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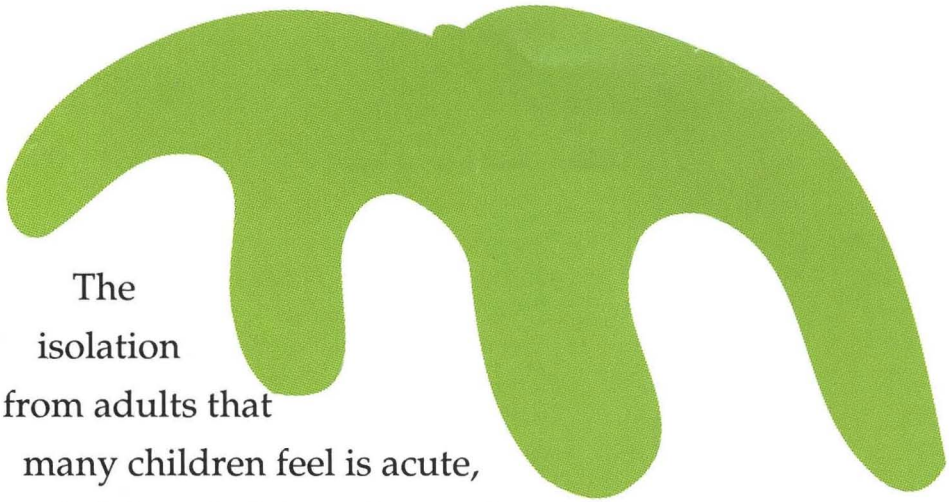

The isolation from adults that many children feel is acute, painful, and ultimately numbing. Logically, children turn for comfort to the most available people, their peers, but they do this in an environment that discourages long-term friendships, just as it discourages any long-term emotional investment in a place—a city, a neighborhood, a street, a woods. Consequently much of their openness whether with peers or with parents, is fleeting but intense, with a vague sense of desperation attached to it— but they still reach out.

—*Richard Louv*

THAT IS THE HAPPIEST CONVERSATION WHERE THERE IS NO COMPETITION, NO VANITY, BUT A CALM, QUIET INTERCHANGE OF SENTIMENTS.

—*Samuel Johnson*

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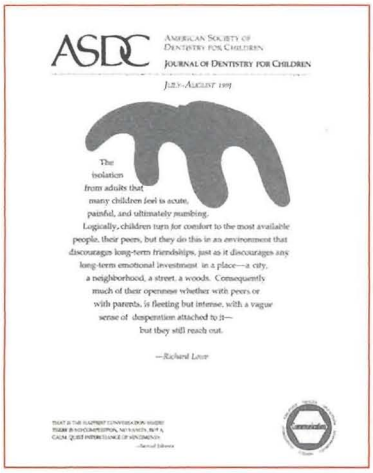

This is the first of seven covers concerning major categories of adolescent development.

CLINIC

BEHAVIOR

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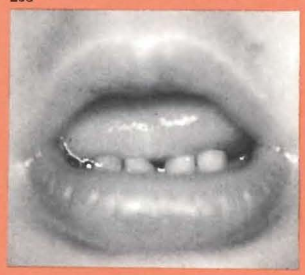

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For the busy reader

A clinical study on direct and indirect class II posterior composite resin restorations—page 281

The combination of composite resins with adhesive intermediate agents and techniques is still questionable with respect to application to posterior regions of the dentition. To add data to the information already available about the clinical behavior and longevity of class II composite resin restorations, a longitudinal study has been started; its design is discussed in this paper.

Requests for reprints should be directed to Dr. C.M. Kreulen, ACTA Louwesweg 1, 1066 EA Amsterdam, The Netherlands.

The treatment of erosion using porcelain veneers—page 289

Two cases reported here demonstrate the use of porcelain veneers to restore lost tooth tissue due to erosion. The veneers have advantages compared with other restorations in terms of aesthetics and resistance to wear. The patients described in these two reports have been seen over periods of two and three years and have been satisfied with the results, with each reporting no further pain.

Requests for reprints should be directed to Dr. James S. Reid, Senior Lecturer/Consultant, Department of Child Dental Health, Glasgow Dental Hospital and School, 378 Sauchiehall Street, Glasgow G2 3JZ, Scotland.

The CO_2 laser in surgery of vascular tumors of the oral cavity in children—page 293

The three cases of children treated for excision of oral hemangiomas presented here illustrate the advantages of using the CO_2 laser rather than a scalpel in surgery for vascular lesions of the oral cavity. This laser has the ability to coagulate, vaporize, or cut; its main advantage, however, is its ability to seal blood vessels during surgery. Satisfactory healing in infants and children makes the CO_2 laser the preferred method for performing vascular surgery.

Requests for reprints should be directed to Dr. Shlomo Barak, Chairman, Dental and Oral Surgery Division, Maccabi Health Care, 27 Hamered, Tel Aviv, Israel.

A comparative study between visible-light-activated and autopolymerizing sealants in relation to retention—page 297

Two hundred twenty-nine first permanent molar occlusal surfaces were treated with sealants, from a group of sixty-one children. When the three sealants were analyzed at the end of the six-, twelve-, eighteen-, and twenty-four-month periods, it was observed that retentive loss was gradual. Both Concise and Delton showed superior retention when compared with Sealite.

Requests for reprints should be directed to Dr. John M. Davis, Associate Professor, Department of Pediatric Dentistry, School of Dentistry, University of Washington, Seattle, WA 98195.

A study of children's taste and visual preferences in dentifrices—page 300

Variables and gimmicks can make choosing a dentifrice for a child complicated. Various flavors, colors, shapes, consistency, labelling, and type of dispensers provide a constellation of choices for the consumer. This study sought to determine whether children actually prefer the dentifrices designed for them. Visually the child-oriented products were preferred; modern containers were preferred over the traditional. In terms of taste, however, "child-flavored" dentifrices were not preferred over the regular flavor of the same brand, when one is tasted after the other.

Requests for reprints should be directed to Carol Sherrill Spear, Associate Professor, Department of Dental Hygiene, School of Dentistry, West Virginia University, Morgantown, WV 26506.

Child patient behavior: a new perspective—page 303

Child behavior in the dental office continues to be a fundamental concern in pediatric dentistry, due to its importance in the ability to provide quality care. This paper reviews certain empirical observations regarding child behavior in light of a recent report that outlined physical changes in nerve fibers follow-

ing behavioral conditioning.

Requests for reprints should be directed to Dr. Hashim S. M. Nainar, Department of Pediatric Dentistry, University of Connecticut Health Center, 263 Farmington Avenue, Farmington, CT 06032-9984.

Pediatric dentistry demographics: more than just numbers of children—page 306

Few dental practitioners or even the general public would be surprised to hear that a large and growing population of minority children do not receive needed dental services, either in terms of prevention or treatment. The numbers of children overall will remain relatively stable: minority children will be more represented, however, as the numbers of non-minority children decrease or level off in the first third of the next century.

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.

There's no such thing as a typical family—page 310

More than half of all children are likely to experience a period of living with a single parent in the 1990s, usually in reduced economic circumstances. Many pediatric dentists have had to modify practice procedures as they expanded their services beyond the traditionally served population groups, to include members of changing types of households.

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

Management of a departmental budget using an electronic spreadsheet—page 314

Many dental school departments utilize computers, which provide the chairperson with important information on the status of the departmental budget. With the appropriate software, awareness of the funds remaining in each of the budget categories allows rapid decisions on a variety of issues. A computer-driven spreadsheet can be indispensable, providing essential information on current income and disbursements, and facilitating comparison with previous, current, and projected operations.

Requests for reprints should be directed to Dr. Robert Rapp, Professor of Pediatric Dentistry for Research, Department of Pediatric Dentistry, School of Dental Medicine, Univesity of Pittsburgh, Pittsburgh, PA 15261.

A model for a children's dental health carnival—page 320

The University of Nebraska Medical Center College of Dentistry held its third annual dental health carnival last year, as a way of promoting preventive dentistry to children and parents. It has also provided the school with a mechanism for teaching the students the importance of, and the logistics of, being involved in a community service project. Nearly 2500 children and their parents attended the seven-hour, thirty-eight station event last year, which was staffed by an organized workforce of 250 volunteers from the dental community.

Requests for reprints should be directed to Dr. Stanton D. Harn, Department of Oral Biology, University of Nebraska Medical Center, College of Dentistry, 40th & Holdrege Streets, Lincoln, NE 68583- 0740.

Oral manifestations of familial hypophosphatemic rickets after phosphate supplement therapy: a review of the literature and report of case—page 328

The patient was a seven-year-old boy with familial vitamin D-resistant hypophosphatemic rickets. His mother, and her mother, were also affected. Before phosphate treatment was introduced in the patient, an impaired incorporation of calcium, and its exchange with sodium, was thought to be the principal etiological factor in the formation of globules. Supplementation therapy then resulted in a less elevated Ca/P ratio in the root area

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DOYLE *continued from page 274*

tion of which I had become a member," says Dr. Doyle.

After starting private practice in Lexington, Dr. Doyle was instrumental in reactivating the Kentucky State Unit of ASDC in 1967. "I felt that if the practice of child dentistry by general practitioners needed a shot in the arm, ASDC was the way to go."

Over the next several years he addressed and lectured to nearly all of ASDC's local and state units. And in 1976, Dr. Doyle became president of the organization at ASDC's 50th anniversary meeting in San Francisco.

"ASDC is unique in that it is the only real organization composed of both specialists and general practitioners with a focus on care for the child," says Dr. Doyle. "The organization really fathered the specialty of children's dentistry. ASDC existed before there was a specialty in child dentistry and it helped establish the American Board of Pediatric Dentistry. They in turn helped establish the specialty of children's dentistry and the American Academy of Pediatric Dentistry. So the world of pediatric dentistry really owes a great deal to ASDC."

MUELLER *continued from page 274*

ticular sedative procedure are and under what circumstances it might be better to work in a hospital rather than in an office."

These are not skills a practitioner uses every day, says Dr. Mueller. "Maybe it's only going to happen once or twice in a lifetime that a dentist will need to use these procedures. But you need to keep up the skills. When it does happen, you need to know how to manage it.

Dr. Mueller's credentials are formidable. A graduate of the University of Kentucky and later the University of Louisville dental program, he served on the faculty of both the University of Florida School of Dentistry and School of Medicine from 1981-85 as well as serving as director of the dental school's pediatric residency program. In 1985, Dr. Mueller moved on to his current position as Chief of Dentistry at Children's Hospital in Denver, as well as Director of the hospital's nationally-known Cleft Palate Clinic and a faculty member at the University of Colorado School of Dentistry.

LEINFELDER *continued from page 274*

er's ASDC presentation will be the development of new dental composites that address the mercury release concerns associated with amalgams. "New materials, techniques and procedures have been introduced and offer a major opportunity," says Dr. Leinfelder. "They're substantially better and have applications to a much wider range of procedures. I think that practitioners who treat children will be interested to see some of the things we can do with new materials. I know I would be."

Dr. Leinfelder's presentation, delivered as one of three prominent scientific papers at ASDC's October Conference, will also emphasize the clinical application of the new dentin adhesives, including presentation of long term clinical research on Scotchbond II, Tenure, Universal Prismabond 3 and Gluma adhesives. A pioneer in the use of resin and ceramic bonded inlays, including the CAD/CAM System for generating ceramic restorations, Dr. Leinfelder's lecture will be indispensable for GP's and pediatric specialists looking to apply new developments to pediatric practice. Finally, Dr. Leinfelder will present information on recent developments in prosthetic restorative materials and techniques.

"The folks at ASDC are a really dedicated group and have a lot to offer our profession," says Dr. Leinfelder. "Their conference is the only place a general practitioner can come to get serious up-to-date briefings on developments that will affect his child patients. This makes their meeting very important."

Dr. Leinfelder, a native of Wisconsin, earned both his DDS, and MS degrees from Marquette University.

BUSY READER *continued from 273*

of the affected teeth, as well as a cure for the boy's bone structure. What the therapy did not cure was the globular appearance of the dentin and the hypomineralized stripe of pulpal horn extending to the cusp tips, an apparent permanent outcome of the disease.

Requests for reprints should be directed to Dr. Markku Larmas, Institute of Dentistry, University of Oulu, Aapistie 3, SF-90220 Oulu, Finland.

Impeded eruption of a permanent maxillary incisor by a denticle and a cyst—page 335

Cysts and tumors, including odontomas, can delay the eruption of teeth. In this case the delay was due to a denticle and a cyst.

Requests for reprints should be directed to Dr. Lian Chin Boon, Associate Professor, Department of Oral Surgery, Faculty of Dentistry, University of Malaya, 59100 Kuala, Lumpur.

Ingestion of dental mirror fragments: report of case—page 337

A case is reported in which one treated pediatric patient gave his plastic, disposable dental mirror to a 2.5-year-old sibling, who while playing chewed on the mirror and the mirrored glass surface broke in the child's mouth. After thorough examination including x-rays, the patient was released with no further complications. Potentially severe injuries could have occurred, resulting in legal liabilities.

Requests for reprints should be directed to Dr. Curt Goho, Pediatric Dentistry, DC #3, U.S. Army Dental Activity, Ft. Lewis, Washington 98431.

A clinical study on direct and indirect class II posterior composite resin restorations: Design of the investigation

Clinic

C. M. Kreulen, DDS
W.E. van Amerongen, DDS, PhD
H.B.M. Akerboom, DDS, PhD
P.J. Borgmeijer, DDS, PhD
Ch.M. Kemp-Scholte, DDS, PhD

Currently, the use of adhesive restorative techniques has become very popular in dentistry. In particular, the combination of composite resins with adhesive intermediate agents and techniques has been used with satisfactory results in the anterior teeth for years.[1] The application of these materials and techniques to posterior composite resin restorations, however, is still questionable.[2]

Among the advantages of these materials are their high esthetic qualities and the tissue-saving technique: there is no need to prepare retentive undercuts or to remove all unsupported enamel prisms.[3] Furthermore, it has been suggested that adhesion to the enamel reestablishes the coherence of the tooth thus strengthening it, in contrast to what occurs when conventional amalgam restorations are constructed.[4]

Despite the adhesion, failure of marginal adaptation commonly occurs at the composite-dentin interface, and to a lesser extent at the composite-enamel interface.[5] The contraction of composite resins during polymerization, the weak bond strength to dentin (which is in-

Drs. Kreulen, van Amerongen, Akerboom, and Borgmeijer are with the Department of Pediatric Dentistry, and Dr. Kemp-Scholte is with the Department of Dental Materials Science, Academic Centre for Dentistry (ACTA); Amsterdam, The Netherlands.

creased by means of dentin pretreatments and adhesive intermediate agents) and the high degree of stiffness of posterior composites (due to the high filler loads) seem to be responsible; microleakage is the result.[6-9] In this process, absorption of water by the material is able to interfere, which may result in various gap widths, but also in different degrees of chemical disintegration when aging.[10] While excessive wear of the conventional posterior composite resin used to be the main disadvantage in clinical applications, the wear resistance is not a major problem today. Composite resins generally show a lower wear resistance, however, than amalgam or enamel.[11]

Many laboratory investigations of posterior composite resins study the material properties of different types of composite resins. Based on these properties, theories are developed predicting the clinical behavior of composite resin restorations. The complex environment in which these restorations have to perform accounts for some unpredictability of these tests.[12] The clinical trial still seems to be necessary, therefore, in dental materials research.[13]

In order to add data to the information already available about the clinical behavior of Class II composite resin restorations, a longitudinal study has been started and its design will be described in this paper. Research will be done on the longevity of restorations and its possible influences such as choice of the material, operator skills, working time needed and location of the restoration concerned.

BACKGROUNDS AND OBJECTIVES

As a result of the debate concerning possible detrimental systemic effects of amalgam, dental practitioners are faced with an increase in demands from patients for replacement of their amalgam restorations. Also, the shift from necessary to elective dental services and the generally increasing importance of esthetics cause growing demands for tooth-colored posterior restorations.[14,15] This has led to an increased production of posterior composite resin restorations.[16]

The use of composite resins in the posterior region has led to the development of some alternative, non-Black, cavity designs for the treatment of proximal carious lesions. Examples are the "tunnel" preparation and the "box-without-step" preparation, which are considered to be more adhesive-specific and less tooth-destructive compared with Black's cavity designs.[17,18] Another typical development in dental adhesive research is the post-curing and indirect application of posterior composite resins. Material properties should be enhanced, but the clinical implications of these restorative techniques are not clear yet.[19-21]

A drawback in the adhesive technique is the accurate processing required in handling the materials, resulting in a time-consuming procedure. This factor, in combination with the reported limited longevity of these restorations, raises doubts about the economic justification of making them routinely.[11]

The objectives of this study are:

- ☐ To test clinically the longevity of Class II posterior composite resin restorations in comparison with similar amalgam restorations.
- ☐ To examine the clinical characteristics of these Class II posterior composite resin restorations during five years of evaluation.
- ☐ To determine the treatment-time required for Class II composite resin restorations in comparison to amalgam Class II restorations.
- ☐ To compare the direct-filling technique with the indirect inlay technique according to the objectives stated above.
- ☐ To assess the clinical behavior of the "box-without-step" restorations compared with the "conventional" Class II composite restorations.
- ☐ To evaluate interactions of the type of composite resin material, patient and operator factors, restoration type, and tooth type in relations to the clinical behavior of the restorations concerned.

MATERIALS AND METHODS

Overall design

To achieve these objectives, three clinical studies were designed:

I. Application and evaluation of Class II posterior composite resin restorations and similar Class II amalgam restorations.
II. Application and evaluation of posterior composite resin restorations, prepared according to a "box-without- step" cavity design (abbreviated to: box restoration).
III. Application and evaluation of Class II posterior composite resin indirect inlays and amalgam restorations.

Materials

The amalgam Class II restorations serve as a control group. Tytin[a] has been chosen because of the good

clinical results obtained with this material during a previous long-term amalgam study.[22]

In an attempt to compare the behavior of different types of composite resin restorative material, three posterior composite resins were selected, namely Herculite XR[b], Clearfil Ray Posterior[c] and Visiomolar[d]. Their differences in chemistry of the organic matrix and the size of the filler particles (the microfiller particles of each material excluded) were the deciding factors in this choice. These resins were used for the three studies, except for Clearfil Ray Posterior, which in study III was replaced by Clearfil CR Inlay.

- ☐ *Herculite XR* is an ultrafine hybrid posterior composite resin (average particle size 0.6 μm) based on an organic matrix containing a mixture of dimethacrylates and trimethacrylates. Compared to *Visiomolar*, *Herculite XR* shows a higher degree of water absorption after curing.[23]
- ☐ *Clearfil Ray* is based on a similar organic matrix, but additionally it contains tetra-functional methacrylate monomers. Polymerization of these monomers results in a higher degree of cross-linking. The filler particle size is bigger than the Herculite's (average 4 μm); the material also shows a higher degree of water absorption than Visiomolar.
- ☐ *Visiomolar* has a tricyclodecandimethacrylate base. Due to its hydrophobic character, *Visiomolar* shows almost no water absorption.[24] The average filler particle size is 6-7 μm.

To avoid variations in material properties, all restorations of each brand were made from one batch. Each composite restorative material was used in only one distinct color mode so as to avoid differences between restorations in polymerization depth after the same period of light curing.

Trial design

In designing this research, it was preferred to apply both test (composite) and control (amalgam) restorations within one dentition. Moreover, in studies I and III, every patient received each of the four restorative materials (or even two times this series), randomly allocated to four (or eight where applicable) teeth to be restored. In addition, each patient involved took part in either study I or study III. The implementation of the restorative phase of study II was combined with the other two studies. This concerned teeth that had to be restored, but were not included if four (or two times four) restorations were assigned in case of study I or study III. These teeth should be free of occlusal caries.

Informed consent required to participate in the study.

In order to obtain similar test conditions for each restoration, teeth with an extent of caries indicating a standard conservative Class II cavity preparation were selected (no cuspal replacements). The cervical extension of the proximal outline should not exceed the cementoenamel junction, because in this way a sufficient cervical marginal seal could be achieved and big differences in adhesion could be avoided. Taking into account the occlusal anatomy, the increasing occlusal wear of distally placed restorations, and the accessibility of the tooth to be restored, P_1inf and M_2sup + inf were not selected.[25] Other requirements were: that the patients should have full dental arches, and that the teeth to be restored should have no increased mobility, no tartar, (preferably) normal occlusal contacts, and should be vital.

Population to be studied

Patients were primarily selected by the polyclinical department of ACTA.[e] They were enrolled from half-year check-up appointments and from a moderate advertising campaign. The patients were required to be between fifteen and thirty-five years of age and have good general health. Subjects with areas of marginal gingivitis or slightly increased probing depth of the periodontal pocket were not excluded; severe periodontal disease was an impediment, however, to join the study.

[a]Kerr, Santa Ana, USA
[b]Kerr, Santa Ana, USA
[c]Cavex Holland/Kuraray, Haarlem, The Netherlands
[d]ESPE, Seefeld/Oberbay, Germany
[e]ACTA = Academic Centre for Dentistry Amsterdam

Agreement to a written *informed consent* was necessary and the patient promised to come for evaluative sessions in future, at least for five years.

Each patient was fully treated by one of three operators. During the five-year trial, this dentist will provide for the dental health of the patients, in order to ensure good recall attendance; no fee was or will be charged, except when crowns or bridges are needed.[22] In studies I or III individually, twenty patients were treated by one operator, resulting in 180 composite restorations (20*3*3) and sixty amalgam restorations (20*3*1) for each study. In this calculation, patients with two series of four restorations were accounted for as two separate subjects.

Restorative procedures

All restorative procedures have been described in detail to ensure consensus in treatment by the three operators. The materials used were handled as recommended by the manufacturers while during the restorative phase the output of the light-activating unit[f] was standardized.

In study I, a Class II preparation of standard size in accordance with Rodda's design was made, following which rubber dam was applied, the remaining carious dentin was removed and enamel, not supported by dentin, was cut away.[26] The outline (outer surface surrounding the preparation) was colored using red nail polish.[27] The cavo-surface-margin of the preparation was bevelled, but an occlusal bevel was only applied to those parts of the occlusal outline where the cavo-surface angle was about 90 degrees (a selective bevel).

If necessary, a Ca $(OH)_2$ lining[g] was applied in the deepest areas of the cavity. After dentin surface treatment with a conditioner[h] all the removed dentin was replaced by a radiopaque glass-ionomer lining cement[i].[28] The cement was protected against dehydration by a varnish[j] and after curing the preparation was finished with x-fine diamonds[k].[29] To allow proper filling and light-curing, translucent matrices and wedges[l] were used.[30] Acid etching[m] (60 seconds), washing (30 seconds) and air drying of the enamel (etching of the glass ionomer base was avoided) was followed by applying and curing of an adhesive bonding agent (which was prescribed by the manufacturer of the material to be used[n]).[31,32] The boxes were filled in three horizontal layers of composite resin, each layer separately light-cured from the buccal and lingual direction for twenty seconds, followed by incremental filling and curing of the occlusal part of the cavity.[33] After removal of the matrix band, the proximal surfaces were cured for an additional forty seconds, the restoration was roughly contoured and the rubber dam was removed. Then the occlusal height of the restoration was verified and, if necessary, adjusted[o]. Further finishing and polishing of the restoration was done after about two weeks using x-fine diamonds[p], rubber points and cups[q] and polishing paste[r].[34] If necessary, finishing strips[s] for the proximal surfaces were used.

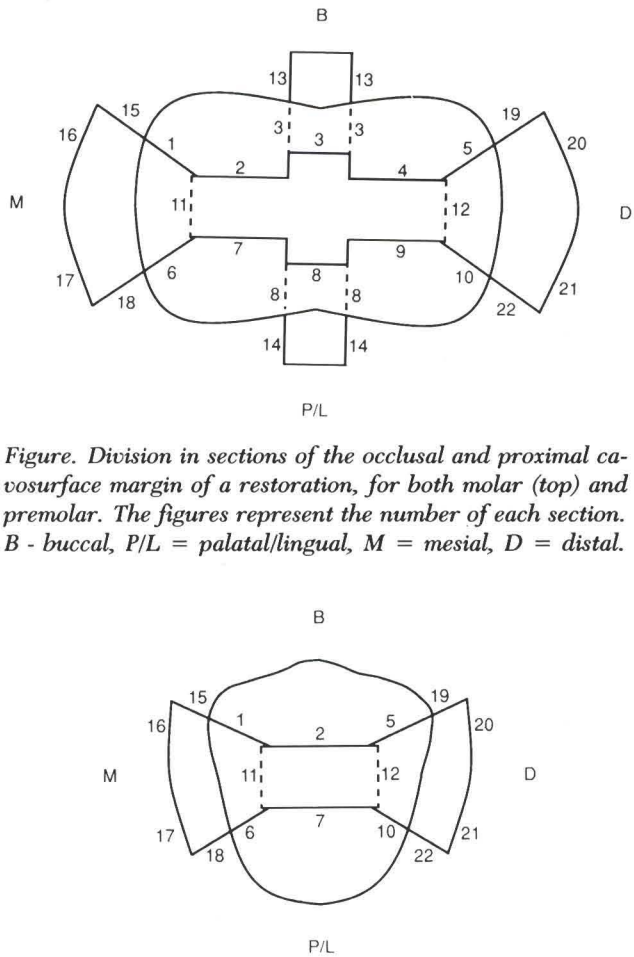

Figure. Division in sections of the occlusal and proximal cavosurface margin of a restoration, for both molar (top) and premolar. The figures represent the number of each section. B - buccal, P/L = palatal/lingual, M = mesial, D = distal.

[f]Translux CL (Kulzer)
[g]Life (Kerr)
[h]Dentin conditioner (GC)
[i]Fuji lining cement (GC)
[j]Fuji Varnish (GC)
[k]E-fine diamond grit stones (Komet).
[l]Transparent (Pre)molarbands and Luciwedges (Hawe)
[m]Ultra-etch (Ultradent)
[n]XR Primer/Bond (Herculite XR), Kerr. Visio-bond (Visiomolar), ESPE. Clearfil Ne Bond (Clearfil Ray Posterior), Cavex/Kuraray).
[o]E-fine diamond grit stones (Komet)
[p]E-fine diamond grit stones (Komet)
[q]Exa-special (Edenta)
[r]Lusterpaste (Kerr)
[s]Sof-lex (3M)

Table □ Modified Ryge evaluation criteria. The alphabetical ratings originally described by Cvar and Ryge were replaced by a numerical order for the enhancement of statistical processing.

Marginal adaptation; dependent on the type of restoration, each section is separately evaluated (see fig. 1). For instance, a mesio-occlusal restoration with a buccal extension, placed in a molar, is assessed for section 1, 2, 3, 4 / 6, 7, 8, 9 / 12, 13 / 15, 16, 17, 18.
0 = The restoration does not include this section.
1 = No visible evidence of a crevice along the section of the margin, no catch of an explorer.
2 = Visible evidence of a crevice along the section of the margin, an explorer catches slightly.
3 = An explorer penetrates into a crevice but no dentin or base is exposed.
4 = An explorer penetrates into a crevice, dentin or base is exposed.

Marginal discoloration; the number of discolored sections is counted (see fig. 1)
0 = No marginal discoloration.
1 = Number of discolored sections is one through four.
2 = Number of discolored sections is five through eight.
3 = Number of discolored sections is nine through twelve.
4 = Number of discolored sections outnumbers twelve.

Color match;
0 = The restorative material is amalgam.
1 = The restoration matches a standard measure in color.
2 = The mismatch in color is within acceptable range of a standard measure.
3 = The mismatch in color is outside the acceptable range of a standard measure.

Anatomic form;
1 = The restoration is continuous with existing anatomic form.
2 = The restoration is discontinuous with existing anatomic form, but the missing material is not sufficient to expose dentin or base.
3 = Sufficient material has been lost to expose dentin or base.

Surface texture;
0 = The surface of the restoration is smooth.
1 = The surface is slightly rough.
2 = The surface is slightly pitted.
3 = The surface is slightly rough and pitted.
4 = The surface is rough.
5 = The surface is pitted.
6 = The surface is rough and pitted.

Interproximal contact;
0 = There is no contact between the restoration and the adjacent tooth.
1 = The contact is light and it is relatively easy to pass a metal strip (thickness 0.05 mm) between the restoration and the adjacent tooth.
2 = The contact is "normal".
3 = The contact is tight and it is difficult to pass a metal strip between the restoration and the adjacent tooth.

The procedures for the amalgam restorations were virtually the same as described in the long-term clinical amalgam investigation mentioned before.[22] The most important features of the procedure are the preparation of a standard size cavity (Rodda's design), the use of rubber dam, the application of the $Ca(OH)_2$ lining at deeper places and polishing of the restoration after two weeks.

In study II the procedure used for making the box restorations differed hardly from the standard Class II composite restorations, with the exception of extensions to the preparation. These preparations included the proximal surface and the occlusal surface to the extent that it concerned the fossa triangularis.[18]

The restorative procedure in study III (indirect inlays) initially followed the description mentioned in study I. Bevels are not indicated, however, so the red nail polish was not necessary. The cavity design should be focused upon preparation of slightly conical enamel cavity walls. Application of lining and base materials was in accordance with study I (possible undercuts introduced by the glass ionomer cement must be removed). The preparation session was completed by making full-arch impressions (addition-silicone material[t]) of the upper and lower jaw and a temporary restoration was made from a light-cured silicone material[u].

After the return of the composite resin inlay from the dental laboratory, it was fitted carefully while using rubber dam, and contact points were checked. Etching, application and curing of bonding preceded placement of the inlay with a dual cure resin cement[v]. The outline of the inlay was roughly finished and occlusion/articulation were checked. Two weeks later the restoration was repolished.

Evaluation procedures

The base-line evaluation of the restorations was divided into three parts. Firstly, general information (like sex, age, periodontal health) was collected about the patient and about the tooth to be restored (like type of tooth, quality of interproximal contacts). In addition, the time needed to make a restoration was recorded. After the restoration was completed, notes were made by the dentist whether a $Ca(OH)_2$ lining was used, the cavity size was estimated and other details concerning the tooth or restoration were recorded.

In the second part, a clinical evaluation was carried out in a separate session. This initial review followed for the greater part the Ryge criteria for clinical assessment of restorative materials.[35,36] In examining the marginal adaptation, the outline of the restoration was divided into sections (Figure).[22] Evaluation of each section provides more accuracy about the location of the assessments along the cavosurface margin. Furthermore, in order to improve the distinction between the ratings of each category of the Ryge criteria, some modifications were introduced (Table). This evaluative check-

up was carried out within two months after placement. Assessments were independently made by two operators, each not involved in making the restoration to be evaluated. Calibration of the evaluators was included.

The evaluation procedure was extended by the following activities:

- ☐ Making full-arch, alginate impressions[w] and casts[x] (upper and lower jaw).
- ☐ Making addition-silicone impressions[y] of the restored teeth with individual, partial impression-trays. Silicone impressions of the opposing teeth are also made.
- ☐ Taking standardized bite-wing radiographs, with an individual relocation jig.[22]
- ☐ Taking color pictures of each restoration under investigation, with a fixed enlargement.
- ☐ Taking color slides of the posterior part of the arches with clinically marked occlusion and articulation contacts.

A nonclinical assessment is the third part of the baseline evaluation. The partial impressions of the restored teeth mentioned above were used for the purpose of an additional evaluation of the marginal adaptation. They were photographed by means of a stereomicroscope in a standardized way and the pictures obtained of the negative image of the restoration will be assessed for marginal adaptation.[37,38] Surface changes of the opposing teeth can be studied by evaluation of casts, obtained by the silicone impressions. The bite-wing x-rays are to be examined for cervical marginal adaptation and the possible presence of voids in or recurrent caries under the restorations. The color pictures merely serve as a visual record of the restorations, while the slides enable a visual record to be made of the changes in the occlusal contacts over the course of time. In addition, with the help of the full-arch casts, excessive occlusal deterioration—by bruxism, for instance—and other changes in the dental arch can be traced.

The procedure used for the initial review will be repeated in subsequent, annual, evaluative sessions. Moreover, the usual half-year check-ups are planned to take place in between each annual assessment. During these half-year check-up appointments the patients' periodontal health will be evaluated using a modification of the sulcus bleeding index according to Mühleman.[39]

DISCUSSION

In amalgam studies, the clinical characteristics, including marginal adaptation, surface smoothness and anatomic form, were perceptible symptoms of deterioration.[22,40] Various clinical investigations into the longevity of posterior composite resin restorations have adopted similar criteria for evaluation of the appearance of these restorations. The assessments have generally been limited to visual-tactile judging, however, and left behind the evaluation of those parts of the restorations that were clinically difficult to examine. One might question, therefore, whether these characteristics can accurately predict the long-term behavior of these restorations in the short term; but at the moment, no other evaluative methods are available to achieve this goal.

In this study, each patient receiving each composite resin and amalgam restoration provides the opportunity to assess the possible influence of patient factors on the clinical behavior of the restorations. The possible influence of operator factors can be detected, since each operator made each type of restoration. Consensus in treatment between the operators was examined by a dental assistant, as the same assistant assisted all three dentists. The operator factors have to do with the type and location of the restoration and the skills of the dentist. The latter can be expressed in the time needed to make a restoration.

A marginal gap near amalgam restorations will probably be sealed by the corrosion products of the alloy, but in the absence of corrosion and as a result of the polymerization contraction, leakage near composite resin restorations should more easily lead to recurrent caries. In order to prevent microleakage, a bevelled enamel carosurface margin has been recommended.[42,43] On the other hand, it is believed that in the case of an occlusal, bevelled margin, after finishing/polishing, a thin marginal excess of composite material could remain beyond the outline of the bevel, without being detected. Since the marginal excess is not adhered to an etched enamel surface, it is prone to fracture under occlusal loading.[44]

This marginal excess could easily be made visible, however, with the use of a red nail polish, applied to the cavosurface margin (outer surface) before preparing the bevel, to provide contrast.[27] The preparation of a bevel is still useful, therefore, provided that it is done

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[t] Provil (Bayer)

[u] Fermit (Vivadent)

[v] Porcelite Dual Cure (Herculite XR), Kerr. Tulux-Cem (Visiomolar), ESPE. CR Inlay Cement (Clearfil Ray Posterior), Cavex/Kuraray.

[w] Cavex Impressional (Cavex)

[x] Vel-Mix Stone (Kerr)

[y] Extrude (Kerr)

Cervical bevel is controversial.

at locations where the cavity-wall is parallel to the prism rods. At the cuspal slopes the prisms are cut across their long axis during preparation of the cavity and a good adhesion is possible without bevelling (Figure, sections 2,4,7 and 9); a selective bevel is useful.[45] The nail polish also protects the unprepared enamel surface against etching. Additionally, to prevent occlusal loading of the bevel, the occlusion can be marked with indicating paper before preparation, so as to determine the location of the bevel.

The preparation of a cervical bevel is controversial.[46] Scanning electron microscopic research shows that the prism orientation in the cervical region differs between various teeth.[47] Rupture of prisms on the individual teeth; and in the clinical setting, isolation of prisms are likely to occur, therefore, along the incremental enamel lines. As a result of the occlusal orientation of these incremental lines, rupture will cause a friable margin. A bevel can remove these loose prisms in advance and presumably provides a better bond.[48]

The selective bevel preparation was applied to the cavity design in studies I and II. In study III, however, a butt-joint, nonbevelled, cavity design was used because the bevel parts of the inlays could easily be broken while handling and luting the inlay.

The composition of the posterior composite resin restoration is based upon using the glass ionomer cement as a dentin substitute. In this study, etching of the glass ionomer base was avoided so as not to reduce the free surface area of the composite, while being polymerized, by bonding to the base.[49] Because most of the composite restorations would be replacements of existing amalgam restorations, preparation of rounded internal cavity angles (the "adhesive preparation" according to Lutz) was not possible.[46] While finishing the glass ionomer base, its corners and the step to tooth structure, however, were rounded.

Postoperative sensitivity and its causes have been discussed by various authors.[50] An evaluation system has been developed to gain more insight into sensitivity after treatment (to be published). The additional nonclinical assessment of the marginal adaptation, as described in the third part of the evaluation procedure, has been applied for future comparison of situations of subsequent evaluation periods. In addition, wear measurements are to be made, but it is not clear which measuring method should be adopted. For this purpose, the partial impressions of the restored teeth, intended for the marginal evaluation, are also poured in epoxy resin.[z] The epoxy resin casts are made to ensure the ability to adapt an appropriate method in future. A review of feasible techniques is given in a separate paper.[51]

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[z]Araldite D (Ciba-Geigy)

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The treatment of erosion using porcelain veneers

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The dissolution of tooth enamel due to ingestion of fruit juices, either natural or synthetic, some mineral waters and other substances of low pH (Range 2-3.5) may result in a disfiguring and often painful condition of the teeth.[1,2] This condition had been called 'erosion' and this term will be used to describe the loss of tooth substance on the lingual surfaces of the anterior teeth.[3] Loss of tooth tissue on the occlusal surfaces of posterior teeth has been termed 'perimolysis'.[4]

Erosion of tooth tissue from the lingual surfaces of maxillary anterior teeth often results in painful symptoms due to stimuli from the temperature of foods or even cold air. Treatment has been difficult and often unsatisfactory, involving further loss of tooth tissue to enable, for example, crown work to be completed. In younger patients, the loss of tooth tissue during conservative procedures can endanger the pulpal vitality so that any nondestructive process used to solve this difficult situation is to be welcomed. One such report used resin-bonded-metal onlays cemented in place using dentine adhesives and composite resin with success.[5] Another report employing a similar technique involves a further reduction of already depleted lingual enamel.[6]

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The use of metal onlays, however, presents problems with aesthetics in such thin teeth, which often have loss of hard tissue in the incisal edge area.

In many of the cases in which erosion has occurred, the lower incisors are in contact with the eroded area. Before any restoration can be placed, further tissue removal would be necessary to avoid interference with the occlusion. Fortunately, orthodontic treatment can produce either intrusion or relative intrusion of incisors, thereby creating the necessary space. In younger patients overbite can usually be reduced by simple removable appliances incorporating a flat anterior biteplane, but occasionally fixed appliances would be more effective.

The purpose of this paper is to present two cases where porcelain veneers were placed on the eroded areas of maxillary anterior teeth to solve the problem of pain and to restore the lost tooth tissue.

CASE REPORT

A fifteen-year-old girl was referred to the Child Dental Health Unit by her Community Dental Officer for advice and treatment of "the attrition" of her maxillary permanent incisors. The medical history did not reveal anything of significance and the girl appeared to be of average stature and weight for her age. After investigation of her diet, however, it was discovered that she consumed a lot of chocolate and mint-flavored confec-

tionery. She also drank three cans of a popular, commercial, caramel-colored soda plus one carton of regular orange juice per day. Initially these sugary drinks were consumed through a straw, but the patient stated that recently she had stopped using the straw.

The oral examination revealed adequate oral hygiene, no gingivitis and a moderate decay rate. Severe erosion was seen on the lingual surfaces of the maxillary central and lateral incisors, with dentine exposed (Figure 1). The maxillary canines exhibited some erosion of enamel—insufficient, however, to expose dentine. There was also loss of enamel from the incisal edges of the central incisors, and the mandibular incisors occluded with the lingual surfaces of the maxillary incisors. The patient reported that the central and lateral incisors became painful from cold air, toothbrushing, and on eating. These were the reasons for her seeking dental advice.

Figure 1. Lingual erosion of the maxillary incisors and canines. Case 1.

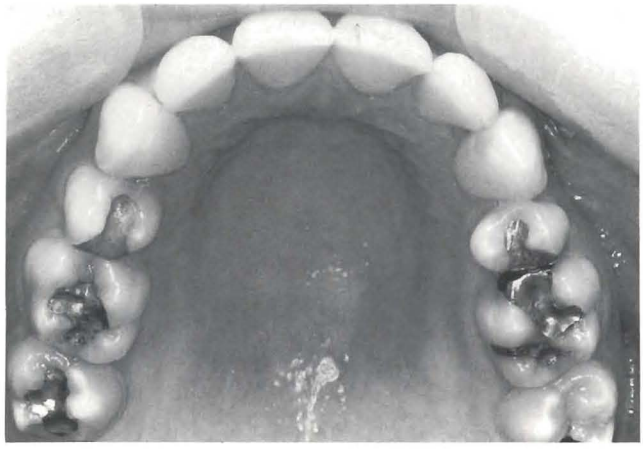

Figure 2. Cemented porcelain veneers on teeth shown in Figure 1. Case 1.

Alginate impressions of both jaws were taken using stock trays. A removable bite-raising appliance with an anterior flat bite plane was constructed on the models obtained. This appliance was worn for nine months and provided space in the anterior region to allow for the fitting of the porcelain veneers. A custom tray was also constructed for the maxillary teeth and a master impression taken in an elastomeric material at a subsequent visit.

No tooth preparation whatsoever was made. The shade for the veneers was chosen at this visit, using a standard porcelain shade guide.

The master impression and instructions were given to the ceramist and used in the construction of the six veneers to cover the lingual surfaces of the maxillary incisors and canines.

Cementation

The patient had a thorough dental prophylaxis using a non-oily, nonfluoridated paste. A rubber dam was applied to isolate the six maxillary anterior teeth. Etching gel then was applied to the enamel covering the lingual surfaces of the canine teeth and was limited to the available enamel at the periphery of the erosion areas on the lingual surfaces of the incisors. All the teeth were thoroughly washed and dried. The veneers were silaned and had a bonding agent applied and light-cured. A bonding agent* was applied to the lingual surfaces of the teeth and light-cured. The veneers were loaded with composite and placed on the teeth (Figure 2).

*Scotchbond 3M Dental Products, 3M Health Care, England.

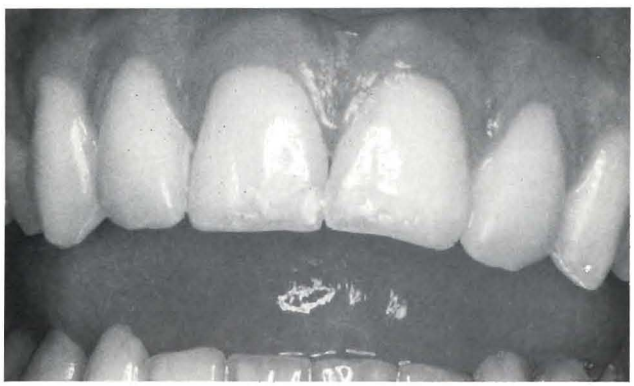

Figure 3. Labial view. Case 1.

Interproximal matrix strips were used to prevent any "bridging" effect of the composite between the veneers.

The composite was light-cured. Polishing was carried out using fine-fluted, tungsten-carbide burs and interproximal polishing strips. Finally the occlusion was checked and the patient reported satisfaction with the result and that her pain had resolved (Figure 3).

CASE REPORT

A twelve-year-old girl was referred to the Child Dental Health Unit by her general dental practitioner for advice and treatment of her painful maxillary permanent central incisors. The medical history revealed nothing of significance and the patient appeared well nourished. Investigation of her diet revealed that she was drinking several cans of a commercial soda drink each day, through a straw. She was also consuming substantial amounts of confectionery. The oral examination revealed adequate oral hygiene, good gingival health, and a low decay rate. The permanent central incisors, however, had lost a considerable amount of hard tissue from the lingual surfaces, with dentine being exposed. The lingual view of these teeth on the model shows the loss of hard tissue (Figure 4). The patient experienced pain from these teeth during eating and drinking and wanted treatment to alleviate the pain. As the mandibular incisors occluded with the lingual surfaces of the maxillary incisors, alginate impressions were taken and a removable bite-raising appliance constructed and worn for six months. A custom tray was also constructed. Once again no tooth preparation was performed and a master impression was taken using an elastomeric impression material. The appropriate shade was selected from a porcelain shade guide. Porcelain

Figure 4. Model view of maxillary central incisors. Case 2.

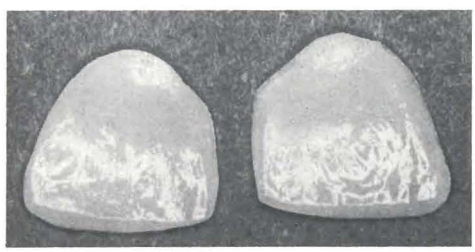

Figure 5. Lingual porcelain veneers. Case 2.

veneers were constructed for the lingual surfaces of the maxillary central incisors (Figure 5).

Cementation

This was done as described for the previous case. The patient reported satisfaction with the result and that her pain had resolved. The patient was also concerned regarding the mid-line diastema in 1/1 area. This gap was closed using labial porcelain veneers.

RESULTS

All the veneers have remained in place over a period of three and four years. The patients have reported satisfaction with the aesthetics and that the previous discomfort had resolved (Figures 6,7).

DISCUSSION

Conservative treatment of erosion problems in permanent incisors in the young patient presents difficulties. It is inadvisable to consider crowning at these young ages, not only because it can be technically dif-

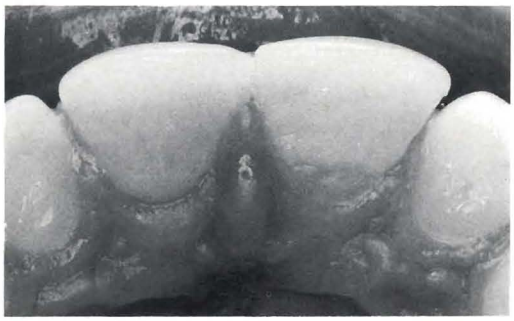

Figure 6. Lingual porcelain veneers of maxillary central incisors after three years. Case 2. Further eruption of the right maxillary central incisor revealed the veneer finish line.

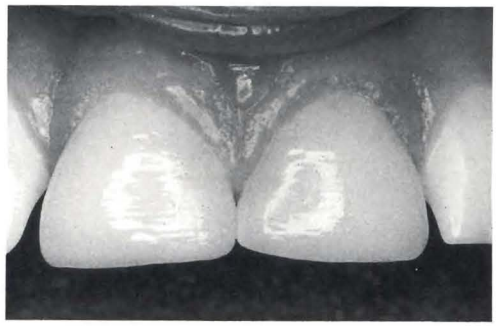

Figure 7. Labial porcelain veneers of maxillary central incisors after three years. Case 2.

ficult, but also because the assault on the dental pulp during the preparation and cementation stages of crowning can lead to its death. Many of the children are still at the stage when dental trauma is most common and the developing dentition may require early replacement of successful crowns. The use of composite restorations using dentine bonding agents is worthy of consideration. These materials will wear and may lead to overclosure of the occlusion, however, as time passes. Etched metal onlays have been shown to be successful, but have disadvantages. The metalwork will change the color of those eroded, thin teeth and the metalwork cannot be used to replace lost hard tissue at the incisal edges. Reporting on the effect of palatal porcelain veneers on the occlusion and wear rate of the occluding teeth will be required.

CONCLUSION

Two cases have been shown to demonstrate the use of porcelain veneers, to restore lost tooth tissue due to erosion. The veneers have advantages over other restorations in aesthetics and resistance to wear. The patients treated have been reviewed over periods of three and four years and have been satisfied with the results, while reporting no further pain.

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The CO_2 laser in surgery of vascular tumors of the oral cavity in children

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Lasers have been used in medicine for nearly two decades. Their use in the field of oral and maxillofacial surgery, however, is relatively new.[1] Of the many different types of lasers used in medicine and surgery, the CO_2 laser is most suitable for use in the oral cavity.

The CO_2 laser beam has a wavelength of 10.6 μm, which is well-absorbed by water and hence by tissues that have a high water content, such as the oral soft tissues. The absorbed energy causes vaporization of the intra- and extracellular fluid and destruction of the cell membranes.[2] The CO_2 laser can be used in two ways:

- ☐ With a focused beam, the laser is used as a "light knife" for performing hemostatic incisions.
- ☐ With a defocused beam, for vaporizing and debulking of tissue.

When vaporization is performed, the laser can be pulsed, thus avoiding the necessity for anesthesia.[3]

A major advantage of the CO_2 laser is its ability to seal blood vessels during surgery, making the excision of vascular lesions relatively hemostatic. Where access to such lesions is difficult, vaporization can be performed using the defocused beam. Lesions of the oral cavity usually fall into this category because of its specific anatomy. The fact that pressure dressing cannot be applied to the oral cavity makes it important to be able to perform hemostatic surgery.[4-6] Furthermore, bleeding in the oral cavity is always accompanied by the risk of aspiration, especially in young children.

The following cases illustrate the advantages of using the CO_2 laser in the surgery of vascular tumors of the oral cavity in children.

CASE 1

An eight-month-old infant was referred for excision of a large hemangioma of the lower lip resulting in several hemorrhagic episodes that made feeding difficult (Figure 1a). Surgical intervention is mandatory in such cases, but at this age surgery is usually delayed because of the tendency to resorb spontaneously. The tumor was excised with the CO_2 laser at 10 watts, using general anesthesia, without significant blood loss. The wound was closed with interrupted sutures (Figure 1b).

CASE 2

A six-year-old boy was referred for laser surgery for a hemangio-lymphangioma of the right maxillary buccal sulcus and the inner aspect of the lip (Figure 2a). According to the parents, two attempts at surgery were interrupted due to excessive bleeding. Using general anesthesia, the tumor was excised with the CO_2 laser at 10 watts without significant bleeding (Figure 2b) and the wound sutured (Figure 2c).

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a.

b.

Figure 1a. Large hemangioma of the lower lip in 8-month-old infant; b. Excision of large hemangioma of the lower lip, immediately postoperation.

Figure 2a. Hemangiolymphangioma of the maxillary buccal sulcus and inner aspect of the lip in a six-year-old boy; b. The excised tumor surface; c. The excised tumor wound immediately postoperation; d. One month after excision of hemangio-lymphangioma.

a.

b.

c.

d.

a.

b.

c.

d.

Figure 3a. Cavernous hemangioma of the upper lip in a one-year- old child; b. The excised tumor surface; c. The excised tumor wound immediately postoperation; d. Excised tumor; e. Two months after excision of hemangioma of the upper lip.

There was practically no postoperative swelling nor did the child complain of pain or discomfort. Figure 2d shows the condition after a month.

CASE 3

A one-year-old child was seen with a swelling of the upper lip, which was clinically diagnosed as a cavernous hemangioma (Figure 3a). Using general anesthesia, the tumor was excised with the CO_2 laser at 10 watts. Blood loss was minimal (Figure 3b). The wound was closed with interrupted sutures (Figures 3c,d).

Histopathologic examination confirmed the hemangioma. Postoperative period was uneventful and healing was highly satisfactory (Figure 3e).

e.

The CO_2 laser seals blood vessels.

DISCUSSION

The CO_2 laser has many advantages over a scalpel in surgery for vascular lesions of the oral cavity. Unlike the scalpel, the laser has the ability to coagulate, vaporize, or cut. The major advantage of the CO_2 laser, however, is its ability to seal blood vessels during surgery.

The use of the CO_2 laser in surgery for vascular lesions of the oral cavity especially in infants and children is of particular significance because of the hemostasis and satisfactory healing, and the lack of postoperative swelling, pain, and discomfort.[1] The laser is also easier to use than a scalpel, in many areas of the mouth.

The described cases are of young children with oral hemangiomas. These cases would have been more difficult, if a scalpel had been used, because of excessive bleeding during surgery. Excessive bleeding can be dangerous, particularly if transfusions are required.

A hemangio-lymphangioma of the upper lip is shown in Case 2. Two attempts at surgery using a scalpel were interrupted because of excessive bleeding. The CO_2 laser was used to excise the tumor without significant bleeding.

Two infants (cases 1 and 3) suffering from oral hemangiomas underwent excision with the CO_2 laser. In such cases, where surgery is performed with a scalpel, there is usually massive bleeding, blood transfusions are often necessary and postoperative swelling and pain are noted.

It is recommended that the use of the CO_2 laser in surgery for vascular lesions of the oral cavity be considered, especially in infants and children.

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INFORMED CONSENT AND BEHAVIOR MANAGEMENT

Informed consent issues are having an increasing impact on behavior management of children. The courts maintain that treatment by health care professionals without prior consent is battery and the health professional who touches a patient without consent may be liable.

Lawrence, S.M. *et al*: Parental attitudes toward behavior management techniques used in pediatric dentistry.
Pediatr Dent, 13:151–155, May-June 1991.

A comparative study between visible-light-activated and autopolymerizing sealants in relation to retention

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An early loss of primary and permanent teeth due to the high incidence of caries, is a frequent observation by dentists, and is a constant challenge in the search for a solution.

As a result of its natural formation, the occlusal surface is highly susceptible to decay, and preventive measures such as control of bacterial plaque and topical applications of fluoride solutions have little effect on such surfaces.[1,2] More effective measures, therefore, are necessary, such as the application of occlusal sealants.[3-6]

The present study was done to compare the retention capacity of two visible-light-activated sealants (Concise–3M and Sealite–Kerr) with an autopolymerizing sealant (Delton–Johnson & Johnson).

MATERIALS AND METHODS

In the present study, sixty-two Brazilian primary school children (thirty-five boys, twenty-seven girls) ages six to eleven, from Araraquara, São Paulo, were examined. Children with three first permanent molars in treatable condition received one type of sealant. Table 1 shows the distribution of teeth with sealants.

The technique of sealant application first involved mechanical cleaning of the occlusal surface using a rubber cup and a mixture of flour of pumice and water, followed by thorough rinsing, isolation with cotton rolls, careful drying, acid-etching with 37 percent phosphoric acid solution for sixty seconds, and finally abundant washing, using suction. The tooth was then isolated again using cotton rolls, dried with care, and the sealant applied according to the manufacturer's instructions. Following each application, the sealants were tested using an explorer for verification of retention. A single investigator was responsible for selection of teeth for the study, application of sealants, and the evalua-

Table 1 ☐ Distribution of teeth according to arch and sealant at the beginning of study.

Sealant	Arch		Total
	Maxilla	Mandible	
Concise	38	38	77
Sealite	39	37	76
Delton	40	36	76
Totals	118	111	229

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Table 2 ☐ A comparison of sealant retention in different arches after 6 months.

Arch	Status		Sealant Concise	Sealite	Delton
Maxilla	C	(n)	39	36	37
		(%)	100	94.7	94.9
	PC	(n)	–	02	02
		(%)	–	5.3	5.1
	F	(n)	–	–	–
		(%)	–	–	–
Mandible	C	(n)	36	34	34
		(%)	97.3	94.4	94.4
	PC	(n)	01	02	02
		(%)	2.7	5.6	5.6
	F	(n)	–	–	–
		(%)	–	–	–
Totals	C	(n)	75	70	71
		(%)	98.7	94.6	94.7
	PC	(n)	01	04	04
		(%)	1.3	5.4	5.3
	F	(n)	–	–	–
		(%)	–	–	–

n: number of surfaces; %: per cent
C: Complete retention; PC: Partially complete retention
F: Failed retention

Table 3 ☐ A comparison of sealant retention in different arches after 12 months.

Arch	Status		Sealant Concise	Sealite	Delton
Maxilla	C	(n)	38	34	35
		(%)	97	89.5	89.7
	PC	(n)	01	04	03
		(%)	2.6	10.5	7.7
	F	(n)	–	–	01
		(%)	–	–	2.6
Mandible	C	(n)	34	31	33
		(%)	91.9	86.1	91.7
	PC	(n)	02	05	02
		(%)	5.4	13.9	5.5
	F	(n)	01	–	01
		(%)	2.7	–	2.8
Totals	C	(n)	72	65	68
		(%)	94.8	87.8	90.6
	PC	(n)	03	09	05
		(%)	3.9	12.2	6.7
	F	(n)	01	–	02
		(%)	1.3	–	2.7

n: number of surfaces; %: per cent
C: Complete retention; PC: Partially complete retention
F: Failed retention

Table 4 ☐ A comparison of sealant retention in different arches after 18 months.

Arch	Status		Sealant Concise	Sealite	Delton
Maxilla	C	(n)	35	32	33
		(%)	97.2	86.5	86.8
	PC	(n)	01	05	03
		(%)	2.8	13.5	7.9
	F	(n)	–	–	02
		(%)	–	–	5.3
Mandible	C	(n)	33	25	29
		(%)	91.6	73.5	85.3
	PC	(n)	02	09	04
		(%)	5.5	26.5	11.7
	F	(n)	01	–	01
		(%)	2.8	–	3.0
Totals	C	(n)	68	57	62
		(%)	94.4	80.3	86.1
	PC	(n)	03	14	07
		(%)	4.1	19.7	9.7
	F	(n)	01	–	03
		(%)	1.3	–	4.2

n: number of surfaces; %: per cent
C: Complete retention; PC: Partially complete retention
F: Failed retention

Table 5 ☐ A comparison of sealant retention in different arches after 24 months.

Arch	Status		Sealant Concise	Sealite	Delton
Maxilla	C	(n)	35	25	33
		(%)	97.2	69.4	89.2
	PC	(n)	01	11	03
		(%)	2.8	30.6	8.1
	F	(n)	–	–	01
		(%)	–	–	2.7
Mandible	C	(n)	31	21	26
		(%)	88.6	61.8	78.8
	PC	(n)	03	13	06
		(%)	8.6	38.2	18.2
	F	(n)	01	–	01
		(%)	2.8	–	3.0
Totals	C	(n)	66	46	59
		(%)	93.0	65.7	84.3
	PC	(n)	04	24	09
		(%)	5.6	34.3	12.8
	F	(n)	01	–	02
		(%)	1.4	–	2.9

n: number of surfaces; %: per cent
C: Complete retention; PC: Partially complete retention
F: Failed retention

tion of the sealants at six-, twelve-, eighteen- and twenty-four-month intervals. At each reexamination the teeth were evaluated visually, tested by probing with an explorer and recorded as complete (C), partially complete (PC), or failed (F). C occluded the fissure system. PC referred to a sealant clinically absent from some of the pits or fissures. F were those in which sealant was undetectable visually or with an explorer in any pits and fissures.

RESULTS

Two hundred twenty-nine first permanent molar occlusal surfaces were treated with sealants (118 upper molars and 111 lower molars). In a group of sixty-one children, 225 of the original 229 molars were examined and evaluated at six- and twelve-month intervals. After eighteen months, 215 molars from fifty-nine children were evaluated; and by twenty-four months, 211 molars from fifty-eight children were evaluated.

Tables 2, 3, 4 and 5 compare the overall retention rates of the sealants for each arch after six, twelve, eighteen and twenty-four months, respectively. No significant differences were noted, statistically, in relation to complete retention between Concise and Delton sealants, for maxillary and mandibular teeth; and also between Sealite and Delton sealants, for the mandibular arch. Significant differences were observed between Concise and Sealite sealants, in relation to complete retention on maxillary and mandibular teeth, and also between Sealite and Delton sealants on maxillary teeth. There were no significant differences in retention between the maxillary and mandibular teeth, involving the same type of sealant. Table 6 demonstrates the percentages of successes and failures in complete retention after twenty-four months according to sealant and arch.

DISCUSSION

Although the majority of sealants being put on the market recently have the same basic chemical composition, it is important to know the effectiveness and retention

Concise and Delton showed superior retention.

Table 6 ☐ Observation and percentage of successes and failures in complete retention after twenty-four months according to sealant and arch.

Arch		Sealant		
		Concise	Sealite	Delton
Maxilla	n	35	25	33
	% success	97.2	69.4	89.2
	% failure	2.8ns	30.6*	10.8*
Mandible	n	31	21	26
	% success	88.6	61.8	78.8
	% failure	11.4*	38.2*	21.2*
Totals	n	66	46	59
	% success	93.0	65.7	84.3
	% failure	7.0*	34.3*	15.7*

n: number of surfaces; %: per cent
ns: not significant; *: significant

capacity of each one. The basic objective of this research was to make a comparative study of the long-term retention capacity of two light-polymerizing sealants (Concise and Sealite) with the autopolymerizing sealant (Delton). Six months after application, careful examination of each sealant was made, showing the following complete retention capacity: Concise, 98.7 percent; Sealite, 94.6 percent; and Delton, 94.7 percent (Table 2). The results after twelve months were: Concise, 94.8 percent; Sealite, 87.8 percent; and Delton, 90.6 percent (Table 3). Complete retention after eighteen months showed the following: Concise, 94.4 percent; Sealite, 80.3 percent; and Delton, 86.1 percent (Table 4). After twenty-four months, the values for complete retention were: Concise, 93.0 percent; Sealite, 65.7 percent; Delton, 84.3 percent (Table 5).

Despite the fact that Concise was more retentive than Delton, it was noted that in complete retention there was no difference. Both Concise and Delton showed superior retention, however, when compared with Sealite. When the three sealants were analyzed at the end of the six, twelve, eighteen and twenty-four month periods (Tables 2,3,4,5), it was observed that retentive loss was gradual. Sealants Concise and Delton showed a slower loss than Sealite, which showed an accelerated loss during the eighteen- to twenty-four-month period. In reference to Delton, the results were the same as those reported by Mertz-Fairhurst and coworkers, in which Delton showed a marked deceleration after two years of observation.[4] Following the technique of Eidelman, cotton rolls were used to isolate the teeth that were to be treated with sealants.[7] Based on information found in the literature from Eidelman, it seems that absolute isolation is not necessary for the application of sealants, as long as extreme care is taken to avoid salivary contamination of the etched surface.[7]

SUMMARY AND CONCLUSIONS

This investigation was conducted with the object of comparing the retention capacity of two visible-light-activated sealants (Concise–3M and Sealite–Kerr) with the more commonly used autopolymerizing sealant (Delton–Johnson & Johnson). The study included sixty-two children, thirty-five boys and twenty-seven girls, between six and eleven years of age. Two hundred twenty-nine first permanent molar occlusal surfaces were treated with sealants (118 maxillary molars and 111 mandibular molars). Sealants were applied according to the manufactures' instructions and cotton rolls were used for partial isolation. After six, twelve, eighteen and twenty-four months, the surfaces treated with the sealants were examined and evaluated. Three categories were used to evaluate each sealant. During each evaluation period the sealants were graded according to complete, partial, or failed retention. No significant difference was noted between Concise and Delton sealants for C when comparing maxillary and mandibular teeth. Significant differences were observed between Concise and Sealite in relation to C on the maxillary and mandibular arches and also between Sealite and Delton on the maxillary arch. There were no significant differences in retention between the maxillary and mandibular teeth, when the same type of sealant was used.

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A study of children's taste and visual preferences in dentifrices

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Choosing a dentifrice today is no simple matter. There are toothpastes for children and toothpastes for adults. Within each of these two categories there is a wide variety of dentifrices that serve many functions. These functions are anti-plaque, anti-caries, tartar-control, and desensitization.

The basic criteria for a child's dentifrice are that the dentifrice contain fluoride, rank low in abrasiveness, and carry the *ADA Seal of Acceptance.*[1-3] Other variables, however, can make choosing a dentifrice for a child complicated. Advertisers are in a never-ending search for special gimmicks to sell their products. Available are dentifrices in various flavors (mint, bubble gum); colors (green and red, white, and green stripes); shapes (round or star-shaped); and consistency (gel and paste). In addition, the dentifrice container may be a pump or a tube, with either a twist-off or flip-top lid, and bright colorful labels.

Are these eye-catching, specially flavored dentifrices really preferred by children? The objective of this study was to determine whether children actually prefer those dentifrices that are designed and flavored specifically for them.

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METHODS AND MATERIALS

A study of dentifrice choices was conducted with four hundred thirty-five (435) fourth grade children in Monongalia and Preston Counties in West Virginia. This included ten-year-old children from ten different elementary schools located in both urban and rural areas. Appropriate clearance from school authorities was obtained for conducting this study.

Prior to involvement of the children, five test stations were set-up in a designated room or area in each of the schools (Table 1). Each student was given a sheet of paper numbered from 1-5 with A or B choices indicated by each number. The children were instructed to proceed through each station and to circle their preference of A or B at each station. Each student was guided through the stations by the researchers and encouraged to utilize his/her personal judgment in the decision-making at each station.

Station 1 involved taste preference between a regular flavor (A) and children's flavored (B) dentifrice of the same brand. Each child was handed a cotton tip applicator containing a small amount of dentifrice A and then a new applicator containing dentifrice B. After tasting both, the student was asked to circle his/her preference on the sheet.

Stations 2-5 involved visual preferences. Stations 2 and 3 dealt with choices between a blue gel and mint green paste, and between a blue gel and a blue gel with sparkles, respectively. At Station 4, each child

Table 1 ☐ Dentifrice choices at test stations.

Test station	Choice A	Choice B
*1	Regular Flavor	*Children's flavor
2	*Blue gel	Mint-green paste
3	Blue gel	*Blue gel with sparkles
4	*Pump container	Tube container
5	Twist top	*Flip top

Station 1: Taste preference. Stations 2-5: Visual preference.

*Modernized, Child-Oriented

Table 2 ☐ Comparison of the children's choices at each test station.

Test station	Choice A (%)	Choice B (%)
1	207 (48)	228 (52)
2	333 (77)	102 (23)
3	73 (17)	362 (83)
4	326 (75)	109 (25)
5	80 (18)	355 (82)

Calculation of Binomial Distribution indicated statistically significant differences in Stations 2-5, with child-oriented dentifrices and containers preferred. N = 435

Table 3 ☐ Comparison of choices of children from rural and urban schools.

	Choice A	Choice B
Station 1		
Rural	35	33
Urban	172	195
Station 2		
Rural	54	14
Urban	279	88
Station 3		
Rural	9	59
Urban	64	303
Station 4		
Rural	48	20
Urban	278	89
Station 5		
Rural	10	58
Urban	70	297

Rural: N = 68 Urban: N = 367

*Chi-square analyses indicated no statistically significant differences ($p > .05$) in choices of children from schools in rural and urban areas.

chose between a pump or a tube container; and at Station 5, the children chose between a twist-off and a flip-top lid.

An ADA approved dentifrice was utilized for the taste test, and anonymity of dentifrice brands was maintained throughout the study. At Stations 2 and 3, a 1.5-inch strip of each dentifrice was displayed on white paper and labelled A or B.

After collecting all completed student preference sheets, the researchers explained the purpose of the study to the children. Data were categorized according to whether respondents lived in a rural or an urban area, and Chi-square analysis was performed. All tests of significance were at an alpha level of 0.5. The Binomial Probability Distribution Test was also conducted for each of the five tests.

RESULTS

A summary of raw numbers and percentages of choices at each station is presented in Table 2. Calculation of the Binomial Probability Distribution Test indicated that among all student participants, there were no significant differences in taste preference between the regular and children's flavored dentifrice. Statistically significant differences existed, however, in visual preference in Stations 2-5; with the modern, child-oriented dentifrices and containers preferred by the children. The gel was preferred to the paste, and blue sparkle gel to the plain blue gel. The pump container was preferred to the tube and the flip-top lid preferred to the twist-off lid.

Responses at each test station were also categorized according to whether respondents resided in an urban or rural area (Table 3). Chi-square analysis of these data indicated no significant differences in responses of children attending schools in either geographic area.

DISCUSSION

Between the ages of six and twelve, a child acquires the ability to evaluate situations and assimilate information. Desires and needs are considered according to their importance to the individual.[4] From results of a previous pilot study conducted by the investigators, it was decided that fourth-grade children (ten-year-olds) were mature enough to participate in this study with minimal guidance, as long as the directions were precise and the choices and number of test stations were kept at a minimum. Although it was stressed that each child make a personal decision at each test station, it was not unusual for a child to loudly state a choice. This was difficult to control, because the size of the classroom dictated the amount of space between test stations.

As indicated in the results, there was no significant difference in the children's choice of a "regular" flavor and the "kids" flavor of the same dentifrice. This was determined after each child tasted one flavor immediately after the other flavor. Gent and McBurney reported that gustatory (taste sensation) adaptation occurred in less than two minutes, depending upon the strength of the stimulus.

Rinchuse, Zullo and Rinchuse, and Rinchuse, Bugbee and Zullo conducted studies on subjects of various ages to evaluate taste preferences between sweetened and unsweetened toothpastes.[6,7] In each study, the subjects rinsed with tap water for five seconds, ate an unsalted cracker, and rinsed again with water for five seconds between the taste tests. The total interstimulus interval between toothpaste testing was in excess of four minutes. After brushing with each toothpaste, the participant stopped and rated each toothpaste on a scale from 1 (very bad) to 5 (very good). No statistically significant differences existed in the subjects' choices between the two types of dentifrices.

In this study, the participants touched a small dab of each dentifrice to their tongues instead of brushing with each. Whether there was enough time allotted for gustatory adaptation is questionable, since the tasting of one dentifrice was done immediately after the other.

The children were then asked to simply indicate which of the two dentifrice flavors they preferred—not to rank how well each tasted. As observed by the investigators, these ten-year-old children had some difficulty in remembering that they were simply to indicate a pref-

Ten-year-olds prefer dentrifrices designed for them.

erence of the two dentifrices presented. Asking them to rank how well each tasted was felt to be too confusing.

Children from both the rural and urban school settings chose the child-oriented dentifrices in the visual preferences at Stations 2-5. Care had been taken in setting up the stations to avoid presenting the modern, child-oriented dentifrice in a routine sequence at each station.

Although anonymity was maintained throughout the study by the covering of name brands, the children seemed very aware of the brands used. Most of the children indicated that they had seen television advertisements of the dentifrices. Kioulafas, Athanassouli and Weatherell noted that television advertising is a dominant factor in determining the level of sales of a product.[8] And, although television advertising of dental products is basically a commercial enterprise, it does provide dental awareness and improved dental health, if it is done with professional and scientific guidance.[9]

"A consumer's choice and use-frequency of a product are dominated by the degree of immediate personal satisfaction he or she gets when using it. Consequently, design features which make an immediate impression on the user are important determinants of consumer choice."[10] Thus, if a child likes the flavor and design features of a dentifrice, brushing becomes a pleasant experience and this should increase the frequency and length of time of brushing.[3,11] This is contrary to the results of a study conducted by Kleber, Putt, and Muhler who found no significant differences in toothbrushing times or patterns, when children brushed with either a paste or a gel.[12] The flavor of the gel dentifrice utilized in these studies, however, was not that of a children's dentifrice.[3,11,12] Further investigation should be conducted with children to determine whether their preference of a children's flavored dentifrice actually affects the frequency and length of time of brushing.

The authors wish to thank Cathy Jessen for her secretarial support and the fourth grade children who participated in this study.

CONCLUSIONS

From the results of this study, it may be concluded that:

- ☐ Fourth-grade children do not prefer a "child-flavored" dentifrice over a regular flavored dentifrice of the same brand, when one is tasted immediately after the other. Further tests should be conducted, however, in which time is allotted for gustatory adaption between tastings.
- ☐ Children visually prefer dentifrice pastes and gels that are designed specifically for them.
- ☐ Children prefer modern dentifrice-container designs over the traditional.
- ☐ Children from rural and urban schools do not differ in their taste and visual preferences of traditional and child-oriented dentifrices.

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Child patient behavior: a new perspective

Behavior

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Because of its importance in providing quality care, child behavior in the dental office continues to be a fundamental concern in pediatric dentistry. Throughout the animal kingdom, behavior is dependent upon a complex series of structures and events that occur within each organism's nervous system; children are no exception.[1] Although a great deal has been learned about the physiological and biochemical basis for generation and transmission of nerve impulses, reports of a physical basis for behavior have been lacking until recently.[1] This note reviews certain empirical observations regarding child behavior in the light of a recent report by Alkon (1989) that outlined physical changes in nerve fibers following behavioral conditioning.[2]

When a child initially presents for dental care, he or she has to deal with fear of the unknown and varying degrees of discomfort or pain, depending on the child's treatment needs. The child has an inherent "unconditioned" primitive response to fight or flee from situations perceived to be threatening, but generally attempts to cope with the situation cognitively. Cognitive coping involves the manipulation of emotions, an example of which is response transfer.[3] Response transfer refers to the transference of a reaction ordinarily elicited by an "unconditioned" stimulus to a

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"conditioned" stimulus.[2] A classic demonstration of response transfer was performed by Pavlov in his now-famous conditioning experiments.

RECENT PHYSIOLOGICAL FINDINGS

In Pavlovian conditioning, an organism learns to link two discrete temporally-linked stimuli, just as Pavlov's dog learned to link the smell of meat with the ringing of a bell.[2] The fact that the dog associated the two phenomena was demonstrated by a learned behavioral response: salivation. Alkon studied Pavlovian conditioning in the marine snail *Hermissenda crassicornis* and in the rabbit.[2] Rabbits were taught to associate an auditory tone with a puff of air to the surface of the eye. The air causes the nictitating membrane to extend, and with time the rabbit extended the membrane in response to the tone. Similarly, *Hermissenda* were taught to associate a flash of light with the rotation that mimics ocean turbulence. In nature, the snail responds to turbulence by flexing its muscular foot in order to anchor itself to a hard surface. Through conditioning, it learned to do so in response to light.

Alkon noted that the formation of associative memory as demonstrated in these studies appears to involve a sequence of molecular changes at specific locations in systems of neurons. In both the rabbit and the snail, the repeated temporal association of stimuli during Pavlovian conditioning caused a persistent change in the involved neurons. This change, the basis of which is still undetermined, resulted in a reduced flow of potassium ions across the neuronal cell membranes, resulting in facilitated generation and propagation of nerve impulses (i.e., action potentials).* This reduction of potassium ion flow brought on by conditioning and the resultant enhanced excitability within the snail and rabbit neural systems has been shown to last for at least many days, and probably much longer. In the snail, where neurons are few and their connections well characterized, these changes in potassium ion flow have been shown to be a major determinant of the capacity to store and recall the learned association.[2] Further studies by Alkon showed that it is not the stimuli themselves that reduce the ion flow, but the temporal relation of the stimuli.

Within this conceptual framework, a stimulus not temporally linked to another stimulus (i.e., an "unconditioned stimulus") elicits real-time electrical responses within neural systems and associated stereotypical behavioral responses. Nothing is remembered; the input information simply "flows through" the neural system by means of pathways that are genetically determined or "hard-wired".[2] A stimulus that is temporally linked to another associated stimulus (i.e., a "conditioned stimulus") also elicits real-time electrical responses, but they are not the stereotypical electrical and behavioral responses elicited by the "unconditioned" stimuli. The input information from the "conditioned" stimulus flows along a new pathway, one that is not hard-wired nor genetically dictated, but formed in the course of the learning experience. This new pathway is described as a "collateral pathway", the functional efficacy of which is determined by the learning experience.[2]

IMPLICATIONS FOR PEDIATRIC DENTISTRY

Alkon's findings with regard to the development of physical changes in neural networks as a result of behavioral conditioning may have important implications for the management of pediatric dental patients. Venham *et al* (1977) reported that child behavior often deteriorates during sequential dental visits; later as the child becomes more accustomed to the dental situation, behavior frequently improves.[5] These observations could be related to the time domain wherein reduced potassium ion flow results in readily triggered impulses and responses. To elaborate, a child who reacts negatively at his or her initial visit to a dentist may have reduced potassium ion flow by the end of that visit as a result of manifesting the "unconditioned" response to fight or flee the stimulus of the dental situation. If the child again visits the dentist before his or her potassium ion flow returns to normal, inappropriate behavior responses may be easily triggered. The dentist observes this phenomenon as behavior deterioration over sequential visits. The practical significance of the time domain of reduced potassium ion flow is that children manifesting markedly negative behavior and requiring extensive dental treatment may be better treated by scheduling them at well-spaced sequen-

*An action potential is an electrical signal of the nervous system used to send messages over long distances. During the initial depolarization phase of the action potential, there is an inflow of sodium ions and an outflow of potassium ions. This change in the ionic permeability of the membrane and resultant changes in the electrical potential difference across the cell surface membrane results in electrical messages (Hille 1989).[4] Ordinarily potassium ion flow is responsible for keeping the charge on the cell membrane well below the threshold potential at which propagating signals are triggered. When the flow of potassium ions is reduced, impulses can be triggered more readily (Alkon 1989).[2]

tial appointments, allowing their potassium ion flow to return to normal, thereby reducing easy triggering of impulses and inappropriate behavior at subsequent visits. In addition to the short-term benefits of better behavior during the initial course of treatment, this approach could have a long-term impact by lessening the possibility of a learned association being developed between the stimulus of a dental visit and inappropriate behavior responses.

From the perspective of developing desirable behavior patterns, it can be speculated that the establishment of a "collateral pathway" associated with positive experiences might improve and maintain appropriate behavior over appointments. This seems plausible as it has been reported that model learning and desensitization results in significantly less negative behavior in children during restorative procedures possibly because of response transfer.[6] This hypothesis might also partially explain behavior improvement with time as reported by Venham *et al.*[5]

SUMMARY

- ☐ All behavior depends on responses of the nervous system (Shepherd 1988). [1]
- ☐ Alkon demonstrated physical changes in the nervous systems of *Hermissenda crassicornis* and rabbits at the molecular level following behavioral conditioning.[2] This physical change resulted in a reduced flow of potassium ions across the neuronal cell membrane for some time, with resultant enhanced excitability during this period.
- ☐ It is suggested that behavioral deterioration in children during sequential dental visits might be the result of a reduced potassium ion flow across the neuronal cell membrane, with resultant enhanced excitability during this period.
- ☐ Alkon also reported that in a "conditioned" stimulus, information flows along a "collateral pathway" formed in the course of the learning experience.
- ☐ It is hypothesized that behavioral improvement in children following positive dental experiences (model learning and desensitization) may be due to the information of the "conditioned" dental stimulus flowing along a "collateral pathway" formed in the course of the learning experience.

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HIV INFECTION AND AIDS IN CHILDREN

The problem of HIV infection and AIDS in children is increasing as more children become infected each year. With an estimated 1500 to 2000 HIV-infected children born in 1989, the impact of HIV on mortality in children will become more severe. While certain therapies under evaluation may slow the course of HIV disease, HIV infection is likely to remain a highly fatal condition. Prevention of most AIDS cases in children requires prevention of infection in women. Counseling and testing programs for women should be offered, and readily available, in health facilities that serve reproductive-age women at high risk of HIV infection. Women who are already infected should be advised to consider the risk of perinatal HIV transmission in making reproductive choices. These programs are urgently needed, especially in areas with high incidence of perinatally acquired HIV infection.

Chu, S.Y. *et al*: Impact of the human immunodeficiency virus epidemic on mortality in children, United States. Pediatrics, 87:806–810, June 1991.

Demography

Pediatric dentistry demographics: more than just numbers of children

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

"... are we so certain of the economic viability of pediatric dentistry that we may overlook minority children?"[1]

In 1989, the American Academy of Pediatric Dentistry in its study of practitioner busyness, noted that:

- ☐ 74 percent of pediatric dentists reported increased numbers of patients seeking care and increased numbers of patient visits.
- ☐ 12 percent of pediatric dentists reported decreases in levels of practice activity.
- ☐ 3 percent of pediatric dentists reported their schedule of patients was "seriously deficient."[2]

Indeed, times have changed since the early 1980s when I titled a presentation, "Verifying an oversupply of pedodontists: some added factors."[3] The then-current information on the increasing numbers of pediatric dentists, supplemented with data on the decreasing population under eighteen years of age, stagnation in the use of dental services, decreases in dental caries, and minimal financial support for dental services by governmental agencies, all seemed to confirm a generally pessimistic future for pediatric dental practice.*

Lest we be lulled into complacency now that there has been an upturn in the prospects for pediatric den-

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Table 1 ☐ Projected number of children by age.[7,8]

Age	1980*	1990	2000	2010	2020	2030
< 5 yrs.	16.5	18.4	16.9	16.9	17.1	16.3
5–17 yrs.	47.2	45.6	48.9	45.7	45.8	45.8
All children	63.7	64.0	65.8	62.6	63.9	62.1

Note: All projections use the middle series estimates.
*Actual number from census.

Table 2 ☐ Number of children by age and region: 1990, 2000.[7]

	Less than 5 years		5–17 years	
	1990	2000	1990	2000
	In millions			
United States	18.4	16.9	45.6	48.8
Northeast	3.4	3.0	8.5	9.0
Midwest	4.5	3.8	11.1	11.2
South	6.4	6.1	16.2	17.6
West	4.1	4.0	9.8	11.1

Table 3 ☐ Projected number of children less than five years of age by race and Hispanic origin.[7-10]

	Less than 5 Years of Age					
	1980	1990	2000	2010	2020	2030
	In millions					
White	13.4	14.9	13.3	13.1	13.0	12.3
Total Nonwhite + Hispanic	4.7	5.8	6.0	6.8	7.3	7.5
Black	2.5	2.8	2.7	2.8	2.9	2.8
Other races	0.5	0.7	0.8	1.0	1.2*	1.4*
Hispanic	1.7	2.3	2.5	2.9	3.2	3.3

Note: Hispanic persons may be of any race.
*Estimate by this writer based upon growth in previous periods.

Table 4 ☐ Projected number of children five to seventeen years of age by race and Hispanic origin.[7-10]

	5–17 Years of Age					
	1980	1990	2000	2010	2020	2030
	In millions					
White	39.2	36.5	38.6	35.3	34.7	34.4
Total Nonwhite + Hispanic	9.9	14.0	16.5	17.3	18.6	19.8
Black	7.0	7.2	7.9	7.8	7.9	8.0
Other races	1.2	1.9	2.4	2.7	3.0*	3.3*
Hispanic	1.7	4.9	6.2	6.8	7.7	8.5

Note: Hispanic persons may be of any race.
*Estimate by this writer based upon growth in previous periods.

tistry, the reality is that pediatric dental practitioners must develop a continuing supply of patients as current patients "age out" of their practices.

Despite this need for continued sources for pediatric patients, a large and growing population of minority children do not receive needed dental services.

- ☐ Non-minority children have more of their services needs met than their minority counterparts.
- ☐ In some regions in the nation, large segments of the young minority population are not receiving needed dental services.
- ☐ Minority children have fewer visits for dental services with a smaller percent of the visits for preventive "check-ups" than non-minority children.**

"Few dental practitioners (or even the general community) would be surprised with these findings. The continued relationship between family economics, education levels, dental insurance, the adequacy of government funding for dental programs, and the availability and use of dental services has been documented repeatedly."[1]

*For an extended review of the changes in pediatric dental practice during the 1980s, see an earlier presentation by this writer in the Journal of Dentistry for Children.[4]

**For an extended review of the use of dental services by minority children and the extent of services provided by pediatric dentists, see earlier presentations by this writer in the Journal of Dentistry for Children.[1,5,6]

But many practitioners would be surprised when they learn that:

- ☐ The overall numbers of children will remain relatively stable during the first third of the twenty-first century, but at lower levels.
- ☐ The numbers of non-minority children will decrease.
- ☐ The numbers of minority children will increase.

OVERALL NUMBERS OF CHILDREN

The U.S. Bureau of the Census projects that:

- ☐ During the final years of the twentieth century, there will be an increase from 64 million to almost 66 million children (resulting from a decrease in the number of children less than five years of age and an increase in the number of older children).
- ☐ In the first third of the twenty-first century, the number of younger children will remain constant at the 1980 level of between 16 and 17 million children.
- ☐ During the same period, the number of older children will decrease to the level of 1980: somewhat more than 45 million children (Table 1).
- ☐ During the final years of this century, in all regions of the nation, there will be a decrease in the numbers of children less than five years of age and an increase in the numbers of older children (Table 2).

NUMBERS OF MINORITY CHILDREN

But the overall changes in the general numbers of children mask the fact that:

- ☐ There will be a general decrease (or at best, leveling off) in the numbers of white children.
- ☐ There will be an increase in the numbers of black, "other" races and Hispanic children.
- ☐ The Hispanic population will represent the largest number of minority children (replacing the black population) (Tables 3 and 4).

"...are we so certain of the economic viability of pediatric dentistry that we may overlook minority children?"[1]

ECONOMIC REALITIES

While it may sound mercenary, the ability of the practitioner to function is predicated upon financial return. The reality is that, compared to non-minority children:

- ☐ A greater percent of minority group children live in families that are below the poverty level; 15 percent of white children, compared to 39 percent of Hispanic and 45 percent of black children (Table 5).
- ☐ A smaller percent of minority children have dental insurance and children without insurance use fewer dental services.[11]

And complicating this picture further, has been the continuing decline in the share of dental expenditures provided by governmental agencies. For example, between 1980 and 1990, federal, state and local government share of dental expenditures (primarily Medicaid funds) will decrease from less than four percent to two percent of total dental expenditures (Table 6).

Table 5 ☐ Number and percent of children less than 16 years of age who are below the poverty level by race and Hispanic origin: 1988.[7]

	All races*	White	Black	Hispanic
	(numbers in millions)			
Number	11.6	6.9	3.9	2.5
Percent	20.4%	15.2%	45.4%	38.9%

Note: Hispanic persons may be of any race.
*Includes other races not shown separately.

Table 6 ☐ Distribution of national expenditures for dental services.[12,13]

	Private		Public	
Year	Private Insurance	Direct Payment	Federal Gov't	State & Local
1980	23.4%	72.7%	1.9%	1.9%
1990	33.9	64.1	1.0	1.0

The ability to maintain a practice is predicated on financial return.

While spending for Medicaid dentistry constitutes a minor component of total national expenditures, it must be emphasized that the Medicaid program provides funds for those individuals for whom pediatric dental services are most needed. (Note: Expanded dental care for poor children is required under a law [Public Law 101-239] that took effect in April 1990. Medicaid's Early and Periodic Screening and Diagnosis Program expanded the number of children eligible for care and required additional care for older children. By April 1991, states must report to Congress on the number of children receiving dental services.)

WHERE TO NOW?

"Mr. Rostenkowski (Chairman of the House Ways and Means Committee) said that, 'the sad story of the 1980s was that the old have gotten more while the young have gotten less' "[14]

"Never before has one generation of American teenagers been less healthy, less cared for or less prepared for life than their parents were at the same age."

(—Commission established by the American Medical Association and the National Association of State Boards of Education)[15]

We must capitalize on the developing awareness of the needs for health and social services for children; in particular, minorities and poor children. Legislators and the many funding agencies are aware of the need. "It's not that we don't know what to do. It's that we were not doing it."[15] Emphasizing the projected growth in the number of minority group children (and the general decrease or, at best, leveling off in the number of non-minority children) could bring the necessary ac-

tion to provide for the health needs of all children.

And, from the dental profession's perspective, the future of pediatric dentistry could rest upon our ability to develop methods to increase services to minority group children.

"Or, are we so certain of the economic viability of pediatric dentistry that we may overlook minority children?"[1]

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PARENTAL PRESENCE IN EMERGENCY ROOM

It is unclear whether parents should be permitted to comfort their children during all procedures performed in emergency rooms. However, inasmuch as most physicians do not ask parents to leave the room when their child receives a routine immunization, it is likely that we can develop the same comfort with parental presence in emergency rooms. Sorting out which parents will be helpful to their child is far more difficult.

Some information from the dental literature suggests that parental presence is effective in reducing a child's pain and anxiety. Frankl and others reported that children between 41 and 49 months of age were more cooperative and less fearful when their parents were present. In a study of parental presence during immunization, Shaw and Routh found that children younger than 18 months of age cried less when parents were present in contrast to a group whose parents were not present. These studies were not conducted in emergency rooms, but they indicate that parents can help their children cope with pain. When parents do stay with their children during invasive procedures, it is important for physicians to tell parents how they can help their child remain calm.

This study demonstrates that in our emergency room the majority of parents appear to remain with their children when they undergo venipuncture or intravenous cannulation. The parental decision to stay or leave is frequently made by the parent without discussing the decision with the physician. The reasons for parental presence or absence during these or other procedures require further study, but they include both overt and covert encouragement and/or discouragement by the medical personnel involved.

Bauchner, H. *et al*: Parental presence during procedures in an emegency room: results from 50 observations.
Pediatrics, 87:544–548, April 1991.

There is no such thing as a typical family

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

In part because of the continuing rise in out-of-wedlock childbearing, more than half of all children are likely to experience a period of living with a single parent during the 1990s, usually in reduced economic circumstances."[1]

Norman Rockwell's picture of a family gathered about the Thanksgiving Day dinner table probably portrays best the idealized "typical" American family. Freckle-faced kids, parents and grandparents are all prepared to dig into the mounds of food after the required expression of thanksgiving. Radio and television programs have continued with their particular variations of the "all-American family." Whether these idealized families ever existed is no longer the issue. The reality is that, as we enter the decade of the 90s, "there's no such thing as a typical family!"

"Each of us has a concept of the typical family and how it has changed over time. Being rooted in our own family experience and community, our views are seldom, if every, an accurate depiction of the typical family."[1]

Consider some of the changes:

- ☐ Relatively fewer of us are living in family households, particularly in "traditional" nuclear families, than did in earlier years of this century.
- ☐ Women in this country are bearing fewer children and they are doing so later in their reproductive years.
- ☐ Those who live in family households (still a substantial majority of the population) live in less stable, more heterogeneous families than did previous generations.
- ☐ Regardless of the presence of children (even infants) women are more likely to work outside the home than to work solely as homemakers.[1]

In short, mom may not be available to shepherd her freckle-faced little "darling" for any number of needed services (including pediatric dental care)—if in fact 1) there is a woman in the family grouping, and 2) it is realistic to speak of "freckle-faced youngsters" in a nation as heterogenous as the United States.

Many pediatric dentists have had to modify practice procedures as they expanded their services beyond traditionally served population groups (i.e. nonminorities and children in families with higher incomes).[2] But increasingly, pediatric dentists, and dentists in general, will need to modify many of their activities as they attempt to provide needed services to the variety of families that are undergoing transformation—far more extensively and rapidly than most of us can imagine. The following presentation will provide an overview of these developments.

CHANGING TYPES OF HOUSEHOLDS

Although married-couple households still constitute more than 58 percent of the almost 93 million house-

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Table 1 ☐ Household by type and percent increase: 1989.[1]

Type of household	Number 1989	Percent increase 1970–1989
	(000s)	
Total	92,830	46%
Family		
Married couples	52,100	16
Female householder no spouse present	10,890	96
Male householder no spouse present	2,847	132
Nonfamily		
Single person	22,708	109
Multiple persons	4,286	292
Unmarried couples	2,588	395

Table 2 ☐ Composition of households: selected years, 1960–1988.[1]

	1960	1970	1980	1988
Single-person households	13.0%	17.1%	22.6%	24.1%
Multiperson nonfamily household	1.7	1.7	3.6	4.4
Other families without children	6.4	5.6	5.4	6.6
Married couples without children	30.3	30.3	29.9	29.9
Other families with children under 18	4.4	5.0	7.5	8.0
Married couples with children under 18	44.2	40.3	30.9	27.0
Total	100%	100%	100%	100%

Table 3 ☐ Trends in labor force activity of families with children under age 18, by type of family: selected years 1975, 1988.[3]

Family type	1975	1988
	(Numbers in thousands)	
Total families with children	30,375	32,347
Married couple families		
Number	25,400	24,611
Percent of total families with children	84.0%	76.1%
Percent in labor force		
Father only	52.6%	32.7%
Father and mother	43.4%	63.0%
Mother only	1.6%	2.2%
Families maintained by women (no spouse present)		
Number	4,461	6,666
Percent of total families with children	14.6%	20.6%
Mother in labor force	59.9%	67.2%
Families maintained by men (no spouse present)		
Number	454	1,070
Percent of total families with children	1.4%	3.3%
Father in labor force	87.0%	90.2%

Table 4 ☐ Family characteristics of children by age: 1975, 1988.[4]

	Children under 6 years old		Children 6 to 17 years	
Family characteristics	1975	1988	1975	1988
Total children (000s)	18,366	19,887	45,208	38,554
Percent in:				
Two parent families	86.8%	81.0%	83.1%	75.8%
Only father in labor force	55.3	36.5	42.5	24.5
Mother and father in labor force	23.3	38.5	32.2	44.6
Single parent families	13.2%	19.0%	16.9%	24.2%
Maintained by women	12.7	16.6	15.4	21.2
Maintained by men	0.5	2.3	1.6	2.9

holds in this country, in the past twenty years their numbers increased by only 16 percent; compared to one, two, three and almost four hundred percent increases in other household arrangements, including single and multiple person arrangements (Table 1).

The Norman Rockwell "typical family" (i.e. married couple with children under eighteen years) represented 44 percent of U.S. households in 1960; but only 27 percent in 1988. During the same period, the proportion of households represented by single person arrangements almost doubled; reaching almost one quarter of all households in 1988 (Table 2).

TRENDS IN LABOR FORCE ACTIVITY OF FAMILIES WITH CHILDREN

In general

In 1988, married couple families represented 76 percent of all families with children; a decrease from 84 percent in 1975. Families maintained by women (with no spouse present) represented 20.6 percent of all families with children; an increase from 14.6 percent in 1975. Families maintained by men (with no spouse present), although more than doubling in number since 1975, represented only 3.3 percent of all families with children.

During this period from the mid 1970s to the late 1980s, there have been dramatic changes in the labor force activity of the men and women in the various family arrangements that contained children. For example, in married couple arrangements:

- ☐ A decrease from more than one half to less than one third of families where only the father was in the labor force.*

*With a most sincere expression of gratitude and apology to my wife and millions of other women (and men) who carry out homemaker services, it should be noted that the U.S. Bureau of the Census does not consider such activities in one's own home as labor force activity.

☐ An increase from 43 percent to 63 percent of families with both father and mother in the labor force.

In families maintained by women (no spouse present):

☐ An increase from 60 percent to 67 percent of families with the mother in the labor force (Table 3).

The increase in the percent of two parent families where both parents were in the labor force, (and single parent families where the women were employed) occurred in families with children under six years of age and those families with older children (Table 4).

Table 5 ☐ Family characteristics of children by race and Hispanic origin: 1975, 1988.[4]

	White		Black		Hispanic Origin	
Family characteristics	1975	1988	1975	1988	1975	1988
Total children (000s)	54,292	48,449	8,210	7,937	4,751	6,311
Percent in:						
Two parent families						
Only father employed	49.7%	31.3%	23.5%	13.1%	45.7%	32.2%
Both parents employed	30.6%	45.1%	23.2%	27.7%	22.7%	28.4%
Single parent families						
Maintained by women	10.7%	14.9%	41.6%	49.5%	18.7%	25.4%
Maintained by men	1.2%	2.7%	1.5%	3.2%	1.1%	2.9%

By race and ethnicity

Two parent families: the decrease in the percent of two parent families where only the father was in labor force, occurred in white, black and Hispanic families. Similarly, the increase where both parents were employed occurred in all groups. Employment by only the father, represented the working arrangement for 13 percent of black families with children; compared to over 31 percent for white and Hispanic families.

Employment by both parents, represented the working arrangements for 45 percent of white families with children; compared to approximately 28 percent for black and Hispanic families.

Single parent families: there was an increase in the percent of employed women in white, black and Hispanic families. By 1988, one half of black children were in single parent families maintained by working women (Table 5).

By income

There are wide and consistent differences in the median income levels of the various family arrangements in which children are raised. Two-parent families (especially those where both parents are employed) have constant dollar incomes (i.e. removing the effects of inflation) that are one and half to two times greater than the incomes of single families maintained by men and women. In 1987, single-parent families (with younger children) that were maintained by women had one sixth the median income of comparable two-parent families where both parents were employed.

The median family constant dollar income of black and Hispanic families with children, 1) did not keep pace with the rate of inflation, and 2) ranged from two thirds to one half of the income of white families (Table 6).

Day care arrangements

The continuing increase of women in the work force has resulted in needed day-care arrangements for children. Although the news media has tended to emphasize group care centers, and nursery and preschool arrangements, 41 percent of the children (under five years of age) of working mothers are cared for in someone else's home; 30 percent in the child's own home (Table 7).

CHANGING FAMILY ARRANGEMENTS ARE NOT UNIQUE TO THIS COUNTRY

The increasing percent of women in the work force is occurring in the many industrialized countries

Table 6 ☐ Median family income in constant dollars for children under 18 years by family characteristics: 1975, 1980, 1987.[4]

		Two parent families		Single parent families				
	Total children	Father employed	Both Parents employed	Maintained by women	Maintained by men	White families	Black families	Hispanic families
1975	$28,340	$30,319	$36,482	$10,754	$23,248	$30,101	$16,505	$19,438
1980	29,152	30,746	38,258	10,567	19,676	30,815	16,409	19,523
1987	30,007	31,652	40,890	9,007	20,781	32,357	14,250	17,504
1987	Less than 6 yrs. of age 27,503	29,633	37,623	6,397	14,543	29,668	12,357	15,474
1987	6–17 years of age 31,366	33,282	42,432	10,517	25,270	33,864	15,116	18,485

Table 7 ☐ Day care arrangements for the children of working mothers: 1986.[4]

	Under age 5	Ages 5–14
Total number (000s) Arrangements	9,046	19,976
Child's home	29.7%	13.8%
Another's home	41.3	5.4
Day/group care center	14.7	1.9
Nursery school/ preschool	6.4	0.9
Kindergarten/ grade school	1.2	69.9
Child care for self	–	4.9
Mother cares for child at work	6.7	3.2
Totals	100%	100%

Table 8 ☐ Percent of women between ages 25 and 34 years in labor force by country: 1970 and 1988.[5]

Country	1970	1988
Canada	41.2%	74.9%
Denmark	na	90.0
France	52.2	74.5
Germany	47.6	61.5
Japan	46.8	54.5
Netherlands	23.9	55.4
Sweden	60.7	89.4
United Kingdom	43.3	66.0
United States	44.7	72.6

Table 9 ☐ Percent distribution of single parent households as a total of all households with children by country: 1985–1988.[5]

Country	Percent
Canada	14.8%
Denmark	20.3
France	10.9
Germany	13.5
Japan	5.9
Netherlands	12.3
Sweden	16.9
United Kingdom	12.7
United States	22.9

Table 10 ☐ Labor force participation rates of lone mothers with children under 3 and 18 years by country, 1986 or 1988.[5]

Country	Under 3 years old	Under 18 years old
Canada	41.3%	63.4%
Denmark	80.9	85.9
France	69.6	85.2
Germany	50.4	69.7
Italy	68.0	67.2
United Kingdom	23.4	51.9
United States	45.1	65.3

Note: Lone mothers, include divorced, separated, never-married and widowed women.

throughout the world; reaching as high as 90 percent in some countries for women between 25 and 34 years of age (Table 8).

However, the United States leads other industrialized countries with the highest percent of single parent households (23 percent of all households) Table 9).

By the late 1980s, in various industrialized countries, 40, 60 and 80 percent of lone mothers (including divorced, separated, never-married and widowed women) of children under three years of age participated in the labor force (Table 10).

IMPACT ON PEDIATRIC DENTAL PRACTICES

Most of us enjoy the nostalgia of Norman Rockwell pictorial commentaries on what, for many, may represent a bygone era. Today's fast-track world is a modern era: "career tracks", "mommy tracks", "daughter tracks", "life-in-the-fast-lane", and "latch-key children". Equal-opportunity legislation, demands for increased day-care-center services, and any number of programs to permit women to maintain their dual family and career objectives, have replaced the world of Rockwell's paintings. [A recent student, who was enrolled in an undergraduate course that I present at our college, informed me that she hoped for a future as a housewife and mother; but was reluctant to admit this to any of her career-minded female friends.]

Twenty-three percent of U.S.A. households have only one parent.

No doubt every dental practice has been confronted by these changing family arrangements. But it is the pediatric dentist who, most often, may need to respond to the unavailability of a parent when providing needed dental services and necessary homecare follow-up. Yet, many practitioners may be unaware of the magnitude of the changes in family living arrangements of the children in their practices. All too often, their own family experience may cloud the reality of their patient's family setting. Taking a patient's history in today's world must move beyond the "usual" dental, medical and social factors. The young child's home environment may be quite different from that with which most practitioners can identify.

As pediatric dentists expand their services to both traditional and underserved population groups, increasingly, they will need to deal with situations that make us long for the halcyon days of Rockwell's paintings. Incidently, which picture is your favorite?

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Budget management

Management of a departmental budget using an electronic spreadsheet

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Dennis Galletta, PhD, CPA

In this period of declining financial resources being experienced by many dental schools, prudent financial management is a matter of concern to managers of departmental budgets. The "changing pattern of dental disease" phenomenon, primarily characterized by a reduction in the occurrence of dental caries, is producing a decline in income for dental schools.[1-6] Occurring simultaneously is a reduction in enrollment of students in dental schools along with a decline in the number of patients seeking treatment in dental school clinics.[7,8] Compounding the complexity of the situation is a termination of several dental schools as dentistry adjusts to a changing economic environment.[9,10]

Such realities demand that funds available for dental education be utilized with precision, a factor often difficult to achieve for departmental chairpersons expert in clinical and basic science areas, but less in budget management. Many dental school departments utilize computers, which, when equipped with appropriate software, provide the chairperson with important information on the status of the departmental budget. Awareness of the funds remaining in each of the budgeted categories allows rapid decisions on a variety of issues: availability of funds for the purchase of supplies,

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instruments, and teaching aids; and to support faculty travel.

A computer-driven spreadsheet can be indispensable in the management of a departmental budget, while providing essential information on current income and disbursements, and facilitating comparison with previous, current, and projected operations.

Spreadsheet programs also provide graphic representation of collected data on budget operations, thus facilitating rapid analyses of ongoing operations. Most departmental chairpersons are familiar with traditional paper worksheets used to provide tabular presentation of numerical data, as well as a variety of graphics that assist with budgetary supervision. An "electronic spreadsheet" by comparison can provide similar information in a more rapid and comprehensive manner. Although illustrations in this article apply to dental school departments, the principles presented on use of electronic spreadsheets can extend to any large dental practice utilizing budgetary practices.

The purpose of this article is to describe the use of a computer-driven electronic spreadsheet designed to assist with the budgetary management of a dental school department. In addition, it will present a format suitable for use with a departmental electronic spreadsheet.

OPERATION OF AN ELECTRONIC SPREADSHEET

A computer-driven electronic spreadsheet can be used to perform a variety of qualitative and quantitative analyses in the management of a departmental budget. Besides performing a variety of mathematical calculations automatically in response to instructions (formula) imbedded within the spreadsheet, a comprehensive spreadsheet program will also guide the construction of graphs, thereby facilitating visual analysis of the data generated (Figures 1,2 and 3). Electronic spreadsheet programs can improve greatly the users' efficiency and productivity.

Electronic spreadsheets are also applicable to large private practices.

There are many commercial spreadsheet programs available (for example, Lotus 1-2-3, Framework III, Microsoft Excel, and Full Impact), designed for use with a variety of specific computers.[11] These spread-

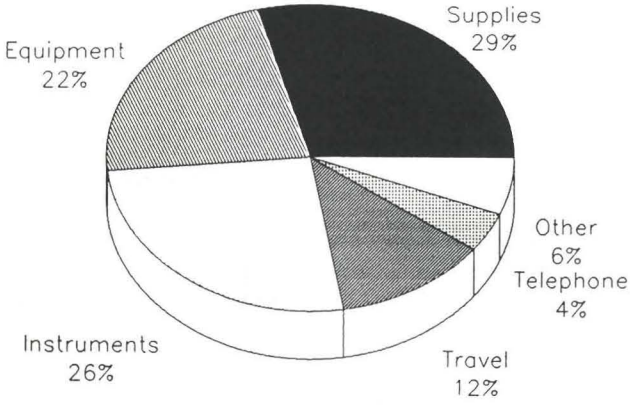

Figure 1. Expenditures for 1990.

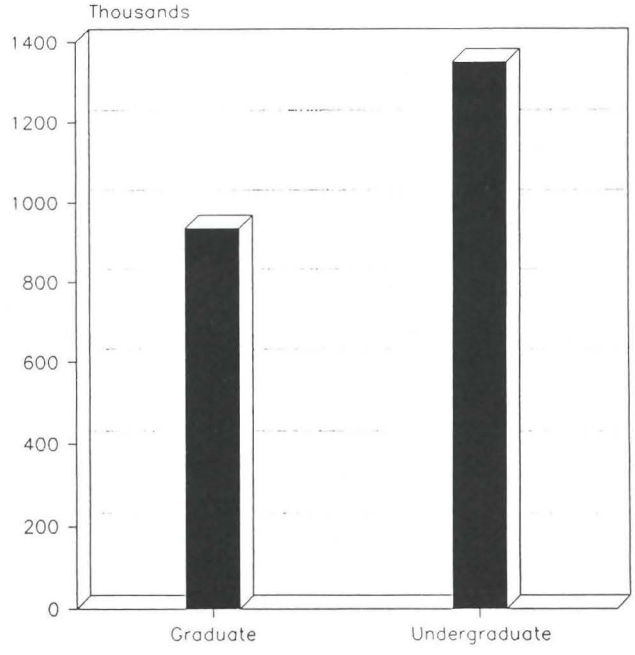

Figure 2. Comparing income by division.

sheet programs allow the operator to insert his or her own criteria, thereby facilitating calculation of the type of analysis desired by the user.

In an electronic spreadsheet (similarly to a paper spreadsheet), there will be displayed on the screen of the computer monitor vertical columns and horizontal rows. Each cell formed by the intersection of a column and a row is most often identified by its column letter and row number. Although most spreadsheet programs hold hundreds or even thousands of rows and columns, the hardware and software used determine how many rows and columns can appear on the screen at once. While a spreadsheet might be huge, the user only sees as much as can fit on the screen at one time. By sliding this "window" around, the user can see whatever portion is desired.

A cursor can be moved on the screen to allow the user to examine or enter a particular cell's information. The contents of the cell appear elsewhere on the screen in a large space for editing or examining in total.

Cell contents usually include (1) labels or (2) values. *Labels* are not intended to be affected by mathematical operations. They are intended only to provide a reader with an understanding of what is entered in a spreadsheet. For example, in the simple spreadsheet illustrated in Figure 4, the words "Supplies," "Instruments," etc., are entered as labels. These labels have no impact on the outcome of the spreadsheet other than to identify the results to the reader. *Values* are also entered into the cells, and are often considered as the focus of the spreadsheet. For example, the amount for supplies in Figure 4 can be used for further calculations.

Values might either be entered directly or be the result of a *formula* that is entered into the cell. The amount for "Supplies" discussed earlier could have been entered as 42000 entry to appear as $42,000.00 if desired.

Spreadsheets can be recalculated by the user. This

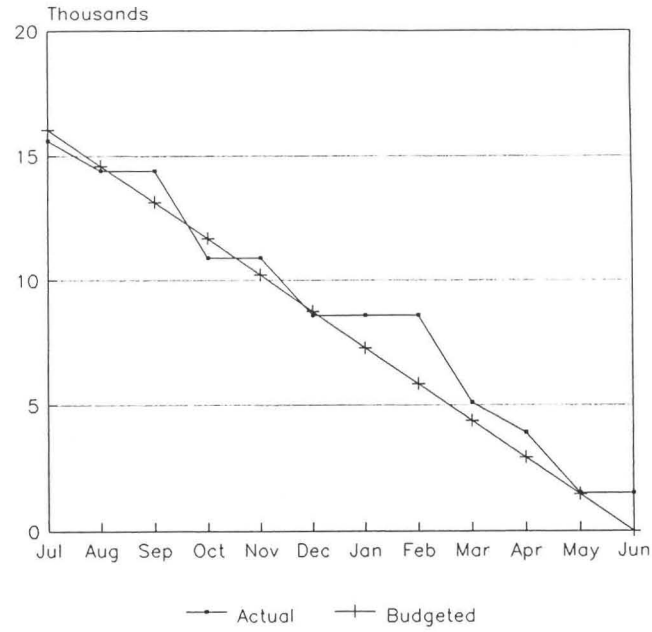

Figure 3. Budgeted vs. actual travel expenditures of pediatric dentistry faculty.

	A	B	C
1	Item	Budget	Percent
2	Supplies	$40,000	30%
3	Instruments	$30,000	23%
4	Equipment	$35,000	26%
5	Travel	$17,500	13%
6	Telephone	$5,500	4%
7	Other	$4,500	26%
8			
9	Total	$132,500	100%

Figure 4. Simple spreadsheet.

recalculation is important for situations in which the amounts that appear are updated or corrected. Many spreadsheets are automatically recalculated in their entirety whenever any new value is entered anywhere on the spreadsheet. Recalculation allows a spreadsheet to be reused in later periods with current data entered into strategic locations, replacing last period's data. For example, the spreadsheet in Figure 4 computes the total expenditures as well as percentage of each expenditure to total expenditures for a given period. By

A	B	C	D	E	F	G	H
Month 1 July	Budget for the month (TOT/12)	Prior Requis. filled	New Requis.	Year to date expended (C+D)	Budget remaining (TOT-E)	% of budget remaining (F/TOT)	scheduled % of budget remaining (% year remaining)
Supplies	3500		2400	2400	39600	94.29%	91.67%
Instruments	2667		750	750	31250	83.33%	91.67%
Equipment	3125				37500	100.00%	91.67%
Travel	1458		1900	1900	15600	89.14%	91.67%
Telephone	492		440	440	5460	92.54%	91.67%
Other	717		320	320	8280	96.28%	91.67%
Totals	11958	0	5810	5810	137690	95.95%	91.67%

Figure 5. Spreadsheet for disbursements, first month of the fiscal year. TOT indicates total budget for that category.

entering the next period's amounts for each expenditure, the total will be updated as well as the percentages.

If, at the end of the following year, the amounts in column B are updated, the result will appear without the need for entering the formulas anew. Assuming the categories remain the same, all that is required is to enter the six amounts, and the correct results will appear. The *data* (raw values) and the *model* (formulas and other relationships), therefore, are separate. This separation of data and models is important to enable "what if" analysis as well as linkage to actual accounting data.[12-15]

As the user enters information into the spreadsheet, errors might result. There are many warnings in the accounting and computer literature about such errors. Such warnings are frightening, in that errors exist in one third to one half of all spreadsheets in use and that single errors have been found to involve up to $7 million.[16,17] Further, these errors are difficult to find, even by experienced CPAs and experienced spreadsheet users.[18]

Some errors are caught immediately by most spreadsheet packages. For example, if the user inadvertently leaves out a keystroke, the package will display an error message in a particular part of the screen, sound a beep of some sort, and prevent the user from entering more data until the error is corrected. Such error capturing only occurs, however, when the error results in a combination of keystrokes that cannot be interpreted by the computer. If the user left out the 2 in 26, there would be no indication that the formula is incorrect. Such an error could be serious in nature, and has proven to be very difficult to find.[19] It is important to take great care in entry of formulas and amounts in a spreadsheet.

The next section will illustrate how a spreadsheet can be helpful to a departmental budget manager.

A departmental budget manager must walk a narrow tightrope, making sure that spending does not exceed available funds and that important acquisitions are indeed made on a timely basis. To accomplish these goals, accurate and up-to-date information should be consulted before any expenditure is made. The most useful information would include an indication of, for any given category, how much, in total, is budgeted; how much has been expended to the current item; how much is left; and whether or not funds are being expended at an excessive rate. This section outlines how a spreadsheet might be used to provide such information.

FUND UTILIZATION

Disbursements in many categories are likely to be found in any organization. Figure 5 illustrates a spreadsheet that provides information about the status of all departmental disbursements, including *supplies, instruments, equipment, travel, telephone,* and *other.* A *total* appears below. Those row heading labels are entered in column A of the spreadsheet to identify the amounts entered in the other columns. In addition, labels that identify contents of the columns appear at the top, including *budget for the month, prior requisitions filled, new requisitions filled, year to date expended, budget remaining, percent of budget remaining,* and *scheduled percent of budget remaining.* Some abbreviation of row and column headings is often required so that more can appear on screens and printed output. Whether or not abbreviations are used, it might be essential to provide documentation that explains all disbursement categories as well as column headings. In this case, the row headings are self-explanatory, while some column headings need further elaboration.

Several of the columns involve amounts entered directly, like *budget for the month* (column B), *prior requisitions filled* (column C), and *new requisitions filled* (column D). The other columns contain formula that perform the arithmetic noted at the top of each column.

The amount that is remaining (column F) is very useful information for the budget manager. Often the manager wishes to know, however, whether or not this

		ACTUAL REQUISITIONS												
BUDGET		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Supplies	42000	2400	2200	1800	4500	3400	1200	3200	7000	2100	2000	3700	10000	43500
Instruments	32000	750	10300			9500	3795		4750				3000	32095
Equipment	37500				8000			2000		1200			26000	37200
Travel	17500	1900	1200		3500		2300			3500	1200	2400		16000
Telephone	5900	440	544	328	762	498	512	438	626	391	733	490	430	6192
Other	8600	320	2350	400	1000	3	900	375	90	2100		20	750	8308
Total	143500	5810	16594	2528	17762	13401	8707	6013	12466	9291	3933	6610	40180	143295

Figure 6. Summary of entire years' expenditures. Note: Amounts could be entered directly from totals obtained manually, or summarized from detailed spreadsheets found elsewhere.

Month 2 AUG	Budget for the month	Prior Requis. filled	New Requis.	Year to date expended	Budget remaining	Percent budget remaining	Scheduled percent of budget remaining
Supplies	3500	2400	2200	4600	37400	89.05%	83.33%
Instruments	2667	750	10300	11050	20950	65.47%	83.33%
Equipment	3125	0		0	37500	100.00%	83.33%
Travel	1458	1900	1200	3100	14400	82.29%	83.33%
Telephone	492	440	544	984	4916	83.32%	83.33%
Other	717	320	2350	2670	5930	68.95%	83.33%
Totals	11958	5810	16594	22404	121096	84.39%	83.33%

Figure 7. Spreadsheet for disbursements, second month of the fiscal year, illustrating how information from one month flows to the next. The "prior requisitions filled" amounts in Month 2 are taken from the "Year to date expended" in month 1 (Figure 5).

remaining budget amount is decreasing each month at a comfortable rate. Toward the end, column G illustrates *the percent of budget remaining,* so that the manager can, at a glance, get a feel for how much has been expended in each category.

Finally, column H shows what is the *scheduled percent of budget remaining,* derived either by dividing the number of months left in the fiscal year by 12, or by entering what is expected, given seasonal fluctuations. The manager can quickly scan columns G and H together to gain an efficient insight as to whether or not the velocity of spending must be adjusted. Figure 3 can be a very useful graphic representation of spending, derived from a spreadsheet summarizing an entire year's progress (Figure 6). Such a graph can be generated easily for any single category or for total expenditures. Adjustments can be accomplished by delaying or speeding up purchases, or even by consulting with the school's fiscal manager to obtain permission to shift funds from one category to another.

Adjusting categories or correcting errors can be relatively uncomplicated when a spreadsheet program is used. Often the correct amounts can be simply typed over the incorrect ones, and the updated results are known within seconds. This can create problems, however, in that it might be difficult to determine how amounts were derived; no "audit trails" are left automatically, and the user should carefully document any entries or changes to spreadsheet amounts.

Printed versions of the monthly budget report can be quickly obtained, making it unnecessary for the budget manager to have a computer or terminal at his or her desk. These forms of hard copy are also important for record-keeping and auditing purposes. Each month's spreadsheet often includes only details on the current month, and an accumulation of previous months (Figure 7).

The final month's results are shown in Figure 8. Some categories are overspent while others are underspent. Overall, the department has remained under budget by $205. Performance this close to budget might be facilitated by close monitoring during the year.

FUND SOURCES

It is sometimes important to capture fund sources on a spreadsheet as well as disbursements. Figure 9 illustrates a section of a spreadsheet that captures its sources. Column A includes the same expenditure categories that appear in the expenditures spreadsheets. Columns B and C represent two different accounts, or sources, or funds. Column D is simply the total of B and C.

Income sources might need to be shown in this way because there are sometimes restrictions in how these sources can be used. Income can be directed to cover only the academic instructional expenses of a department (such as lectures and seminars, but not clinical teaching). In this scenario, a spreadsheet can list income supporting these activities as *ledger 1* (Column B). *Ledger 2* (Column C) might include income intended to cover clinical expenses (operation of the clinic). The *total* (Column D) can serve as the source for the amounts in Figure 5, in the *budget for the month* column. The amounts in the *total* column can serve as the source for the amounts that were shown in the *budget for the month* column in the disbursement spreadsheet (Figure 5).

CONCLUSIONS

This article has illustrated how spreadsheets might be used to control expenditures in a dental school department. Monitoring of those expenditures is becoming essential during these days of shrinking budgets and enrollments. Although there is an abundance of text material that covers the basics of spreadsheeting, this article is meant to outline a general strategy for such monitoring.[20-23]

Month 12 JUN	Budget for the month	Prior Requis. filled	New Requis.	Year to date expended	Budget remaining	% of budget remaining	Scheduled % of budget remaining
Supplies	3500	33500	10000	43500	−1500	−3.57%	.00%
Instruments	2667	29095	3000	32095	−95	−.30%	.00%
Equipment	3125	11200	26000	37200	−300	−.80%	.00%
Travel	1458	16000		16000	−1500	8.57%	.00%
Telephone	492	5762	430	6192	292	−4.95%	.00%
Other	717	7558	750	8308	−292	3.40%	.00%
Totals	11958	103115	40180	143295	205	.14%	.00%

Figure 8. Spreadsheet for final month of the fiscal year. Note how some categories are overspent while others are underspent. Local rules will dictate how such a case is handled.

A	B	C	D
Item	Ledger 1	Ledger 2	Total
Supplies	$21,000	$21,000	$42,000
Instruments	$30,000	$2,000	$32,000
Equipment	$37,500	$0	$37,500
Travel	$0	$17,500	$17,500
Telephone	$4,300	$1,600	$5,900
Other	$7,100	$1,500	$8,600
Totals	$99,900	$43,600	$143,500

Figure 9. Spreadsheet for fund sources. Note: The two "Ledger" amounts refer to different sources of funds. Various restrictions might be placed on their usage.

By designing spreadsheets with care, not only can errors be prevented, but useful information can be made available that will allow a budget manager to determine the extent to which he or she is heading toward a deficit or excessive (undesirable) surplus condition. Underspending might deprive the department of needed acquisitions, while overspending might create administrative problems.

Spreadsheets can be helpful in constructing budget models, which are sets of formula that allow arithmetic manipulation of data entered in separate cells. By changing data (for instance, when recording expenditures in the next year), the same operations will be performed on that data, obviating the need for re-entering formula.

Finally, a variety of useful output can be printed by spreadsheet programs. Monthly progress reports can be helpful, as well as yearly summaries. Graphic output can supplement the tables and provide quite vivid representations for management action.

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Community project

A model for a children's dental health carnival

Stanton D. Harn, PhD
Curtis G. Kuster, DDS

National Children's Dental Health Month originated in 1941. It has developed into the dental profession's most widely supported and publicly recognized event.[1]

Numerous programs are conducted annually to promote dental health in children and to demonstrate dentistry's commitment to community involvement. These projects include grade school programs, contests, programs at shopping malls, media presentations, promotions, dental dramas, museum exhibits, and health fairs.[2-4] These programs are generally sponsored by component dental societies with assistance from dental auxiliary groups, health departments, and other interested parties.

The University of Nebraska Medical Center College of Dentistry has hosted a Children's Dental Health Carnival the past three years, and held the fourth carnival on February 2, 1991. The carnival has been a means of promoting preventive dentistry to children and parents, as well as providing the College of Dentistry with a mechanism for teaching students the importance and logistics of being involved in a community service project.

The purpose of this article is to share with others an outline and description of how a dental health carnival may be conducted.

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PROGRAM

The Children's Dental Health Carnival took place on two floors of the College of Dentistry and was composed of thirty-eight individual events (stations and booths) (Floor Plan Map—Figure 1). Each event, excluding registration, was a component of one of six major categories:

I. Screenings
II. Educational booths
III. Educational games
IV. Fun games
V. Entertainment events
VI. Product promotional booths

The registration booth was the first station of the carnival. It is essential that this booth employ people who can give directions and explanations clearly and personably. Six people operated in this capacity at all times.

The workers of the registration booth instructed each parent or guardian to sign a register. The participants were then given the Floor Plan Map (below) and verbal instructions for proceeding through the carnival. Time and age recommendations were noted. A large plastic bag with handles, containing a Screening Evaluation Form (Figure 2), was given to each child. The Screening Evaluation Form was completed by the clinicians at the screening stations.

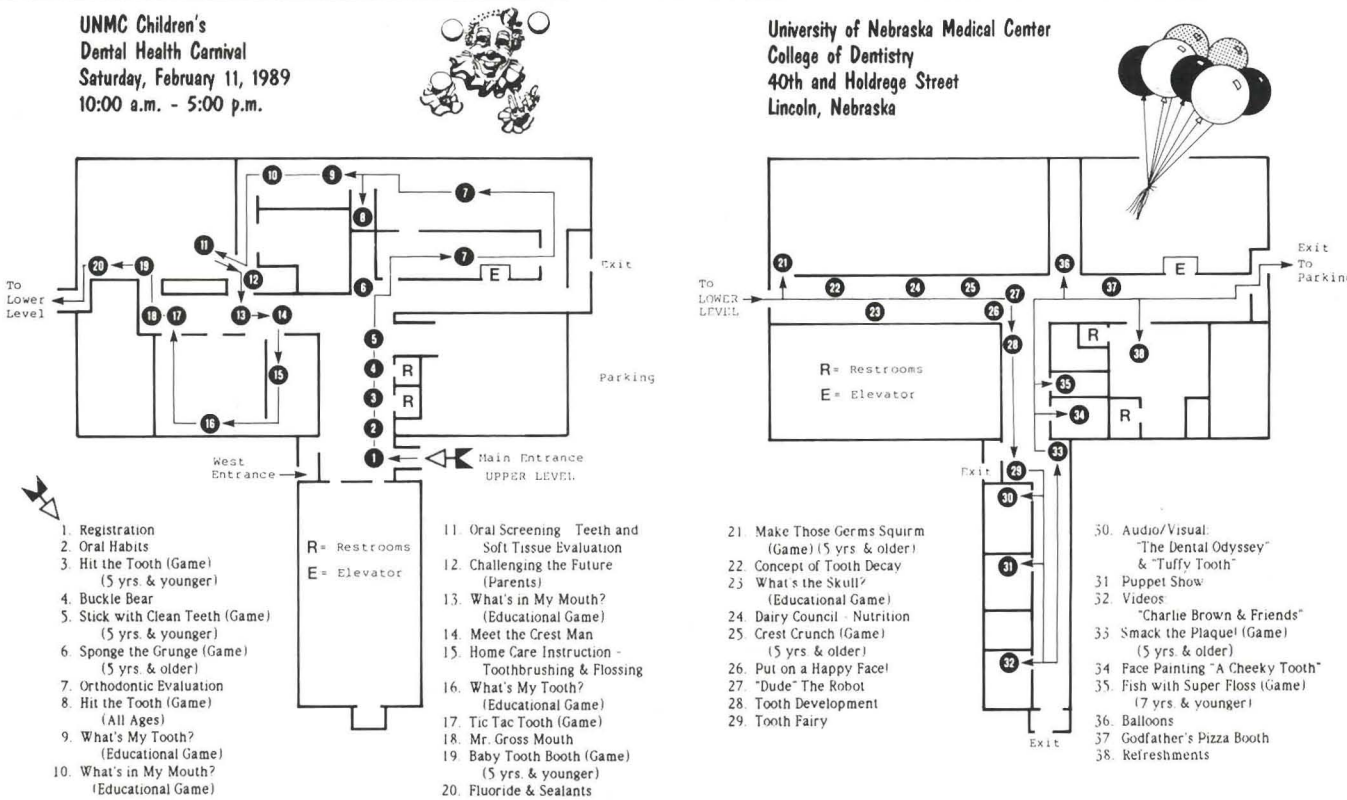
The six major categories, with a discussion of each event, are presented below. The booth number following each discussion corresponds to the number on Figure 1.

I. *Screenings*

Three screening stations were used, 1) orthodontic evaluation (Booth 7), 2) oral screening (Booth 11), and 3) home care instruction (Booth 15). An orthodontic evaluation was conducted and discussed briefly with the parent or guardian. Oral screening examined the teeth, gums and soft tissues. Home-care instruction introduced the children to some of the techniques of preventive dentistry. Toothbrushing and flossing instructions and demonstrations were provided. The results of each screening station were recorded on the Screening Evaluation Forms (Figure 2) by the clinicians.

Each screening station utilized a regular clinical area

Figure 1.



of the college, which consisted of fifteen individual dental operatories. Orthodontic evaluations were conducted by orthodontists, dentists and senior dental students; oral screenings were conducted by dentists, senior and junior dental students; and home-care instruction was conducted by dental hygienists, senior and junior hygiene students, and sophomore and freshman dental students. The time spent with an individual child in a screening station varied, depending upon the children's and parents' questions.

The screenings were accomplished by visual examination, use of dental operatory lights and tongue blades. No mirrors or explorers were used. Current asepsis techniques were utilized. The dentist, hygienist or student wore a glove, an overglove, a mask and safety glasses. The overglove was changed with each child. Tongue depressors were used in place of instruments, and were discarded after each examination.

Three screening stations, instead of one, were used for two main reasons. First, it allowed the children to be moved through the carnival more expediently; and second, it benefitted children who were apprehensive. Many children were afraid and/or shy entering the first screening station; by the second and third, however, they showed no reluctance and climbed right into the chairs.

Figure 2. The screening evaluation form completed by the clinicians at the screening stations.

CHILDREN'S DENTAL HEALTH CARNIVAL

February 3, 1990

University of Nebraska
Medical Center
College of Dentistry
40th & Holdrege
Lincoln, NE 68583-0740
(402) 472-1305

Welcome to the 1990 Children's Dental Health Carnival, sponsored by the UNMC College of Dentistry, with the help of Lincoln District Dental Association, Lincoln Dental Hygiene Association, Dairy Council of Central States, State Department of Health, Southeast Community College, Lincoln/Lancaster County Health Department, Dental Division, and Lincoln Dental Assistant Society. We trust this will be a fun and educational time for you!

#7 ORTHODONTIC EVALUATION

PRESENT BITE RELATIONSHIP

_____ Crowding
_____ Spacing
_____ Within normal limits
_____ Potential bite problem developing
_____ Other

Comments: _____

_____

#11 ORAL SCREENING

TEETH AND SOFT TISSUE EVALUATION

_____ Visible decay (cavities)
_____ Gums & soft tissue within normal limits

Comments: _____

_____

#15 HOME CARE INSTRUCTION

Comments: _____

_____

Thank you for attending the Children's Dental Health Carnival. These screenings do not replace a complete examination which should be done every 6 months. Today's screening will only note major problems without the benefit of x-rays, etc. We recommend checkups every 6 months. If you have no current dentist, we recommend you contact a member dentist of the Lincoln District Dental Association or the University of Nebraska Medical Center College of Dentistry.

II. *Educational booths*

The carnival contained eight "educational" booths which were defined as booths that provided basic instruction of a dental related subject. These were as follows:

1. "Oral habits" (Booth 2)—Parents/guardians were provided with information concerning oral habits, i.e. thumbsucking, use of pacifiers, etc.

2. "Fluoride and sealants" (Booth 20)—This booth provided information about various types of fluorides. The relationship between fluoride levels in the drinking water of the surrounding cities and towns and incidence of dental caries was also presented. A typodont was used to display sealants in one quadrant and the participants were encouraged to feel the difference between the sealed and unsealed teeth.

3. "Mr. Gross Mouth" (Booth 18)—This booth was sponsored by the American Cancer Society and demonstrated the effects of smoking and tobacco on oral structures.

4. "Concept of tooth decay" (Booth 22)—The process of tooth decay was discussed and displayed using pictures, tooth models, and graphic analogies.

5. "Nutrition" (Booth 24)—The nutrition booth was sponsored by the Dairy Council of the Central States. Numerous nutritional testing games were provided.

6. "Tooth development" (Booth 28)—Seven human skulls ranging in age from six months fetal to young adult were displayed, with their corresponding stages of tooth development. The skulls were complemented with pictures showing normal eruption timetables.

7. "Buckle Bear" (Booth 4)—This booth was sponsored by the Nebraska State Department of Health. Various displays were used, including a huge bear, to demonstrate the importance of using seat belts in preventing head and neck injuries.

Tooth development

> Interest is maintained at a high level by offering many entertaining events.

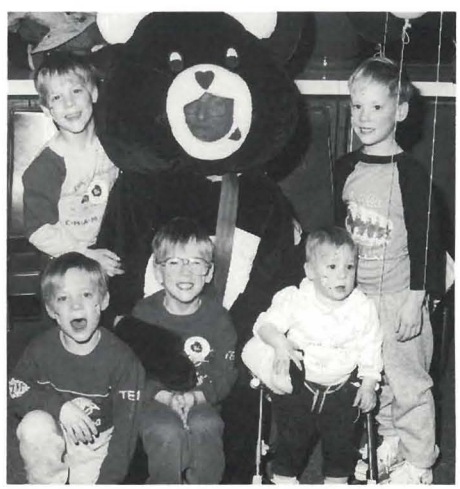
8. "Challenging the future" (booth 12)—This was a public relations booth sponsored by the College of Dentistry and directed at the adults attending the carnival.

All the educational booths were coordinated by the sponsors of the booth, by dental hygiene or dental students, or in some cases, by faculty members knowledgeable about the particular area. The program at each booth lasted roughly two to five minutes, with a coordinator available to answer questions.

III. *Educational games*

Seven educational games were employed in the carnival. An educational game was defined as a game that

Buckle Bear



contained a strong teaching component. These were as follows:

1. "What's My Tooth?" (Booths 9 and 16)—Two variations of this game were used in separate areas. Pictures, models, and names of four teeth (molar, premolar, canine, and incisor) were matched in one game. The other game utilized pictures, names, and a mandible containing a full set of teeth. After learning the association at Booth 9, the children were asked to apply it later at Booth 16.

2. "What's In My Mouth?" (Booths 10 and 13)—A single game was used at one station, and two of the games were used at another. Each game displayed a huge mouth in which the children placed their hands and palpated various unseen items. One game asked the children to identify three things that are "good for your teeth," (i.e. apple, carrot, banana). Another game asked them to identify three things that are "okay to put in your mouth," (i.e. sugarless gum, toothbrush, toothpaste) and the third game asked them to identify three things which are "bad for your teeth," (i.e. hard candy, candy bar, can of soda pop).

3. "Baby Tooth Booth" (Booth 19)—This game catered to the five years and younger group and was essentially a take-off of "ducks in the pond" games. Plastic ducks were painted several colors that coincided with certain primary teeth painted on a large picture of a mouth. The children were asked to pick up a duck and match it with the same colored tooth. The children were then told the name of the tooth they matched.

4. "What's The Skull?" (Booth 23)— This game contained several games directed at specific age-groups. Pictures of seven different animals and cards with their names were shown. The children were asked to match them. Then pictures of the skulls of these animals were shown and the children were asked to match the skull to the animal. Very small children (two to four years) were simply asked to contrast two of the animals, i.e., a beaver and a primate. Older children (nine to twelve years) were asked to compare three different primates. In-between ages (five to eight years) contrasted three different skulls—primate, rhinoceros, and bear.

IV. *Fun games*

Nine different fun games were used in the carnival. Games in this category were simply "fun"; each game, however, was named for and employed something related to dentistry:

1. "Hit The Tooth" (Booth 3 and 8)—Two of these games were used at different areas in the carnival. Tooth-

Stick with clean teeth

Sponge the Grunge

shaped dolls made by the students were placed on a board. Children were handed three beanbags and depending on age, were placed at various distances and told to knock the tooth dolls off the board.

2. "Stick With Clean Teeth" (Booth 5)—This game consisted of a large mouth with white velcro-covered teeth.

3. "Sponge The Grunge" (Booth 6)—This was a wet-sponge throw, using a huge tooth with a cutout the size of a human head. Students and volunteers put their heads through the cutout and children were instructed to hit the grunge!

4. "Tic Tac Tooth" (Booth 17)—This game was a take-off of tic-tac-toe using pegs and rings. Each peg represented something dental (tooth, toothbrush, or toothpaste).

5. "Make Those Germs Squirm" (Booth 21)—This game was another wet-sponge throw, using two giant teeth and two holes for heads. These games are popular with older children.

6. "Crest Crunch" (Booth 25)—This utilized a giant tube of toothpaste (six feet tall) which, when a foot

Tooth Fairy

Dude the Robot

Face Painting—A Cheeky Tooth

pedal was activated, "spit" a golf ball down a curved tube into a container.

7. "Smack The Plaque" (Booth 33)—This game used a springboard upon which sat a blob of "plaque." When the board was hit by a lightweight mallet, the plaque flew into assorted containers.

8. "Fish With Super Floss" (Booth 35)—This was an offshoot of the typical fishing games. A giant fish with a large mouth and teeth was placed in a doorway. Children fished through the mouth with small poles. The fishing line was nylon rope (super floss), with a clothespin attached to the end.

V. *Entertainment events*

There were nine different entertainment events. Many had educational overtones.

1. "Puppet show" (Booth 31)—This event is traditionally a favorite among the children and parents alike. Each year, the dental students create a new puppet show in which the characters instruct children about proper care of teeth.

2. "Audio-visuals" (Booth 30)—This area consisted of films created by the College of Dentistry staff to educate and entertain children.

3. "Videos" (Booth 32)—This area used several children's films attained from libraries of local dental societies and the ADA.

4. "Tooth Fairy" (Booth 29)—A favorite of the smaller children. There were four tooth fairies, one every two hours. Each brought her unique style, beauty, elegance and charm to the character. One tooth fairy brought her dog, dressed in a tutu, who sat on a table next to her. The kids loved it!

5. "Dude the Robot" (Booth 27)—This was an event made possible by the Douglas County (Omaha, NE) Attorney's Office. "Dude" stands for "Don't Use Drugs Ever" and instructs children about the perils of drug use.

6. "Put on a Happy Face" (Booth 26)—This event used a video camera and allowed children to put their smiling mouths on a television screen. The children's mouths were projected as a part of several faces, including sad faces. They had no trouble smiling for the right face.

7. "Face Painting—A Cheeky Tooth" (Booth 34)—Carnival workers and children alike all seemed to want a molar painted on their cheeks. Dental or dental hygiene students with artistic talent found themselves at home in this event. At any given time, three or four artists were busily painting their own rendition of a "molar" on someone's cheek.

8. "Balloons" (Booth 36)—No carnival is complete without balloons. Each child was given a helium-filled balloon on a string. The balloon station was situated near the end of the carnival so that the balloons would not interfere with other carnival activities.

9. Refreshments (Booth 38)—This may not be considered entertainment by some, but the children certainly enjoy it! Refreshments followed the general theme of the carnival—education. In keeping with this philosophy, only food and drinks having nutritional value were served—carrots and celery sticks, home- processed University cheese, 2 percent milk, and 100 percent orange juice. Popcorn was also served; what would a carnival be without it? Many parents were thankful for the healthy snacks. Most dental schools have vending machines in lounges or other community areas that sell pop, candy, ice cream, etc. At the college, these machines are located in a main hallway, along the route of the carnival- goers. The machines were covered with white paper and decorated with nutrition posters so

carnival goers would not see any "bad" snack items! The old adage is appropriate here, "Do what we say, not what we do ourselves!" A special food table consisting of sandwiches, cookies, coffee, and pop was prepared for the workers in the carnival. This was kept in an area away from the carnival route and provided a place where workers could go to relax. Since the refreshment booth was the final event, an evaluation form was distributed there. The responses have been overwhelmingly positive, with some positive suggestions for changes.

VI. *Product promotional booths*

Two such booths were included in the carnival:

1. "Meet the Crest Man" (Booth 14)—Proctor and Gamble supported the carnival by donating numerous educational handouts, toothpaste for children as well as for their guardians, and door prizes such as telephones and big wheels. The "Crest Man" distributed handouts and adult toothpaste at this booth. Children's toothpaste and other educational materials were distributed at other booths.

2. "Godfather's Pizza" (Booth 37)—This booth distributed discount pizza coupons to the children. The reward for this came after the carnival closed its doors—Godfather's pizza was served to people who cleaned up after the carnival ended.

Product promotional booths are great as long there is true benefit in their representation.

To conduct a carnival of the size described takes a significant number of dedicated workers. In each of the last three years, 2,000-2,500 children and parents/guardians participated as guests. The carnival lasted only seven hours (10:00 AM to 5:00 PM), thus it was obvious that a considerable organized workforce was needed. Approximately 250 workers were assigned to 1.5-2.5- hour blocks, i.e. 9:30-11:30, 11:30-1:00, 1:00-3:00, and 3:00-5:30. Workers were asked to be in position a half-hour in advance and stay a half-hour after their assigned time to ensure continuous coverage of their areas. The time slot between 11:30-1:00 was shorter because of peak crowds.

Pre-carnival set-up took about ten hours and began the previous day at noon. The most time-consuming jobs were hanging crepe paper and constructing the booths. Balloons used for decorating were inflated between 7:00 and 9:30 AM the morning of the carnival. Disassembly of the carnival took approximately three hours and was completed the evening of the carnival.

The diverse backgrounds of the workers is one great positive feature of a carnival. It draws numerous components of the dental community together toward a unified goal. The workforce included students, staff and faculty of the College of Dentistry, as well as local dentists and dental specialists, various auxiliary associations, a dental assistants association, a local community college dental assistant program, the state Department of Health, a predental club, and even a girl scout troop. Additional manpower can always be used. In addition to booth workers, people were utilized as guides and traffic controllers along the carnival route. Many of these people dressed in clown or tooth costumes. One character was called "Big Tooth" and carried a five-foot-tall toothbrush. Costumed characters also assisted in parking cars and guiding people to the entrance.

4' x 8' sign advertising Carnival in front of College of Dentistry

Advertising for a carnival of this magnitude included such things as placing three 4′ x 8′ signs along the streets adjacent to the college. These were in place two weeks before the carnival. One thousand posters (11" x 17") were hung throughout the community. Posters were sent to every public and private elementary school and every day-care center in the community. There were several radio, television, and newspaper announcements during the week of the carnival.

What is an adequate budget for a carnival of this type? This one cost approximately $2,700.00. Two thousand dollars were appropriated by the Dean of the College of Dentistry and the rest was donated by var-

The authors wish to acknowledge the secretarial assistance provided by Ms. Christine Cary and Mrs. Rose Reynolds in preparing this manuscript.

ious dental associations. A basic breakdown of this budget would be:

- ☐ Advertising – $500.00
- ☐ Environment (costumes, games, decorations) – $1,500.00
- ☐ Refreshments – $300.00
- ☐ Asepsis – $200.00
- ☐ Miscellaneous – $200.00

The "environment" was the most expensive category. This amount could be reduced by cutting back on decorations and not giving prizes away at every booth. By the end of the carnival, the children had bags of prizes that caused several parents to remark that it was better than Halloween! We observed the philosophy that education of children should take place in a fun environment. Refreshment costs were minimized because most of the healthy food snacks were donated by local merchants. The major refreshment expense was a food tray for the workers. Asepsis costs may vary according to government regulations.

SUMMARY

A children's dental health carnival can yield many benefits. Some of these are: The general public becomes better informed regarding the importance of dentistry for children; children are presented with preventive-dentistry information in an entertaining environment; and students gain experience in organizing and participating in a community service project.

The Children's Dental Health Carnivals have provided the children of Lincoln, Nebraska and the University of Nebraska Medical Center College of Dentistry with these benefits. The authors would be pleased to share additional information with interested parties.

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RETENTION OF GLASS-IONOMER SEALANTS

In some studies, rapid loss of glass-ionomer sealants has been reported. The aim of this study was, therefore, to examine the retention rate of 4-month-old glass-ionomer sealants (Fuji III). The sealants were applied in 93 newly erupted molars and premolars. After 4 months, 75% of the sealants were totally present, 22% partially lost, and 3% totally lost. No caries was observed. Impressions were taken from occlusal surfaces showing total or partial loss of sealants, and the casts were examined using a stereomicroscope or SEM. Examination revealed that in most of these cases, the material was still left at the bottom of the fissures. This may partly explain why glass-ionomer sealants have prevented caries in previous studies even after they appear to have been lost. In order to examine the penetration of the sealants into the fissures, 28 teeth were sealed in vitro, bisected and examined using a stereomicroscope. In 19 cases, the sealant had penetrated the whole fissure, in 7 cases two-thirds of the fissure and in 2 cases one-third of the fissure or less.

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Case reports

Oral manifestations of familial hypophosphatemic rickets after phosphate supplement therapy: a review of the literature and report of case

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Several reports on the origin, diagnosis, and treatment of the dental manifestations of vitamin D-resistant rickets appear in the literature.[1,2] Improvements in therapy have made treatment possible to a highly successful degree. Improvements in research technology have also increased our understanding of the etiology of the disease and its oral manifestations. Little, if any, information is available, however, on the effect of therapy on the dental manifestations of this family of diseases, their sequelae and current or subsequent treatment, both dental and medical.

Familial hypophosphatemic rickets, also known as hypophosphatemic vitamin D-resistant rickets (HVDRR) is one of the hereditary diseases with a typical dental manifestation and the clinical appearance of classic vitamin D-deficiency rickets.[3]

Since the inheritance of the disease in most patients is X-linked dominant, it is also known as X-linked hypophosphatemia (XLH).[3,4] It is said to be twice as dominant in females as in males, but female patients show less incidence of bone involvement. The disease can be just as severe in both sexes, however.[3-6]

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When a child develops rickets, it is manifested clinically when beginning to walk.[3] Untreated patients exhibit slow growth and bowing of the legs, occipital and frontal bossing, scoliosis and other typical deformities. Widening of the wrists and ankles is usually seen. Radiographic images reveal ricketic bone trabeculation and absence or weakening of the lamina dura.[3]

The disease results from a defect in renal tubular phosphate transport, which is coupled in an unknown manner with the synthesis of $1,25(OH)_2D_3$.[3] Urinary phosphate excretion is increased and hypophosphatemia is manifested.[6,7]

The plasma calcium concentration is usually normal.[3,4] But the plasma concentration of vitamin D, $1,25(OH)_2D_3$ is inappropriately low, since it should be elevated as a result of phosphate depletion.[3]

The treatment is a combination of oral phosphate supplement and large doses of vitamin D.[3,8]

DENTAL MANIFESTATION OF HVDRR

The dental manifestations of vitamin D-resistant rickets can be the first, and sometimes the only, indication of the disease.[1,2,4] The oral signs, which were documented in the early 1960s, include periapical radiolucencies, abscesses, and fistulas associated with microexposures in either the primary or the permanent teeth.[2,4,9] Children receiving adequate medical therapy still have dental manifestations.[2]

Enamel hypoplasia has been reported, though it is uncommon.[4-7,10-12] Some authors consider enamel hypoplasia to occur only in conditions characterized by hypocalcemia and thus to be rare in most cases of X-linked hypophosphatemic rickets.[13-15]

VDRR is especially characterized by pulpal horns extending to dentinoenamel junction.[1,2] This sign can be considered pathognomic for this disease, and is seen in hypophosphatemic mice as well.[7,16] Vitamin D-dependent rickets does not manifest this sign.[17]

Late eruption of the teeth is also reported, but there are cases with no delayed eruption.[18,19] Apical closure is delayed, especially in the permanent teeth.[7] There is also a radiolucent band surrounding the region of the dentinoenamel junction (DEJ) in both the primary and permanent teeth.[7] This occurs in no other abnormality, except the Fanconi syndrome.[12]

Histologically the dentin is globular and thin with large calcospherites.[2,4,5,10,18,20,21] There is a thin layer of normal mantle dentin under the enamel.[4,10] The globules gradually become smaller and more numerous as the pulp is approached.[10] The predentin widens and

Pulpal horns extend to the dentinoenamel junction.

displays small calcospherites in a globular pattern.[10,18] The neonatal dentin appears to be normal or affected, probably depending on whether the mother is affected or not.[4,5,11,18]

A lack of reparative dentin formation is reported, which is thought to be caused by early pulpal necrosis.[6,7] Some authors have observed reparative dentin, however, possibly due to the fact that the active rickets was brought under control before the opposing teeth came into contact; whereupon the odontoblasts should be normal.[10] An obvious lack of reparative dentin formation was also reported in hypophosphatemic mice as a response to natural wear.[16] The cementum is normal.[4]

Two possible explanations for the abnormality have been suggested:

- ☐ The odontoblasts themselves may be impaired.
- ☐ The dentinogenic substance formed by normal odontoblasts may be affected by low serum phosphorus levels.[4,7,10]

The pulpal necrosis and spontaneous abscesses may be induced because the thin, hypomineralized enamel is easily worn by attrition, exposing the pulp and allowing bacterial entry.[4,7,10]

Ca/P RATIOS IN HVDRR TEETH

Using SEM with energy dispersive spectrometry, Abe *et al* (1988) analyzed primary teeth from three children with HVDRR.[10] Two of these were brother and sister who had the familial type of HVDRR. They had been treated with vitamin D2 and phosphate supplementation from the ages of 1 year 8 months, and 6 months, respectively. The third child had the sporadic type of

HDVRR with no family history and she was treated with vitamin D3 from the age of 1 year, 6 months. The Ca/P ratios of the enamel of both the affected and the control teeth were the same, 2.1.

The calcium and phosphorus concentrations of the control dentin were different in each region, but the ratio showed a fixed value of 2.0. The Ca/P ratios of the affected teeth were higher than those of the control dentin either because of the elevated calcium concentration (the patient with the sporadic type of HVDRR, who received no phosphate supplementation) or because the phosphorus concentration decreased as the pulp was approached (the patients with the familial type of HVDRR, who received phosphate supplementation). In this case the calcium concentration decreased in proportion to the phosphorus.[10]

CASE REPORT

The present patient is a seven-year-old boy with familial vitamin D-resistant hypophosphatemic rickets. His mother and maternal grandmother are also affected. The child was treated with normal vitamin D supplement (1000 I.U.) from the age of two weeks to 5 months, at which point the disease was diagnosed. Serum phosphate was low at that time, 0.72 mmol/l (normal 1.0-1.5), while serum calcium was 2.51 mmol/l (normal 2.20-2.70) and vitamin D 16 μmol/l (normal 15-40). He was then given a combination of oral phosphate solution (0.7-3.3 gm/day) and vitamin D (2000-3000 I.U./day). He had difficulties in taking his daily phosphate solution because of the salty taste, but serum phosphate has been at the level of from 0.96 to 1.76 mmol/l and his growth has been normal. At the age of seven years he was 114.8 cm tall (-1.1 SD), had no deformity of the lower extremities and was in good general health.

The child was first sent to the Institute of Dentistry, University of Oulu, Finland, at the age of five years because of spontaneous abscesses in seemingly intact primary teeth. The abscessed tooth d84 was extracted and histological preparations were made. The dentin was found to be globular with pulpal horns extending to the dentinoenamel junction.

The patient returned to the dental clinic at the age of six years with his mother. More abscessed teeth were now found, and both the mother and patient were examined. Orthopantomograms were taken.

Findings concerning the mother

The mother was thirty-two years old at the time of examination. She had had no specific treatment. She was short in stature with bowed legs. All her maxillary teeth except the third molars were present. The pre-

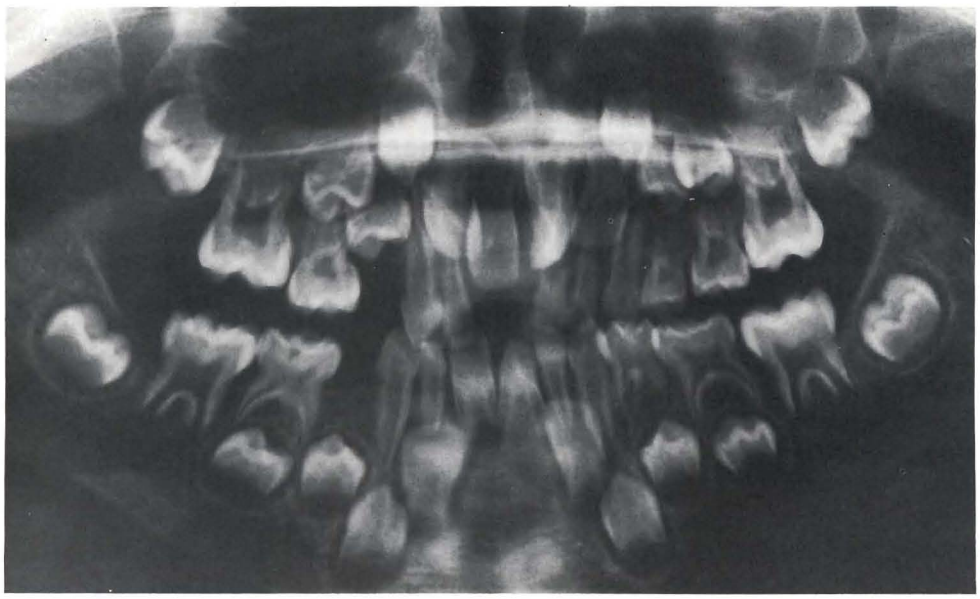

Figure 1. Orthopantomograph of a seven-year-old patient with familial hypophosphatemic rickets. All permanent teeth are visible except the third molars. The enamel in premolars and molars is reduced. There are radiolucencies in the regions of dd 64, 74 and 83. The lamina dura is missing and the borders of the sinuses are obscure.

molars and molars had been restored. In the mandible, dd 36, 46 had been extracted and d 17 was elongated. The molars and some of the premolars had been restored. She had dentinal caries in d17 and initial enamel caries in dd 26, 27 and 44. Her caries status was, nevertheless, better than the average for her age in this area of Finland.[22]

The orthopantomogram showed the enamel of the incisors and the premolars to be slightly reduced in thickness, and the lamina dura was weakened. No periapical lesions were seen. The borders of sinus were weakened and there was regular bone trabeculation.

Findings concerning the child

The child was lively and moderately difficult to handle. He had an early mixed dentition. Dd 55, 84 had been extracted and a few caries lesions and fistulas in the dd 64, 74 region were seen. No enamel hypoplasia was present. His dental age (after Demirjiani *et al* 1973) was 7.4 years at a chronological age of 6 years, 7 months.[23] The orthopantomogram depicted all the permanent teeth except third molars. The enamel of the premolars and molars was reduced in thickness; and the borders of the sinus were obscure, and the lamina dura was missing. There were radiolucencies in the dd 64, 74, 83 region (Figure 1).

Dd 64 and 74 were extracted, hemisected sagittally and kept in buffered formalin until analyzed by energy dispersive spectrometry. One half of each hypophosphatemic (HYP) tooth was decalcified and embedded in paraffin. Histological preparations were made and stained with Giemsa and hematoxylin-eosin.

Similar preparations were made using primary teeth from five healthy control boys of the same age.

Radiographs of the hemisected teeth showed reduced enamel. The pulpal horns did not clearly extend to the dentinoenamel junction, but the enamel was exposed at the cusps especially in d 74. Internal resorption was seen in the same tooth (Figure 2).

Figure 2. Radiographs of the hemisected teeth. Pulpal horns extending to the dentinoenamel junction can be seen also in this macroscopic picture (arrows). The enamel is reduced in thickness and there is internal resorption in d 74.

SEM and Ca/P analyses with energy dispersive spectrometry

The SEM micrographs (JEOL JSM-35 Scanning Microscope) feature was a band 0.16 mm wide of normally arranged dentin under the enamel, except under the cusp-tip region, as also seen in histological sections.[2,21] Elsewhere the dentin was globular, with the globules becoming smaller toward the pulp (Figure 3). Globular pulpal horns reached the cusp tips without any normal dentin. The predentin zone was widened and reparative dentin with a globular appearance was seen. There was cementum on the roots. The enamel had fractured apart from the dentin in the preparations from hypophosphatemic teeth, but not in the control teeth (Figure 3).

Three different sets of measurements were made with an energy probe microanalyzer (JEOL JCXA-733 Super Probe and Link Systems) along different lines from the surface of the enamel toward the pulp. There were only minor differences in the enamel.

The three measurement lines did not differ from each other in the dentin, whereas the differences between the control and Hyp teeth were obvious. There was more sodium (Na) in the affected teeth, whereas the calcium (Ca) and the phosphorus (P) contents were about the same. The Ca/P ratio was higher (mean 1.942, s.d. = 0.065) in the Hyp teeth than in the controls (mean 1.899, s.d. = 0.052) and increased slightly toward the pulp.

Even though the roots of the Hyp teeth were less globular than the crown, there seemed to be the same differences in mineral content between the hypophosphatemic teeth and controls in the root area. The Ca/P ratio was, not as high, however, in the root area (mean 1.925, s.d. = 0.043) of the affected teeth as in the coronal part.

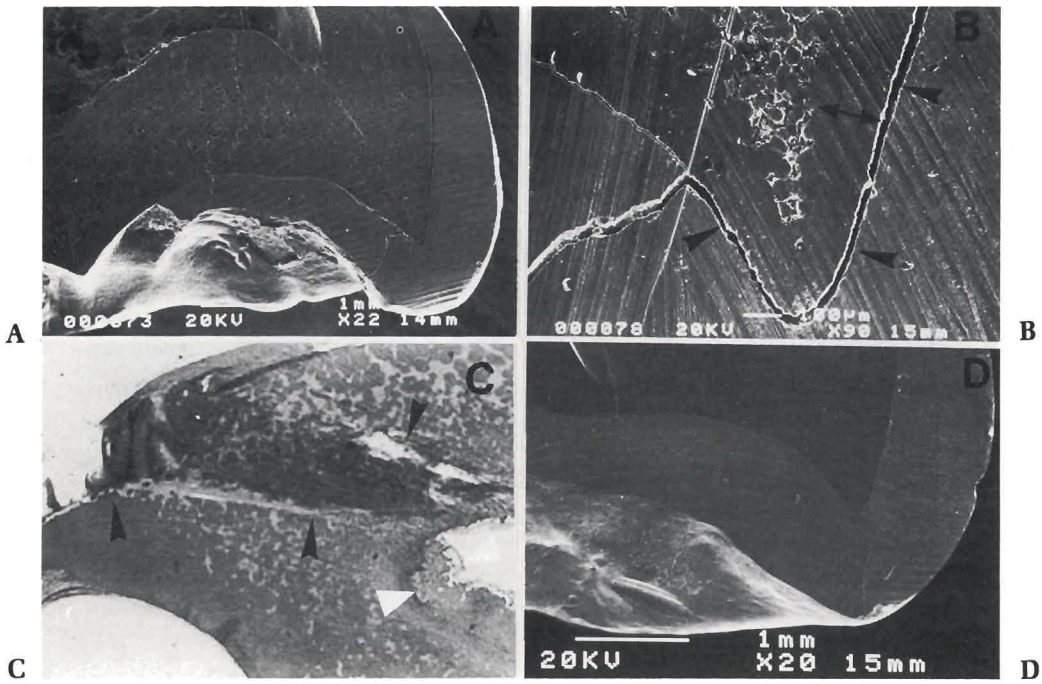

Figure 3. A. Overview of a hypophosphatemic tooth with globular dentin and a 160 μm band of dentin with normal appearance under the enamel.
B. Magnification of Figure 1 A, showing the 160 μm band of normal dentin under the enamel and the gap between enamel and dentin (arrows). Sagittal stripes are due to the preparation of the specimen.
C. Histologic section of the hypophosphatemic tooth with globular dentin and pulpal horn extending to the dentinoenamel junction (black arrows) can be seen. The band of reparative dentin and widened zone of predentin under the cuspal region is seen (white arrows).
D. Control section from a healthy primary tooth of the corresponding area.

DISCUSSION

The globular appearance of the crown and root dentin is in agreement with the other cases reported.[2,4-6,9,18,20,21] The roots of the teeth examined have developed postnatally and had thus mostly been subjected to the phosphate supplement. This normalized the mineral content, but was not able to eliminate the structural disorder of globularity characteristic of the disease. The globules were smaller, nevertheless, than in the coronal part of the teeth, as is also normally seen in untreated patients.[21] It remains undetermined whether the less globular appearance of the root was due to the phosphate cure or whether the root portion would have been like this without treatment.

The findings regarding the dentin affected by familial hypophosphatemic rickets, in agreement with others show a wide band of normally organized dentin beneath the enamel (except under the cusp tip) and root cement.[2,21] This was estimated to be 160 μm wide, and was thus much wider than the 20 μm found in normal mantle dentin.[24]

The formation of the normal dentin band is not dependent on the developmental stages of the individual, because it is seen to be equally wide in the cross sections from the crown of the tooth (prenatal development) to the tip of the root (postnatal development). It must thus be linked to the developmental stages of the dentin only, the disturbance resulting in globularity of the dentin occurring in connection with the more mature (i.e. differentiated) odontoblasts. The onset of dentin mineralization in affected teeth seems to be normal up to a thickness of 160 μm from the dentinoenamel junction. At least four explanations can be put forward:

- ☐ Mineralization is normal until some unknown step of maturation and/or differentiation of odontoblasts (at 160 μm from the dentinoenamel junction) is reached, but the disease achieves penetration from this point onwards.

- ☐ A physicochemical change in the environment may occur at that distance, resulting in globular mineralization of dentin.
- ☐ Ameloblast-odontoblast interaction is reported to be necessary for their differentiation.[25] This connection may be lost at that stage in the hypophosphatemic rickets teeth.
- ☐ Because the predominant effect of 1,25 $(OH)_2D_3$ is not on the odontoblast, but rather on the supporting tissues such as pulp cells, the regulatory effect of the pulp cells on dentin maturation may start at this stage of odontogenesis, and is disturbed in case of HVDRR.[26]

The SEM micrographs of the sections from affected teeth showed the enamel to have separated from the dentin more easily than in the control teeth, although the material had been treated in exactly the same manner. This may indicate some disturbance in the organization of the dentinoenamel junction in affected teeth.

The results of the Ca/P analyses differ from those reported recently by Abe *et al* (1988) in that they reported higher Ca/P ratios in the affected teeth than in the controls, because of either elevated calcium or reduced phosphorus, depending on the individual case.[10] In our series the Ca/P ratio of the dentin was slightly higher than in the controls. In the root area the difference was less obvious. This may be due to the phosphate treatment which took place during the stage of root formation.

We find it paradoxical that the dentin in the affected teeth had about the same phosphorus content as that of the control teeth, although the primary cause of the disease was decreased phosphorus reabsorption and plasma phosphorus content (in our case 0.72 mmol/l before treatment) with a normal calcium concentration (2.51 mmol/l). If the mineral content in the affected teeth was less than in the controls, as reported by Shellis (1982), the phosphate concentration would be either reduced or normal, but the calcium content would be either normal or elevated, respectively.[21] It is probable that the calcospherites (globules) are properly mineralized but that the undermineralized interglobular space distorts the total mineral content.

Before phosphate supplementation treatment was introduced, the impaired incorporation of calcium, and probably its exchange with sodium, was thought to be the principal etiological factor in the formation of globules. Supplementation therapy then resulted in a less elevated Ca/P ratio in the root area of the affected teeth. What the therapy did not cure was the globular appearance of the dentin and the hypomineralized stripe of pulpal horn extending to the cusp tips.

The main problem in dentin treatment is to protect the teeth from abscesses. The cusp tips of all the permanent teeth are now protected by sealants with glass ionomer cements under the sealant to avoid pulpal irritants. The vitality of the teeth will be carefully observed continually.

We also made some minor alterations to the phosphate supplementation treatment prescribed for this child, because he had difficulty in taking his daily Joulien solution. We added 20 percent xylitol to the solution to improve its palatability, but found that it still tasted salty. This xylitol addition should be of some benefit, as it will stimulate the remineralization and absorption of calcium from the intestine.[27,28]

In conclusion, the supplementation therapy resulted in a cure as far as the boy's general appearance was concerned, i.e., in his bone structure. Minor, probably genetically determined alterations remained in the dentin; but the therapy should also result in a cure as regards the degree of mineralization of the root dentin. The globularity of the dentin and widening of the predentin nevertheless seem to represent a permanent outcome of the disease in spite of the therapy. This points to the theory that the development of the teeth is not dependent on bone structure, but is a separate entity in itself.

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CLINICAL VS. RADIOGRAPHIC ASSESSMENT OF APPROXIMAL ENAMEL LESIONS

When discussing ease of diagnosis of small approximal enamel lesions by clinical versus radiographic assessment, the accessibility is an important point. When examination is done in situ very small lesions cannot be observed, and in case of bigger ones, only the margins are visible. X-rays, in contrast, can penetrate all structures. Moreover, the water volume in the pores between apatite crystals does not influence the radiograph, whereas the clinical observability of a small enamel lesion is dependent on the degree of wetness. In extracted teeth the situation is different. There is full accessibility for visual inspection under a variety of conditions (wet or dry), and especially small lesions can be diagnosed with more reliability clinically than radiographically.

de Vries, H.C.B. *et al*: Radiographic verous clinical diagnosis of approximal carious lesions. Caries Res, 24:364–370, September-October 1990.

Impeded eruption of a permanent maxillary incisor by a denticle and a cyst

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Although unerupted maxillary incisors are rarely encountered in adults, it is relatively common in pediatric patients. There are several conditions that could give rise to this abnormality: for example, injuries to the primary teeth may cause dilaceration of the permanent teeth; or the latter may experience abnormal eruption patterns—accelerated, delayed, or failed.[1-3]

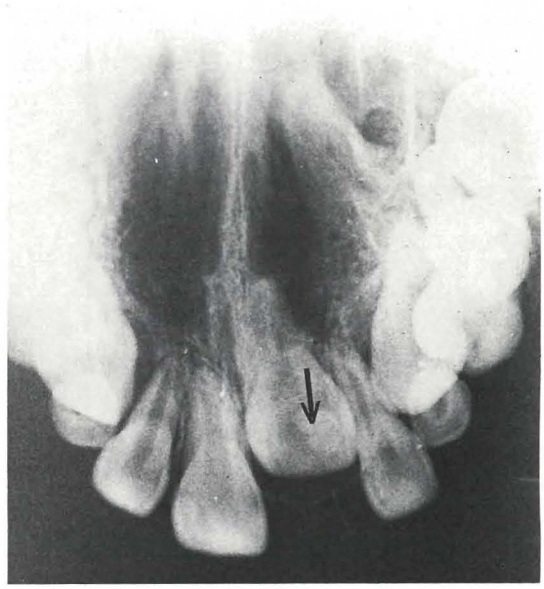
The premature loss of a traumatized primary tooth can affect the eruption. If the succedaneous permanent tooth is due within six months or earlier, the eruption will probably be accelerated. If the permanent tooth is expected to erupt later than six months, however, the eruption will probably be delayed, because of the increased density of tissue formed after the healing of the injury.[4] Obviously the status of the surrounding bone exerts some influence on the outcome.

Cysts and tumors, including odontomas, can delay the eruption of teeth. A case with delayed eruption of the left maxillary central incisor due to a denticle and a cyst is presented.

CASE REPORT

A healthy nine-year-old child was referred for consultation regarding the delayed eruption of the left maxillary central incisor. On examination, a normal Class I occlusion was noted. The maxillary left central incisor was clinically absent. A hard swelling was palpable in the left maxillary labial sulcus. Radiographic examination showed a cystic lesion and a denticle (arrow) in close association with an unerupted left maxillary central incisor (Figure 1). The cyst and the denticle were surgically removed using local anesthesia (Figure 2).

Figure 1. An occlusal radiograph showing the cyst lining and the denticle in close association with the unerupted left maxillary central incisor.



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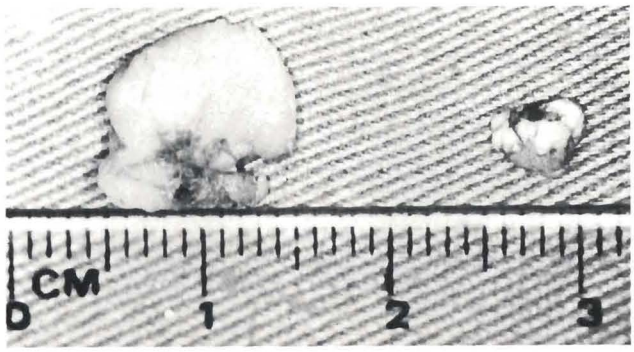

Figure 2. The dentigerous cyst and denticle after removal.

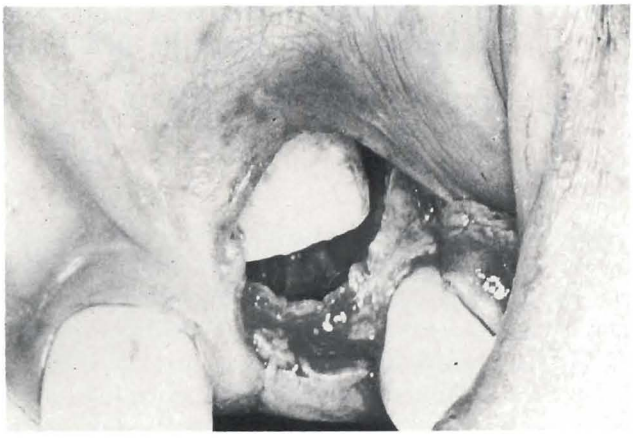

Figure 3. The unerupted maxillary left central incisor exposed by surgery.

The crown of the unerupted left maxillary central incisor was exposed surgically to enable a fixed orthodontic appliance to be fitted (Figure 3). Three months after orthodontic treatment, the left maxillary central incisor was in its normal position in the dental arch.

DISCUSSION

Although trauma is commonly associated with delayed eruption of the permanent successor, in our present case, the etiology comprised not trauma, but a denticle in association with a dentigerous cyst. The denticle and the cyst impeded the eruption of the left maxillary central incisor.

Our current knowledge on the origin of denticles and dentigerous cysts is incomplete. Hitchin postulated that odontomas are either inherited or caused by a mutant gene or by genetic interference during tooth development.[5] In contradiction to this, experimental production of these lesions in rats by traumatic injuries has been reported. Furthermore, odontoma-like proliferation with a morphology of an odontoma was noted in some 6 percent of 207 permanent teeth traumatized during development by injuries to the primary teeth.[1,2]

It is very evident in this case that in both lesions, the pathologic process is initiated only after amelogenesis had occurred. The denticle and the dentigerous cyst occurring at the same site can be explained by the fact that both lesions are derived from one common source of odontogenic epithelium, probably the cell rests of Serres (dental lamina remnants) of the unerupted tooth. Some of these odontogenic islands undergo proliferation to develop the denticle; while others suffer degeneration to form a cystic cavity enveloping the tooth.[6] The stimulus for such aberrations could be a genetic defect in the tooth-forming process. The possibility that there are two separate pathologic entities occurring coincidentally and simultaneously in the maxilla, should not be discounted.

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Ingestion of dental mirror fragments: report of case

Curt Goho, DDS

A potential complication while treating the child dental patient is aspiration or ingestion of a foreign body. Although the literature recommends preventive measures during dental care, such as the use of a rubber dam and floss ligatures, children can still be involved in aspiration/ingestion incidents, both during dental treatment and at other times.[1]

Seventy-five percent of foreign body ingestions/aspirations involve children under the age of ten.[2] Ninety-two and a half percent of the foreign objects enter the gastrointestinal system. The other 7.5 percent of objects are aspirated. If ingested, 90 percent of the objects pass uneventfully in two to twelve days. The remaining 10 percent are involved in impaction, septic abscess, or perforation of the gastrointestinal tract.[3] Impaction is more likely to occur in younger patients. Sharp objects often require surgical intervention due to their predilection to impact and perforate.[4]

Localization of the foreign object is most often accomplished with lateral and posterior-anterior (P-A) chest and abdominal radiographs. Materials with low radiopacity, such as acrylic, plastic, or glass, are not readily discernible, however, on radiographic examination.[5]

An often overlooked source of foreign body aspiration/ingestion are the "gifts" or "prizes", such as plastic toys, balloons, or plastic mirrors, given to a child patient after a dental visit. The following case report involves the possible ingestion of parts of a plastic dental mirror by a pediatric dental patient.

CASE REPORT

A family with school-age and preschool-age children presented to a hospital dental clinic for dental examination. At the end of the appointment, the older children were given the plastic, disposable dental mirrors used in their dental examination as a "gift" to take home. After leaving the treatment room, the family went to the reception area, where one of the older children gave his mirror to a younger sibling, age 2.5 years. The child, while playing, and imitating the dental examination, chewed on the mirror and bit the mirrored surface. The mirrored glass broke in the child's mouth. The mother saw this occur, and finger swept the child's mouth, recovering several sharp glass fragments. The dentist was called to the reception area, at which time he did another, visualized finger sweep. A thorough oral examination in the dental treatment room revealed no other fragments, and no lacerations of the soft tissues. The patient's airway was assessed and no respiratory distress was noted.

An examination of the mirror and the recovered pieces could not account for all of the glass fragments (Figure 1). The patient was immediately taken to the radiology department for "stat" P-A and lateral chest and abdominal films. A sample of the mirrored glass was also forwarded for radiographic evaluation of its density.

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Figure 1. The fragmented mirrored surface of the "plastic" dental mirror after being bitten.

Because of low radiographic density diagnosis can be very difficult.

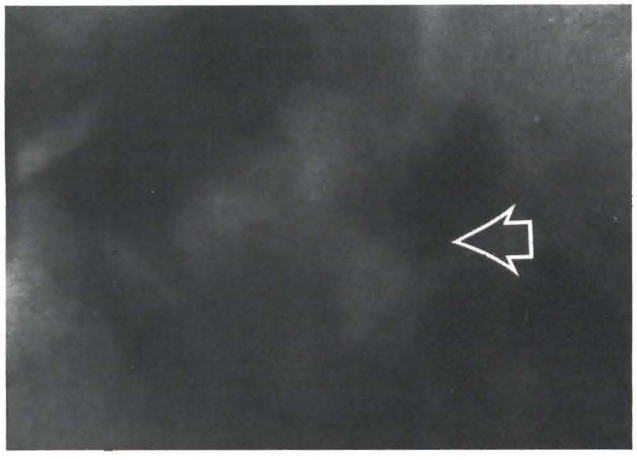

Figure 2. Appearance of mirror glass on a routine exposure P-A chest film. The circular foreign body is barely visible in the center of the radiograph.

Initial examination of the radiographs revealed no foreign bodies in either pulmonary or gastrointestinal systems. A radiograph of the glass sample indicated, however, that they were of extremely low radiopacity (Figure 2). The radiologist reexamined the radiographs, however, with emphasis on searching for low density images of the fragments. Again, no foreign objects were noted, although ingestion or aspiration could not be ruled out based on the radiographic examination alone.

Examination of the patient by the pediatrician on call revealed no findings of aspiration. The pediatrician considered the possibility of ingestion as low, but could not rule ingestion out completely, due to the limited ability to discern glass fragments, radiographically. The patient was then released, with instructions to the parent to contact the hospital immediately, if breathing difficulty, fever, vomiting, chest or abdominal pain, or oral or rectal bleeding occurred. A follow-up appointment with pediatrics was scheduled for two weeks later.

The patient experienced no complications, and at the two-week follow-up examination, all findings were normal.

DISCUSSION

This case report documents an incident involving the possible ingestion of glass fragments from a disposable dental mirror. Due to the low radiographic density of the mirrored glass, diagnosis at the time of the incident was difficult and inconclusive.

Any time aspiration or ingestion of a foreign object is suspected, immediate radiographic examination of the thorax and abdomen is indicated.[6] If the object is suspected of having poor radiopaque characteristics, a sample of the material should be forwarded to the radiologist for radiographic contrast comparison. This information may be used in altering the normal exposure settings used on chest and abdominal radiographs to make identification of low density masses easier. The physician and radiologist should also be informed of the exact nature of the foreign body (sharp glass, long and rounded acrylic lip bumper) as this information

often aids in locating and treating the ingested or aspirated object.

Even with these precautions, poorly radiolucent materials such as acrylic or glass may not be discernible on a radiographic evaluation. If computed tomography (CT) scanning is available, its use should be considered, due to its extreme sensitivity to small changes in x-ray attenuation. CT scanning can often discern otherwise "radiolucent" objects. Recent investigations have shown the ability of a CT scan to locate accurately 10mm X 1.5 mm radiolucent acrylic fragments within the body.[7]

Another consideration is that the foreign object involved in this incident was provided by the dentist. Disposable plastic dental mirrors were not considered dangerous, and were routinely given to children after dental visits. Gift-giving is a common practice in many dental offices. The term "plastic mirror" is misleading, as the reflecting surface is actually a thin glass wafer glued onto a plastic handle. The fact that breakable glass was a part of the "plastic" mirror was realized only when the incident occurred. Considering the potentially severe injuries that could have occurred, and resultant potential legal liabilities, disposable dental mirrors should not be given to children unless essential for home oral hygiene care. If a mirror is given to a pediatric patient, the parents should be given directions and precautions for its use to prevent any aspiration/ingestion incidents.

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

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RANDOMIZED CLINICAL TRIALS

...randomized clinical trials are an important element in the spectrum of biomedical research. Not all questions can or should be addressed by this technique; feasibility, cost, and the relative importance of the issues to be addressed are weighed by investigators before they elect to proceed. Properly carried out, with informed consent, clinical equipoise, and a design adequate to answer the question posed, randomized clinical trials protect physicians and their patients from therapies that are ineffective or toxic. Physicians and their patients must be clear about the vast gulf separating promising and proved therapies. The only reliable way to make this distinction in the face of incomplete information about pathophysiology and treatment mechanism is to experiment, and this will increasingly involve randomized trials. The alternative — a retreat to older methods — is unacceptable.

Physicians regularly apply therapies tested in groups of patients to an individual patient. The likelihood of success in an individual patient depends on the degree of certainty evident in the group and the scientific strength of the methods used. We owe patients involved in the assessment of new therapies the best that science and ethics can deliver. Today, for most unproved treatments, that is a properly performed randomized clinical trial.

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