The diagnosis of ABL in children and adolescents includes increased distances from the cementoenamel junction (CEJ) to the alveolar bone crest (ABC).[1,4-7] In the primary dentition the diagnosis of ABL by increased CEJ-ABC distances may be complicated, however, by the fact that tooth eruption, which is an age-related phenomenon, may also be connected to an increase in the CEJ-ABC distances.[8-10] The purpose of the present study was to examine, therefore, the significance of age and clinical variables such as proximal caries severity, contact loss, mesial drift, gingival inflammation, probing depths, and the loss of lamina dura in the diagnosis of ABL in the primary molar area, as evidenced by increased CEJ-ABC distances.

MATERIALS AND METHODS

After approval from the Institutional Review Board (University of Texas Health Science Center in San Antonio, Texas), fifty-three children with a primary or mixed dentition, were selected at random as they were screened at the clinic (Table 1). All received clinical and radiographic examinations, including two bite-wing radiographs.

After calibration between both authors, in order to confirm the exact understanding of the parameters to be measured, the clinical examination and the radiographic examinations, at the proximal area between the primary molars, were performed by different examiners without being aware of the results of the other examination. The clinical examination included the following parameters:

☐ Gingival Index (GI):

0 = Normal gingiva
1 = Mild Inflammation-slight change in color, slight oedema. No bleeding on probing.
2 = Moderate inflammation-redness, oedema and glazing Bleeding on probing.
3 = Severe inflammation-marked redness and oedema. Ulceration. Tendency to spontaneous bleeding.[11]

☐ Probing depths at the distal surface of the first primary molar and at the mesial surface of the second primary molar.

Both probing depth measurements were done with a periodontal probe calibrated in millimeters (Hu-Friedy, Fox Williams, USA) and all the fractionated measurements were rounded to the nearest millimeter.

☐ Proximal caries severity (PCS) in the adjacent proximal surfaces of the primary molars:

The authors wish to express their gratitude to Mr. Israel Einot for his help in the statistical analysis.

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Table 1 ☐ Distribution of children by gender and age.

Age (in years)	3	4	5	6	7	8	9	10	Totals	mean	SD
Male	1	-	1	7	4	6	3	1	23	7.1	1.6*
Female	-	2	3	3	10	9	2	1	30	7.0	1.4*
Totals	1	2	4	10	14	15	5	2	53	7.1	1.5

* Statistically not significant difference, Student's t test (t = 0.13)

0 = No caries
1 = Incipient caries: minimal size that does not facilitate food impaction between the primary molars.
2 = Severe caries: large enough to facilitate food impaction between the primary molars.

☐ Complete loss of the proximal contact due to caries.

☐ Mesial drift due complete loss of the proximal contact.

Mesial drift was recorded when obvious overlapping was evident between imaginary lines that replaced the missing proximal surfaces.

The radiographic examination was done on selected bitewing radiographs based on the following criteria: presence of both primary molars at least in one quadrant; minimal evidence of distortion; minimal overlapping between the adjacent molar proximal surfaces; and a clear image of the CEJ and the alveolar bone between the primary molars. The distances from the cementoenamel junction to the alveolar bone crest at the distal surfaces of the first primary molars and at the mesial surfaces of the second primary molars were measured, using calipers and a ruler graded in millimeters, on the projected images of the selected radiographs on the screen of a slide viewer (Clearmate II SP slide viewer, Singer Education Systems, Rochester NY, USA). Because of the magnification (x7.2) of the slide viewer, each mm on the screen represented 0.14 mm of the radiograph. In addition the complete absence of the lamina dura on the interdental alveolar bone between the primary molars was recorded.

With the purpose to evaluate the reliability of the clinical and radiographic measurements, eight clinical examinations and the CEJ-ABC measurements in the radiographs of every fifth child were done twice without being aware of the first examination.

Statistical examination

The Kappa coefficient and the test-retest method were utilized to examine the reliability of the clinical and radiographic measurements respectively.[12] The significance of the differences between mean CEJ-ABC measurements was examined with a paired t-Test. The Pearson correlation coefficients between the mean CEJ-ABC measurements per patient and age, and between the CEJ-ABC measurements and their corresponding probing depths were calculated. The significance of the differences in CEJ-ABC measurements among males/females, sites with/without contact and sites with/without lamina dura, was examined with a two-factor repeated measures analysis of variance (ANOVA) . The significance of the differences in CEJ-ABC measurements when grouped by GI or PCS were examined with a one-factor ANOVA. The significance of the effect of age, PCS and GI (independent variables) on the CEJ-ABC measurements (dependent variables) was examined using a multiple regression analysis, with "dummy variables" for PCS and GI since their values are categories (not proportional).[13] A standard computer program for statistical analysis was utilized (StatView® SE + Graphics, Abacus Concepts, Inc. Berkeley, CA 94704, USA) for all examinations with exception of the kappa analysis for which a SPSS-X Release 3.1 for IBM VM/CMS 4.0 was utilized. A 95 percent level of significance was chosen.

RESULTS

The CEJ-ABC was measured at both primary molars in 165 quadrants: one quadrant in four children; two in fourteen children, three in seven children and four quadrants in twenty-eight children. Among these, a normal diastema was present in five quadrants, contact loss in twenty-one quadrants and the complete loss of the lamina dura in nine quadrants. Because all sites with mesial drift corresponded to 97.3 percent of the sites with loss of contact, only the findings for contact loss are presented.

A high reliability of the clinical examination was indicated by a kappa coefficient of ≥ 0.807 for the various parameters. In addition, a not significant difference ($t = 0.153$) and a significant correlation ($r = 0.854$) indicated a high reliability of the radiographic examination.

The mean per patient CEJ-ABC measurements ($n = 53$) were: $0.97 \pm .3$ mm for the first primary molars; 0.78 ± 0.3 mm for the second primary molars; and 0.86 ± 0.2 for both molars together. A statistically significant difference was found between the mean-per-patient measurements for the first and second primary molars ($t = 5.5$, $p = 0.0001$).

The correlation coefficient between age and the mean per patient for the CEJ-ABC measurements was significant ($r=0.39$). On the other hand, when this correlation was examined for each molar separately, the one for the first primary molars was not significant ($r=0.17$, $p>0.05$), whereas the one for the second molar remained significant ($r=0.48$, $p<0.001$). The correlation coefficients between the CEJ-ABC distances and their corresponding probing depths were not significant, neither for the first ($r=0.03$) nor the second molars ($r=0.01$).

ANOVA between the CEJ-ABC distances of both molars and gender, presence/absence of contact and presence/absence of lamina dura (Tables 2-4) indicated significant differences: within the CEJ-ABC distances of both molars in every instance; between the presence/absence of contact groups; and presence/absence lamina dura groups. Furthermore a significant interaction was found between the CEJ-ABC distances of both molars and the presence/absence of lamina dura.

ANOVA indicated that there were no significant differences among the CEJ-ABC measurements when grouped by GI (Table 5), whereas significant differences were found when the CEJ-ABC measurements of both primary molars where grouped by PCS (Table 6).

On examining the effects of age, PCS and GI on the CEJ-ABC measurements using multiple linear regression analysis it was found that:

- ☐ They account for 35.5 percent of the variation noted in the CEJ-ABC measurements of the first primary molar ($R^2=0.126$, $p=0.005$), and, for 40.0 percent for those of the second primary molars ($R^2=.16$, $p=0.0002$).
- ☐ When considering the effect of each variable controlling for the others, age and severe caries had a significant effect on the CEJ-ABC measurements of the first primary molars ($\beta=0.05$, $p=0.03$; and $\beta=0.169$, $p=0.02$, respectively) and on the CEJ-ABC measurements of the second primary molars ($\beta=0.08$, $p=0.0006$; and $\beta=0.174$, $p=0.006$, respectively).

DISCUSSION

In the present study, a relationship between alveolar bone loss and severe proximal caries is indicated by: the significant differences in the CEJ-ABC measurements adjacent to areas with and without contact loss (Table 3); the significant differences in the CEJ-ABC measurements among the PCS groups (Table 6); the

Table 2 ☐ Distribution of CEJ-ABC distances by gender.

		CEJ-ABC distances		
		First molars*	Second molars*	Totals
	n	mean	mean	mean
Male**	71	1.03	0.72	0.88
Female**	94	0.93	0.76	0.85
Totals	165	0.97	0.75	0.86

* Statistically significant difference, ($F=33.06$, $p=0.0001$)§
** Not statistically significant difference, ($F=0.209$, $p=0.6$)§
§ Two factor repeated measures Analysis of Variance.

Table 3 ☐ Distribution of CEJ-ABC distances by presence/absence of contact loss.

		CEJ-ABC distances		
		First molars*	Second molars*	Totals
	n	mean	mean	mean
Contact loss**	21	1.36	0.96	1.16
No contact loss**	139	0.90	0.72	0.81
Totals	160†	0.97	0.75	0.86

† 5 quadrants had a normal diastema
* Statistically significant difference, ($F=29.29$, $p=0.0001$)§
** Statistically significant difference, ($F=17.284$, $p=0.0001$)§
§ Two factor repeated measures Analysis of Variance

Table 4 ☐ Distribution of the CEJ-ABC distances by presence/absence of lamina dura.

		CEJ-ABC distances		
		First molars*	Second molars*	Totals
	n	mean	mean	mean
Lamina dura absent**	9	1.59	1.00	1.29
Lamina dura present**	156	0.94	0.73	0.84
Totals	165	0.97	0.75	0.86

* Statistically significant difference(B), $F=33.367$, $p=0.0001$§
** Statistically significant difference, $F=14.086$, $p=0.0002$§
Statistically significant interaction between type of tooth and presence/absence of lamina dura, $F=4.925$, $p=0.02$§
§ Two factor repeated measures Analysis of Variance.

Table 5 ☐ Distribution of the CEJ-ABC distances by gingival index (GI).

		CEJ-ABC distances			
		First molars		Second molars	
GI group	n	mean	SD	mean	SD
0	5	0.86	0.36	0.94	0.33
1	53	0.92	0.46	0.73	0.50
2	56	0.96	0.53	0.76	0.46
3	46	1.02	0.40	0.74	0.32

Table 6 ☐ Distribution of the CEJ-ABC distances by caries severity.

		CEJ-ABC distances			
		First molars		Second molars	
Caries group	n	mean	SD	mean	SD
none	96	*0.88	0.44	**0.68	0.41
incipient	35	1.00	0.46	***0.74	0.33
severe	29	*1.21	0.47	***1.00	0.51

One factor Analysis of Variance, statistically significant differences:
* $F=6.09$, ** $F=6.67$, *** $F=3.08$, $p<0.05$.

finding that PCS had a significant influence on the CEJ-ABC measurements (Multiple Regression Analysis). These findings are in agreement with previous reports that indicate that food impaction and retention are contributory factors in periodontal diseases.[1,4,14] Furthermore, previous studies done on caries-free teeth indicated a significant correlation between age and the CEJ-ABC measurements of both primary molars, whereas in this study, which included carious teeth, this correlation was not significant for the first primary molars, probably because of the high prevalence of proximal caries found in the first primary molar.[4,8-10,15]

The present finding that no differences were found in the CEJ-ABC measurements when grouped by the GI (Table 5), and the lack of significant influence of GI on the CEJ-ABC measurements when controlling for age and PCS (Multiple Regression Analysis), are in agreement with a previous study in which no significant correlations were found between defects in the margin of the alveolar crest and the presence or absence of gingivitis in the adjacent tissues.[16]

The lack of significant correlations between probing depth and the CEJ-ABC distances found in the present study may result from the fact that probing depths were recorded in whole millimeters; the petite changes in the CEJ-ABC distances in the present sample, therefore, remained unreflected. It should be noted, however, that the present population did not include cases of severe alveolar bone loss, in which probing depths may reflect alveolar bone loss.

Radiographic evidence of fuzziness and/or a break in the continuity of the lamina dura, at the mesial or distal aspect of the alveolar crest, has been described as the earliest radiographic change in periodontitis.[17] On the other hand, Page and Schroeder consider that many of the radiographic features, such as widening of the periodontal ligament space, alveolar bone density, or CEJ alveolar crest distance, which have been used to diagnose periodontitis, are not necessarily measures of periodontitis.[18] Furthermore, Greenstein *et al.*, in a study on the permanent dentition, concluded that caution should be exercised when using the integrity of lamina dura as a diagnostic criteria.[16] In the present study only the complete loss, and not partial loss, of lamina dura was used, therefore, as criterion for the radiographic evidence of alveolar bone loss. The present finding that the CEJ-ABC measurements were larger in areas with no lamina dura (Table 4) indicates that the radiographic evidence of the lack of lamina dura is indicative of alveolar bone loss in the primary molars.

The present finding that age had a significant influence on the CEJ-ABC measurements when controlling for proximal caries severity (PCS) and gingival index (GI) is in agreement with previous studies that indicated a correlation between age and CEJ-ABC measurements.[8-10]

In conclusion the present study indicates that the diagnosis of alveolar bone loss in the primary molar area may be related to: increased CEJ-ABC distances adjacent to proximal contact loss caused by caries; and the complete loss of lamina dura of the interdental alveolar bone crest. On the other hand, in the present study, probing depths and gingival inflammation did not relate to alveolar bone loss.

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EPIDEMIOLOGY

Almost twenty million chronically ill children

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

In 1988), an estimated 31 percent of children were affected by chronic conditions."[1]

The incidence and prevalence of infectious diseases, as well as mortality rates, have fallen markedly during the past decades. But "...one critical dimension of child health, reductions in the prevalence of childhood chronic illnesses have not been nearly as dramatic."[1]

The increasing availability of data from national health surveys provides pediatric dental practitioners with a general overview of the chronic medical conditions that affect one-third of all children—even those children in their practices. The following presentation will be a summary of many of the findings from a national study on the health of children.

SOURCE OF INFORMATION

Data from the 1988 National Health Interview Survey (NHIS) on Child Health was conducted by the National Center for Health Statistics. The NHIS is a continuing nationwide household survey conducted by the U.S. Bureau of the Census. The sample is designed to be representative of the civilian noninstitutionalized population. Each year interviews are conducted in approximately 45,000 households, including about 135,000 persons. In 1988 a special supplemental questionnaire on child and adolescent health was included in the survey. This questionnaire was administered for one randomly selected youngster in each household. Interviews were completed for 91 percent of all eligible children less than eighteen years of age, resulting in a sample of 17,110 youngsters.[1-4]

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DEFINING A CHRONIC CONDITION

A condition was considered chronic if

- ☐ It was noticed more than three months before the interview date, or
- ☐ It was the type of condition that ordinarily has a duration of more than three months (e.g. diabetes, heart conditions and arthritis).

Chronic conditions were categorized as

- ☐ Impairments (e.g. deafness, cerebral palsy).
- ☐ Diseases (e.g. asthma, heart disease).[1]

FINDINGS

Number of chronic conditions

- ☐ 13.3 million children had one chronic condition, 4.1 million children had two chronic conditions. There was a greater number of children less than ten years of age with one or two chronic conditions, than their older counterparts.
- ☐ 1.8 million children had three or more chronic conditions. The number of children with this number of conditions was divided evenly between those less than ten years of age and adolescents (between ten and seventeen years—as defined in the NHIS report) (Figure 1.)

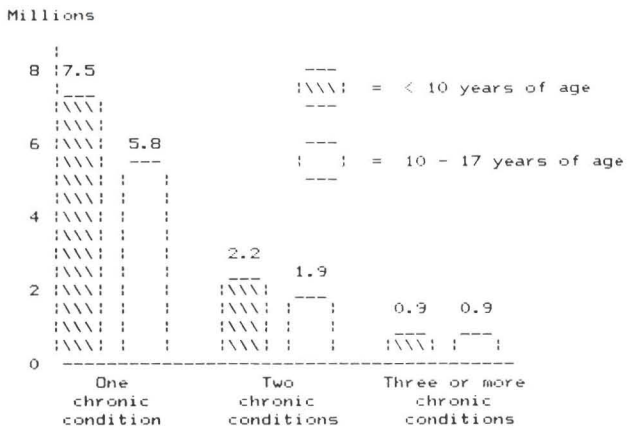

Figure 1. Estimated number of children less than 18 years of age with chronic conditions: 1988.[1]

Types of chronic conditions

- ☐ The most commonly reported childhood chronic conditions included respiratory allergies (including hay fever) and frequent or repeated ear infections.
- ☐ Other common, but less frequent conditions included asthma, eczema and skin allergies, speech defects, frequent or severe headaches and digestive allergies (Table 1).

Prevalence

- ☐ Childhood chronic conditions appeared to be slightly more prevalent among older children. (Note: the difference is not statistically different.).
- ☐ Chronic conditions were more prevalent among boys than among girls.
- ☐ Chronic conditions were more prevalent among white children than black children (Table 2).

In an earlier NHIS study in the mid-1980s, it was reported that the white population of children had far more acute health conditions than their black counterparts. A variety of explanations for these differences were reported in the study report. For example, in the NHIS study, acute conditions were defined partially in terms of the receipt of medical services. Black children may have received less medical attention for health problems. No final conclusions for these differences, however, were noted.[5]*

- ☐ Among adolescents (ages ten to seventeen years), 31.5 percent (or 8.6 million) had one or more chronic conditions. There were minimal differences in the prevalence of chronic conditions between 1) younger (ages ten to thirteen years) and older (ages fourteen to seventeen years) adolescents, 2) males and females and 3) by poverty status.

Chronic conditions were more prevalent in the Western region of the nation than in the Southern region, and among adolescents living in suburban and rural areas than in central city areas. In addition, there were greater differences by race and ethnicity. Chronic conditions were reported more often by white adolescents than by black, Hispanic and other minority ad-

Table 1 ☐ Estimated prevalence of chronic conditions among children less than 18 years of age: 1988.[1]

Condition	Number (in 000s)
All children with chronic conditions	19,556
Impairments	
Musculoskeletal	967
Deafness and hearing loss	975
Blindness and vision impairment	810
Speech defects	1,666
Cerebral palsy	112
Diseases	
Diabetes	64
Sickle cell disease	74
Anemia	557
Asthma	2,700
Respiratory allergies	6,155
Eczema and skin allergies	2,088
Epilepsy and seizures	151
Arthritis	290
Heart disease	965
Frequent or repeated ear infections	5,304
Frequent diarrhea/bowel trouble	1,085
Digestive allergies	1,419
Frequent or severe headaches	1,606
Other	1,256

*See an earlier presentation in the *Journal of Dentistry for Children* for a detailed review of the differences in the health status of black and white children.[6]

Table 2 ☐ Estimated prevalence of chronic conditions in children by age, gender and race: 1988.[1]

	Number per 1,000 children
Age	
Less than 10 yrs	302.2
10–17 yrs	315.0
Gender	
Male	326.2
Female	288.2
Race	
White	324.4
Black	246.5

Table 3 ☐ Estimated prevalence of chronic conditions in adolescents by sociodemographic characteristics: 1988.[2]

Characteristics	Prevalence per 100 adolescents
Age	
10 to 13 years	31.0
14 to 17 years	31.9
Gender	
Male	32.1
Female	30.9
Race and ethnicity	
White	34.8
Black	23.7
Hispanic	24.0
Other	25.5
Poverty status	
At or below poverty level	30.1
Above poverty level	32.4
Region	
Northeast	31.5
Midwest	33.0
South	28.0
West	35.5
Residence	
Central city	28.8
Suburbs	32.4
Nonmetropolitan	32.8

Table 4 ☐ Frequency of difficulties and impact of chronic conditions: 1988.[1]

Frequency of bother	Percent
Never	24.7
Once in a while	53.0
Often or all the time	22.3
Amount of bother	
Never	24.7
Very little or some	50.1
Great deal	25.2
Impact	
Limitation in usual activities	13.3
Percent using medication	63.1
Percent hospitalized in past year	3.8
	Number
Annual number of bed days	2.2
Annual number of lost school days	3.1
Annual number of physician contacts	4.7

olescents (Table 3). (Note: the numerous reports on the NHIS study provide extensive detailed descriptions of the variations in the prevalence, impact, use of medical services, etc. for each of the chronic conditions.[1-4] The emphasis in the current presentation is on general summary material.)

Impact of chronic conditions

☐ On average, childhood chronic conditions were reported "never to bother" children 25 percent of the time. About one half (53 percent) reported that they were "bothered once in a while."

Slightly less than one quarter (22 percent) reported they were "bothered often" or "all the time." The amount of bother caused by these chronic condition ranges from "never" (25 percent), to "very little or some" (50 percent), to "a great deal" (25 percent).

☐ As a result of the chronic conditions:

☐13 percent of the children had limitation in their usual activities,

☐two days per year were spent in bed (in addition to days for acute illness),

☐three school days were lost per year,

☐63 percent used some medication,

☐almost 4 percent were hospitlized during the year, and

☐4.7 annual physician contacts were made (Table 4).

Nationally, an estimated 690,000 children were hospitalized for a total of 7.2 million days for treatment of chronic conditions, with a total cost of approximately $7.5 billion annually for hospital and physician services.[1]

☐ In 1988, 30 percent of children with chronic conditions had no physician services related to their conditions. Ten percent had ten or more contacts and accounted for 63 percent of all ambulatory physician services for chronic illness.[1] Children with special needs (see below) who had the fewest physician contacts (in particular black children and children in low income families) tended more likely to be hospitalized.[3]

☐ Overall, two thirds of all children with chronic conditions were affected mildly by their conditions and experience little or no adverse effects on their activities.

☐ By contrast, about 5 percent of children with chronic conditions were both bothered by their conditions often or all the time and were limited in their usual activities (Figure 2).

☐ Only 2 percent of all children experienced severe chronic conditions. This group of children spent an average of ten days in bed, however, missing eleven days of school and accounted for 27 percent of all bed days and 24 percent of all school absences related to chronic conditions.[1] Nationally a total of 37 million bed days and 41 million school absence days were attributable to chronic conditions.[2]

☐ Adolescents with chronic conditions are more likely than their counterparts without chronic conditions to experience behavioral problems, includ-

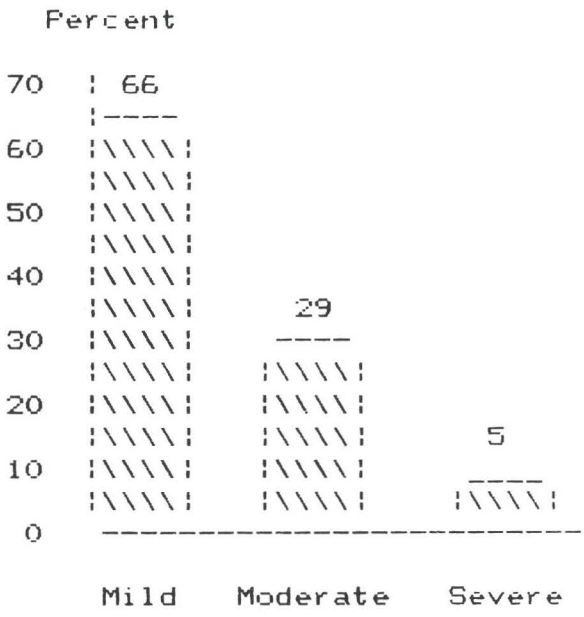

Figure 2. Percent distribution of children with chronic conditions, by severity level: 1988.[1]

ing anxiety and depressed moods, headstrong and antisocial behavior, hyperactivity and peer conflict, and social withdrawal.[2]

Children with special needs

Around 9.6 million (or 15.2 percent) children with chronic conditions were estimated to have special needs. For purposes of the NHIS study, children with special needs were defined as those for whom the condition caused problems, including missing school, staying in bed, limiting their usual activities or experiencing pain or discomfort "often" or "all of the time." The chronic conditions for which more than half of the children experienced these problems were cerebral palsy, severe headaches, epilepsy or seizures, asthma, frequent or repeated ear infections, arthritis and other musculoskeletal impairments.[3]

There were minimal differences in the percent of chronically ill children with special needs by age, gender, family income and place of residence. The rates were higher for nonminority children and non-Hispanic children as compared to their respective counterparts. By contrast, the rates for children who had neither private insurance nor Medicaid were lower than their respective counterparts (Table 5). Results from previous NHIS studies would seem to indicate that these lower prevalence rates may be due to underreporting.[3]

Table 5 ☐ Estimated percent of chronically ill children with special needs by sociodemographic characteristics: 1988.[3]

Characteristics	Percent of children in each category
All children	15.2
Age	
Less than 5 years	15.6
5 to 17 years	15.0
Gender	
Male	15.8
Female	14.5
Race	
White	16.0
Black	12.4
Hispanic origin	
Hispanic	12.1
Non-Hispanic	15.6
Family structure	
Biological mother and father	15.0
Biological mother only	17.1
Other	10.8
Family income	
Less than $25,000	15.3
$25,000 or more	16.1
Place of residence	
Central city	14.5
Non central city	15.2
Non metropolitan area	15.9
Insurance coverage	
Private insurance	15.7
Medicaid	16.5
Neither priv. ins. or Medicaid	13.1

While about three quarters of chronically ill children with special needs had private insurance coverage and 11 percent had Medicaid coverage, it was estimated that about 13 percent had no insurance coverage (particularly Hispanic children and children from low income families).[3]

THOUGHTS FOR PEDIATRIC DENTISTS

An earlier review in the *Journal of Dentistry for Children* dramatized the needs of almost 11 million children with developmental learning disabilities, and emotional and behavioral problems.[7] The current presentation emphasized the fact that almost 20 million (or about a third of all children) had some chronic health condition. While there are many instances of overlap in these two groups, the reality is that significant numbers of youngsters treated by dental practitioners are experiencing ongoing chronic medical and emotional difficulties. As a result, the complex process of history taking, individualized treatment planning and patient management may need to be modified and/or aug-

mented, when caring for any of these "special patients."**

We tend to equate chronic medical conditions with the lengthening of years, rarely considering the possibility that the next youngster in our dental office will be one of the one-third of children with a chronic condition. Are you and your staff considering the many needs of chronically ill children that surely frequent your practice on a daily basis?

**The care and support of these "special" individuals requires added efforts beyond the particular environment of a dental and medical practice. For example, program modifications have been developed at our school to assist two current dental students who have learning disabilities. Reduced workloads with a lengthened course of studies, special tutoring and other aids have provided a successful learning environment.

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THE WONDER YEARS

How can we define the problems of adolescence until we have addressed the problem of defining adolescence?

We submit that it is in the best interests of all who address health concerns for individuals between childhood and adulthood to "agree to agree" on a set of common definitions for this important span of life. Until this happens we encourage the use of a new term—"the wonder years." We do so because we often wonder to what age group or groups researchers, teachers, policy makers, and practitioners are referring when they communicate about health-related issues for members of this population.

. . . many definitions exist for adolescence. Some age groupings for the wonder years end at 17 or 18, whereas others extend to 24 years. For example, the United Nations' definition of "youth" or "young people," encompasses the age limits 15 to 24 years. Similarly, the World Health Organization's definition of those in the years bounded by childhood and adulthood has raised its upper limit to 24 years, or about the time of "total socioeconomic independence" (an even more nonspecific term). Other groups tend to use definitions that are either convenient or to their best advantage.

Grace, T.W. and Patrick, K.: The wonder years.
Pediatrics, 93:495–497, March 1994.

DEMOGRAPHICS

Only a small fraction of our health care dollar is spent on children

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

"

(children) make up nearly 28 percent of the Nation's population, yet they account for less than 14 percent ... of the Nation's ...health care expenditures..."[1]

The results from the most recent national study by the *Agency for Health Care Policy and Research* and the *Packard Foundation's Center for the Future of Children* on general health and dental expenditures indicate that:

- ☐ Per capita expenditures for children (in 1987) were only 59 percent as large as those for adults.
- ☐ Per capita expenditures for the elderly over sixty-five years of age were almost six times those of children.[1]
- ☐ The number of children not covered by health insurance rose by 3.1 million, from 12.7 percent of all children in 1977 to 17.8 percent in 1987. Uninsured children have less access to and use of health care services compared with insured children. For example, in 1987:

□80.4 percent of privately insured children used ambulatory care services, compared with 59.4 percent of children who were uninsured all year.[2]

□57.6 percent of children (3 to 17 years of age) with private dental insurance received dental care, compared to 21.6 percent of children with no private dental insurance.[3]

The following presentation will provide an overview of the findings from various government and private agency studies and other related information in an effort to detail the reality that "only a small fraction of our health care dollar is spent on children."

SOURCE OF DATA

The *1987 National Medical Expenditure Household Survey* was a national probability sample of the civilian, noninstitutionalized population. With a total sample of about 35,000 individuals in 14,000 households, the survey was designed to provide estimates of the health status, use of health services, expenditures, sources of payment and insurance coverage for population groups of special interest to the federal government, including poor and low-income families, the elderly, the functionally impaired, and black and Hispanic minorities.[3-5]

Similarly, national survey data are developed by the Department of Agriculture on housing, food, transportation, clothing, health care, education, child care and other costs for children residing in various family arrangements. (Data are available by region and urban and rural areas of the nation. In an effort to simplify this presentation, only national data are included in the following material.)[6]

HEALTH EXPENDITURES

In 1987, an average of $737 was spent for health services for children (ranging from $426 for children between three and twelve years to $1,524 for children less than three years of age).

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- ☐ The most expensive 5 percent of the children cost an average $8,641 (or 59 percent of total costs).
- ☐ The least expensive 95 percent of the children averaged only $316.[1]
- ☐ By contrast, $1,347 was spent for adults less than age 65 and $4,276 for individuals age 65 and over (Table 1).
- ☐ Approximately 80 percent of children (between three and eighteen years) and adults (less than 65 years) had expenditures for health services, compared to over 90 percent of children less than three years and adults 65 years and older (Table 1).
- ☐ The most striking difference in health expenditures between children and adults was the much larger share of dental care expenditures in the health care budget of children. The most extreme difference existed between children six to eighteen years (for whom dental care represented 30 percent of expenditures) and adults 65 years and older (for whom dental care represented 3 percent of health expenditures). People age 65 and over spend four times as much per capita on health care, however, as do people under age 65.[7] In addition. "(e)very Medicare study over two decades has shown that same profile in end-of-life expenses: ($32 billion per year or) 16 percent of the total Medicare annual budget is reimbursed in the last 60 days of life."[8] "... 25 to 30 percent of medical costs for Medicare patients stem from care during the last year of life...(and) 10 percent of the patients account for 75 percent of all medical costs."[9]
- ☐ There was a direct relationship between increasing family income and expenditures for health care and overall expenditures per child (Table 2).

Lower income, single-parent families spent more money overall per child than lower income, husband-wife families (primarily because of higher transportation expenditures by single-parent families). Lower income, single parents spent less for health costs for their children, however, than their husband-wife family

Table 1 ☐ Modified personal health care expeditures by age: 1987.[4]

Age (years)	Total MPHCE* (billions)	Total population (millions)	Percent of pop. with expenditures	Per capita expenditures	Expenditures per individual with expenditures
All children					
0-18	$49.8	68	83%	$737	$893
0-2	16.8**	11	92	1,524	1,660**
3-12	14.9	35	81	426	525
13-18	18.2	22	80	843	1,053
Adults					
19-64	193.2	144	83	1,347	1,616
65+	121.0	28	94	4,276	4,566

*Includes hospital care, services of physicians, dentists and other health care professionals, prescription drugs and other personal health care services, products and equipment.

**Excludes expenditures associated with initial newborn hospitalization of infants discharged at the same time as their mother.

Table 2 ☐ Health care and total expenditures per child by family structure, family income and age of child: 1991.[6]

	Health Care					Total Expenditures				
	Single Parent Family	Husband-Wife Family	Single Parent Family	Husband-Wife Family		Single Parent Family	Husband-Wife Family	Single Parent Family	Husband-Wife Family	
Age (years)	<$31,200		$31,200+	$31,200-$50,400	>$50,400	<$31,200		$31,200+	$31,200-$50,400	>$50,400
0-2	$90	$250	$240	$320	$400	$3,930	$4,520	$8,150	$6,400	$9,160
3-5	150	230	340	300	370	4,960	4,820	9,500	6,800	9,640
6-8	160	250	360	320	400	5,390	4,810	9,840	6,760	9,500
9-11	190	260	410	330	410	5,690	4,660	10,240	6,570	9,310
12-14	220	260	460	330	410	5,550	5,350	10,020	7,320	10,160
15-17	200	280	430	350	430	5,860	5,700	10,410	7,780	10,690

Note: total expenditures include housing, food, transportation, clothing, health care, education, child care, etc.

Table 3 ☐ Amount and distribution of health expenditures for children by source of funds and age of child: 1987.[4]

Age (years)	Expenditures (billions)	Private				Government		
		Percent distribution						
		All private funds	Out-of-pocket	Private insurance	Other	All public funds	Medicaid	Other
All children								
0-18	$49.8	75.5%	26.9%	42.6%	5.9%	24.5%	12.3%	12.2%
0-2	16.8	58.4	16.8	36.5	5.1	41.6	13.7	27.9
3-12	14.8	79.4	29.7	43.3	6.4	20.6	15.1	5.5
13-18	18.2	88.0	34.0	47.7	6.3	12.0	8.6	3.4

counterparts (Table 2) (See section below on changing family structure.)*

SOURCE OF PAYMENT

There are differences in the distribution of the sources of payment for health care for children and adults. In 1987, two-thirds of the total modified personal health expenditures for children and 72 percent for adults were paid for by third parties, including private insurance and government programs (Table 3).[4] Public programs paid for 24 percent of health care for children, compared to 37 percent for adults.

	Children	Adults
Private insurance	43%	85%
Medicaid	12%	8%
Medicare	—	21%
Other public programs	12%	8%
Total	67%	72%

*For a more detailed discussion of the costs of rearing children, see a previous presentation in the *Journal of Dentistry for Children.*[10]

☐ Public programs (including Medicare) paid 62 percent of expenditures for those 65 years and over. Overall public expenditures for adult health care ($116.7 billion) was almost ten times as great as public expenditures for children's health care ($12.2 billion).[4]

☐ As children age (between O and 18 years) there is a progressive decrease in the proportion of expenditures for health care costs paid for from public funds and a progressive increase in the proportion paid for by out-of-pocket and private insurance funds. In the teenage years, a third of expenditures are paid out-of-pocket, compared to 12 percent from public funds (Table 3).

☐ Over 95 percent of dental expenditures for children were from private funds (53 percent out-of-pocket). As children age, there is a progressive decrease in the proportion of expenditures for dental care costs paid for from public funds. Only for children less than three years of age (for whom overall expenditures were less than 100 million dollars and public funds represented less than one dollar per child) did government funds represent

The health care budget of children includes a much larger share of dental care expenditures than the budget of adults.

almost 20 percent of costs.

- In the teenage years, public funds represented less than 3 percent of dental costs or approximately seven dollars per child. By contrast, out-of-pocket expenditures for dental care during the teenage years was $143 per child (Table 4).
- Dental insurance (particularly private coverage) is a critical factor in the use of dental services. A greater percent of children with insurance coverage, compared to children without coverage, use dental services. This difference exists despite the decrease in the number of visits per user of services between 1977 and 1987 (Table 5).

FAMILY STRUCTURE AND THE USE OF HEALTH SERVICES

The study finding (noted above) that lower income single-parent families spend less money for health services for their children, than lower income, husband-wife families, is most significant in light of the marked increase in the numbers of single-parent families and

Table 4 ☐ Amount and distribution of dental expenditures for children by source of funds and age of child: 1987.[4]

Age (years)	Expenditures (billions)	Private				Government		
		Percent distribution						
		All private funds	Out-of-pocket	Private insurance	Other	All public funds	Medicaid	Other
All children								
0-18	$8.7	95.4%	52.9%	36.5%	6.0%	4.6%	3.5%	1.1%
0-2	< 0.1	80.7	36.0	33.5	11.2	19.3	6.8	12.6
3-12	3.2	92.7	47.9	38.9	5.9	7.3	5.1	2.2
13-18	5.5	97.1	55.9	35.1	6.1	2.9	2.5	0.4
		Per capita expenditures						
	Total per capita expenditures	All private funds	Out-of-pocket	Private insurance	Other	All public funds	Medicaid	Other
All children								
0-18	$129	$123	$68	$47	$8	$6	$4	$1
0-2	2	2	1	1	–	–	–	–
3-12	92	85	44	36	5	7	5	2
13-18	255	248	143	89	16	7	6	1

Table 5 ☐ Health insurance status and use of dental services: 1977, 1987.[3]

Insurance status and age	Percent using dental care		Average number of visits per user	
	1977	1987	1977	1987
3-5 years				
Privately insured	27.7%	43.0%	2.1	1.7
Publicly insured	21.5	34.3	–*	2.1
Uninsured (part year)	17.5	18.0	–	–
Uninsured (all year)	15.7	18.5	–	–
6-12 years				
Privately insured	56.1	62.8	2.8	2.8
Publicly insured	39.4	39.7	2.8	2.4
Uninsured (part year)	40.3	38.4	2.7	2.3
Uninsured (all year)	15.7	18.5	–	–
13-17 years				
Privately insured	56.6	59.1	4.6	4.3
Publicly insured	36.5	34.6	3.5	2.3
Uninsured (part year)	43.4	31.9	3.3	–
Uninsured (all year)	29.6	18.8	3.6	–
All children				
Privately insured	51.7	57.6	3.5	3.2
Publicly insured	34.8	36.9	3.0	2.3
Uninsured (part year)	36.3	31.1	2.9	2.4
Uninsured (all year)	30.1	21.6	3.2	2.6

*Too few respondents to produce reliable estimates

Table 6 ☐ Families with children by family structure: 1975, 1991.[11,12]

	1975	1991
	(Numbers in thousands)	
Families with children	30,375	34,913
Married couple families		
Number	25,400	24,863
Percent	84.0%	71.2%
Families maintained by women		
Number	4,461	8,745
Percent	14.6%	25.0%
Families maintained by men		
Number	454	1,365
Percent	1.5%	3.9%

the frequent association between single parenthood and low income status.

The number of families with children increased from 30 million in 1975 to almost 35 million in 1991. However,

- ☐ The percent of married couples with children decreased from 84 percent to 71 percent of all families.
- ☐ The percent of families with children maintained by single women increased from 14.6 percent to 25 percent of all families (Table 6).

In 1991, 61 percent of black children were living in single parent families.

- ☐ Fifty-eight (58) percent of black children lived in female-maintained, single families.
- ☐ Thirty-one (31) percent of Hispanic origin children and 17 percent of white children lived in single-parent families. (Table 7).
- ☐ Thirty-one (31) percent of single, black-female parents were never married.[12]**
- ☐ In 1990, 44 percent of all single mothers with children had incomes that were below the poverty level, compared to 7 percent of all married couples with children (Table 8). The median income of families maintained by single females with children was $13,092, 31.7 percent less than the median income of husband-wife families with children ($41,260).[14]

**For a more detailed discussion of the evolving family structure, see an earlier presentation in the *Journal of Dentistry for Children.*[13]

Table 7 ☐ Families with children by family structure, race and Hispanic origin: 1975, 1991.[11,12]

	White		Black		Hispanic origin*	
Family structure	1975**	1991	1975**	1991	1975	1991
Total children (000s)	54,292	50,875	8,210	9,543	4,751	7,166
Percent in:						
Two parent families	85.4%	80.1%	49.4%	38.4%	na	69.0%
Single parent						
Maintained by women	11.3	16.9	41.0	57.8	na	27.7
Maintained by men	1.5	3.0	1.8	3.8	na	3.3

*May be of any race
**Does not include data for children living with neither parent

Over 95 percent of dental expenditures for children were from private funds.

Table 8 ☐ Families below the poverty level by family structure: 1970, 1980, 1990.[12]

	1970	1980	1990
	(Numbers in 000s)		
Number of families (with children) below poverty level	3,330	4,432	5,441
Married couples	1,558	1,555	1,610
Single mothers	1,509	2,498	3,302
Single fathers	263	379	529
Percent of all families (with children) below poverty level	11%	13%	16%
Percent of all married couples (with children) below poverty level	6%	6%	7%
Percent of all single mothers below poverty level	45%	42%	44%

SOME RELATED CONCERNS ABOUT OUR CHILDREN

The results of a recent study indicated that during the 1980s, "...parents worked more but earned less, allowing them less time and money to help improve their children's lives."[15] "In 33 states, in which 82 percent of our children live, the conditions of children worsened on more than half of the nine benchmarks."[15]

- ☐ Children living in poverty increased by 22 percent.
- ☐ Births to single teenagers rose 14 percent.
- ☐ Children in single parent families increased by 13 percent.
- ☐ Juvenile incarceration increased by 10 percent.
- ☐ Babies born with low birth weight rose by 3 percent.
- ☐ White single girls accounted for the majority of teenagers having babies.
- ☐ The violent death rate of teenagers between fifteen and nineteen years increased 11 percent, led by suicides and homicides.[15] In 1990, among young children (10-14 years) 560 died from firearm injuries (one out of every eight deaths). Among black teenage males (15-19 years) 60 percent of deaths resulted from firearm injuries, compared to 23 percent of deaths for their white counterparts. Comparable rates for black females and white females were 22 percent and 10 percent of deaths.[16]

OVERVIEW

As this material is being prepared in the early summer of 1993, the Clinton administration and the Congress are laboring to develop some system to resolve the dilemma of inadequate coverage for health care costs. The American Dental Association has issued its position paper in opposition to dramatic changes in the funding for dental care, except for children and the economically deprived segments of our society.[17] (This position is not too unlike its stand in the mid 1960s when it opposed the inclusion of dentistry within the Medicare program.)[18]

But as the various competing lobbying groups emphasize their perspectives before the legislative committees, we must not overlook one of the least costly efforts (and the one with the greatest potential)—increased care of our children.

"...policymakers seeking to increase access to health care should consider options for expanding third-party financing to cover children aged 3 to 12, who incur the least health care expenditures."

It would appear that this is the most appropriate time to remind our legislative representatives that, **Only a small segment of our health care dollar is spent on children!"**

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CHILD PEDESTRIAN INJURY EVENTS

Physicians, health care professionals, child care providers, and schools must incorporate age-appropriate recommendations into their educational programs and messages. For example, they must warn parents about the hazards and risks of toddlers and children being injured in driveways and parking lots because they may not be seen by the driver. Parents must be warned that the 3- and 4-year-old child is capable of darting into the street when not restricted from the street by physical barriers or close "active" age-appropriate supervision. The issues of school-age children darting out impulsively and inattentively into traffic must be constantly impressed on families.

Environmental modifications which separate children from traffic and reduce speed of traffic may prove more fruitful, eg, signing, speed bumps for drivers, and provision of designated play areas. Measures to detect and/or warn out-of-sight children, ie, mirrors, back-up warnings, and motion detection devices should also be considered. Designating streets that should be blocked off from traffic, at least through traffic, in residential communities during hours of peak activity among children may prove useful in certain communities. Neighborhood residents hired as "street watchers" is another strategy to be considered. Expansion of community centers which include child care and supervised recreational activities must be considered.

Although more difficult, educating health departments, city planners, and police departments about the diverse nature of pediatric pedestrian events is necessary to develop communitywide multidisciplinary collaborative intervention measures which can be tested for effectiveness in reducing these injuries.

Agran, Phyllis F.: Differences in child pedestrian injury events by location. Pediatrics, 93:284–288, February 1994.

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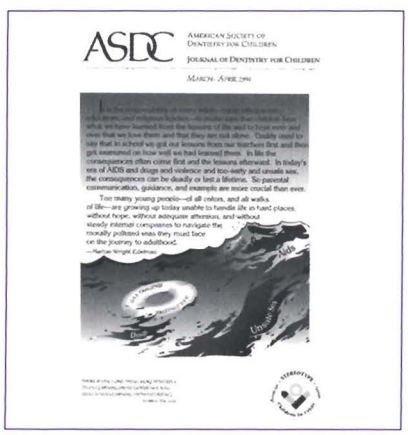

By the time children reach adolescence, their experience and observations of society at work and play should alert them to some of the joys and sorrows lying ahead.

Art and design by Sharlene Nowak-Stellmach

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EPIDEMIOLOGY

DEMOGRAPHICS

REPORTS OF CASES

For the busy reader

Children's dental fear picture test (CDFP): A projective test for the assessment of child dental fear—page 89

The authors comment on various tests that have been used to measure child dental fear. The study reported here describes and tests the reliability of a new method, using a projective technique for assessing child dental fear, the Children's Dental Fear Picture test.

Requests for reprints should be directed to Dr. Gunilla Klingberg, Department of Pedodontics, Faculty of Odontology, University of Göteberg, Medicinaregatan 12, S-413 90 Göteborg, Sweden.

Dental electronic anesthesia for children: Technique and report of 45 cases—page 97

Electronic anesthesia has been used in medicine and dentistry for several years, to alter sensory perception of pain. A new device from 3M, the size of a deck of cards, and powered by a standard 9-volt battery, is described and tested. A step-by-step procedure is described.

Requests for reprints should be directed to Dr. Theodore P. Croll, 708 Shady Retreat Road, Doylestown, Pennsylvania 18901-3897, U.S.A.

Treating fearful children: Does a parent's view of the child's fear change?—page 105

Changes in the attitudes of parents and of children toward dental treatment after two years. Several questions pertaining to dental anxiety are discussed. The parents of fifty-two pediatric patients were in the study group.

Requests for reprints should be directed to Dr. J.S.J. Veerkamp, Department of Pediatric Dentistry, ACTA, Louwesweg 1, 1066 EA Amsterdam, Holland.

Effects of ethnicity and birth month on localized enamel hypoplasia of the primary canine—page 109.

The authors studied 379 teeth from ninety-six children representing five ethnic groups. They learned that localized hypoplasia of the primary canine is the dominant form of enamel hypoplasia in a group of low birthweight babies participating in the *Healthiest Babies Possible Program*, in the city of Vancouver, B.C., Canada.

Requests for reprints should be directed to Dr. Mark F. Skinner, Associate Professor Physical Anthropology, Department of Archaeology, Simon Fraser University, Burnaby, B.C., V5A 1S6, Canada.

Oral health of pediatric AIDS patients: A hospital-based study—page 114

The authors assessed the oral health of a group of HIV-infected children being treated at the National Institutes of Health. All patients were enrolled in treatment protocols of the Pediatrics Branch, National Cancer Institute, NIH. The mean dft for twenty-two children in primary dentition was 4.4. By contrast, a national survey found the average dft for five-year-olds to be 1.7.

Requests for reprints should be directed to Dr. Ingrid H. Valdez, University of Colorado, School of Dentistry, CB C284, 4200 E. 9th Avenue, Denver, Colorado 80262, U.S.A.

Conservative multidisciplinary treatment approach in an unusual odontodysplasia—page 119

In this condition, the teeth show a marked reduction in radiodensity. The authors report on the condition in an eight-year-old boy. The condition was first diagnosed when the patient was three years old. A multidisciplinary treatment approach is recommended.

Requests for reprints should be directed to Dr. Joseph Shapira, Department of Pediatric Dentistry, The Hebrew University-Hadassah School of Dental Medicine, P.O.B. 1172 Jerusalem, Israel 91010.

The significance of age, proximal caries, gingival inflammation, probing depths and the loss of lam-

ina dura in the diagnosis of alveolar bone loss in the primary molars—page 125

The authors examined the significance of age and several clinical variables in the diagnosis of alveolar bone loss. In the present study, probing depths and gingival inflammation did not relate to alveolar bone loss.

Requests for reprints should be directed to Dr. Enrique Bimstein, Department of Pediatric Dentistry, The Hebrew University, Hadassah Faculty of Dental Medicine, P.O.B 1172, Jerusalem, 91010, Israel.

Almost twenty million chronically ill children—page 129

The author summarizes many of the findings from a national study on the health of children. Approximately a third of all children (20 million) had some chronic health condition.

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

Only a small fraction of our health care dollar is spent on children—page 134

The author submits data to support the statement that only a small fraction of our health care dollar is spent on children. Over 95 percent of dental expenditures for children were from private funds (53 percent out of pocket). As children become older, there is a progressive decrease in the proportion of expenditures for dental care costs paid for from public funds.

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

A recurrent traumatic bone cyst: Report of case—page 141

When occurring in the jaws, the traumatic bone cyst usually affects the mandible, commensurate with the observation that this cyst usually occurs in the long bones. It is usually found in patients less than twenty-years old; and in 60 percent of cases, in males.

Requests for reprints should be directed to Dr. Gary H. Breen, 50 Mahoney Avenue, Rutland, Vermont 05701, U.S.A.

Unusual impaction of a primary lateral incisor—page 146

Impactions of primary teeth are very rare. None of the etiologies or predispositions for this condition identified in the literature appears to apply in this case. Treatment plans are presented.

Requests for reprints should be directed to Dr. David L. Rothman, Associate Professor and Chairperson, Department of Pediatric Dentistry, University of the Pacific, School of Dentistry, 2155 Webster Street, Room #522A, San Francisco, CA 94115, U.S.A.