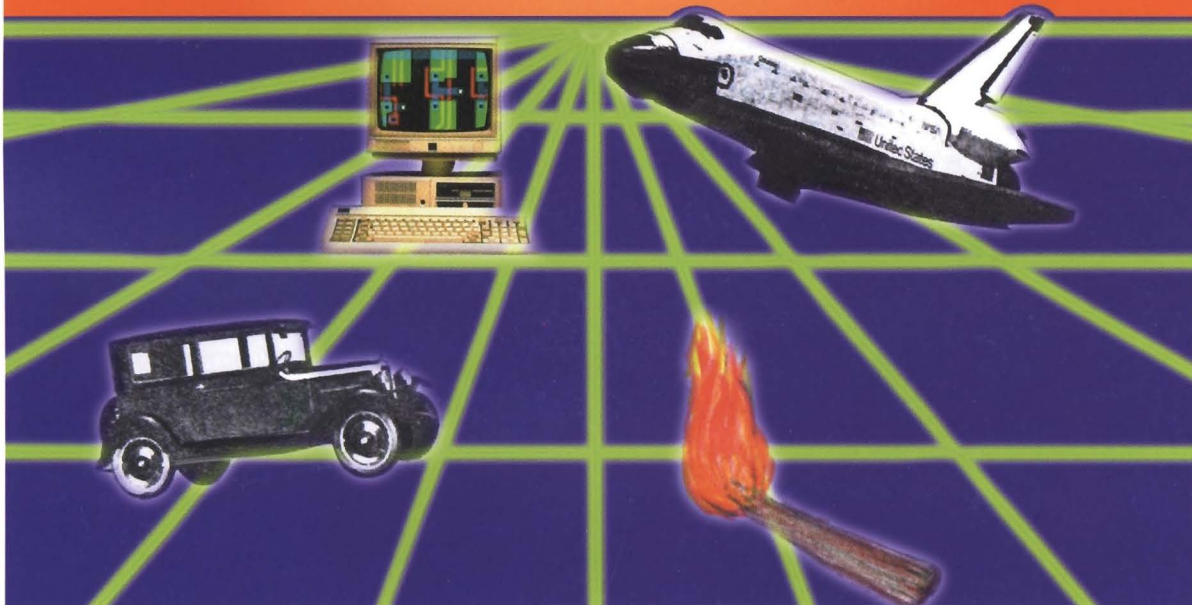


It is not so much our capacity for learning that distinguishes humans from other species but, rather, our capacity to teach. All animals can learn. But humans consciously set out to teach as a way of facilitating development. Human beings construct elaborate and sophisticated cultures and teach them to children. It is because we teach that we do not need to invent the wheel or discover fire over and over again. Children learn from adults in many ways, some of which are inadvertent on the adult's part. Deliberate teaching, however, plays a special role in this learning process. The good teacher understands the difference between what the child can accomplish alone and what the child can do when helped by an adult or a more competent peer. This "zone of proximal development" is the critical territory for interventions that seek to stimulate and support the child's development. When a child's parents and other family members do not provide such stimulation and support, outside intervention is needed. The key is to shape the behavior of adults in the child's life.

— James Garbarino et al



OH, WHAT A TANGLED WEB DO PARENTS WEAVE  
WHEN THEY THINK THAT THEIR CHILDREN ARE NAÏVE.

—Ogden Nash



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It is not so much our capacity for learning that distinguishes humans from other species, but, rather, our capacity to teach.

Art and design by Sharlene Nowak-Stellmach

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## PREVENTION

### 317 Prenatal fluoride for growth and development: Part X

Frances B. Glenn, DDS; William D. Glenn, III, MD; Alphonse R. Burdi, PhD  
*As a result of [these] arbitrary, but customary, divisions of professional interest, the role that F may play in growth and development, especially in pregnancy, has been largely ignored.*

## BEHAVIOR

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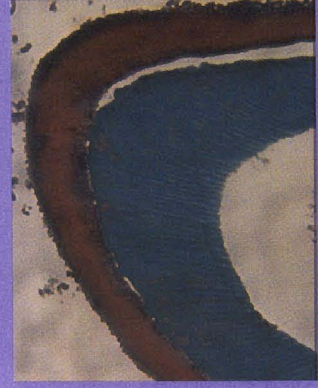
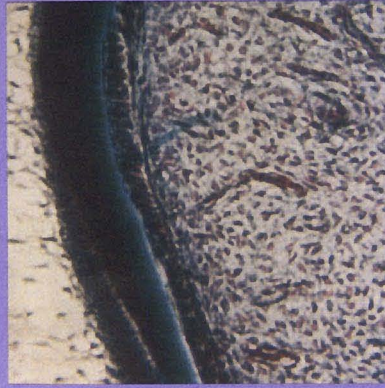
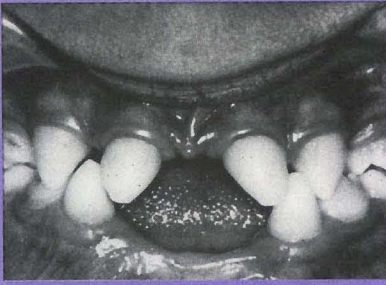
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# PREVENTION

## Prenatal fluoride for growth and development: Part X

Frances B. Glenn, DDS  
William D. Glenn, III, MD  
Alphonse R. Burdi, PhD

**A**lthough fluoride (F) was first put into some of the US public water supply for its nutritional value in 1945, it was not until 1968 that F was designated as an essential nutrient by the Food and Nutrition Board of the American Academy of Sciences.<sup>1</sup> The reason given for this designation was the reduction of caries when F is incorporated into the structure of teeth. Mention was made of the possible effect of F in the maintenance of bone structure (and for reducing calcific atherosclerosis) on the basis of a report by the Harvard School of Public Health, but further investigation was felt needed.<sup>2</sup>

Since that time, F has been considered a "dental" element so that physicians and nutritionists usually only know about F what they are told by dentists. Conversely, dentists are mostly concerned with the postoperative treatment of teeth rather than general growth and development, and do not consider gestational nutrition a part of their expertise. As a result of these arbitrary, but

customary, divisions of professional interest, the role that F may play in growth and development, especially in pregnancy, has been largely ignored. We report two studies and some recent literature that are relevant to these areas of preventive nutrition.

### METHODS AND MATERIALS

- Hamsters, pregnant for three days, were divided into three groups: controls given deionized water, a group given 10 ppm F water, and a group given 20 ppm F water. On the day they were due, seventy-three fetuses were recovered, the mandibular central incisors removed and the teeth treated with 5 percent sodium hypochlorite to remove organic material. The teeth were dehydrated with washes of 25 percent to 95 percent ethanol and the length measured under a dissecting microscope with a micrometer.
- Fresh jaws from a five-month human fetus that was aborted (miscarriage) were donated to us. The mother resided in a nonfluoridated area with 0.3 ppm F in the water. She had taken a 1 mg F tablet (PNF) on an empty stomach at a separate time from her pregnancy vitamin-mineral capsule from the start of the 12th week. At about the 16th week, she began taking 2 mg PNF daily in the same manner. The mandible was embedded in paraffin-celoidin and the area containing the central incisors was sectioned at 5 micra thickness. Two sections were in the frontal plane and the remaining sections were sagittal or parasagittal. Sections were

---

We gratefully thank Andrew Shillen, PhD, Professor of Archeology, Cape Town University, for performing the prenatal fluoride hamster study; L. V. Winter, DMD, for help in formulating this paper; J. Ray Grogan, Prophy Research Corporation, Iowa City, IA, for his idea of using a weight-marked dropper for dispensing fluoride/vitamins during infancy and early childhood and Children's Dental Research Society, Miami, FL for funding this project.

Dr. Frances Glenn is Consultant, Children's Dental Research Society, Miami, FL; is in private practice of pediatric dentistry/orthodontics, Miami, FL.

Dr. William Glenn, III is President, Children's Dental Research Society, Miami, FL; is in private practice of otolaryngology, head & neck surgery, Miami, FL.

Dr. Burdi is Professor of Anatomy and Cell Biology, The University of Michigan Medical School, Ann Arbor, MI.

Table 1 The length of fetal hamster incisors in millimeters with no PNF, 10 ppm PNF, and 20 ppm PNF.

Group	Number	Mean length	Standard deviation	Students t test
No PNF	17	1.95	0.2	p<0.01 vs 10 ppm
10 ppm PNF	27	2.11	0.19	p<0.02 vs 20 ppm
20 ppm PNF	29	2.26	0.26	p<0.0002 vs no PNF

stained with a Masson trichrome connective tissue solution. Three age-matched fetal jaw specimens from non F supplemented pregnancies in low F (<0.3 ppm) areas were prepared in the same manner to serve as controls.<sup>3</sup> The sections were then compared by light microscopy.

## RESULTS

- The length of the fetal hamster incisors increased in concert with the amount of prenatal fluoride given and the differences between the three groups were all statistically significant by Student's t-test (Table).
- The age-matching of the PNF human jaw and the three non-PNF human jaws was checked by comparing the bone, muscle, glandular tissues, and the histology and mass of the dental papillae. These elements were similar in all four specimens. The PNF incisors exhibited advanced maturation morphology in terms of the well-developed cells of the inner enamel epithelium, the ameloblasts, and the odontoblasts (Figure 1) as compared to the control incisors (Figure 2).

## DISCUSSION

These findings, both in an animal model and in a human, support the designation of F as an essential nutrient for the whole tooth, and support the observation that PNF is necessary in order to supply an adequate amount of F during development of the primary teeth.<sup>1,4</sup> It has been long recognized that nutritional F was needed to avoid the occlusal pits and fissures, and this can now be seen as a matter of an essential nutrient allowing full growth and development of the teeth.<sup>5,6</sup> It is recognized that rates of fetal development, tooth sectioning, and staining all tend to vary, but the PNF tooth appears more like a permanent rather than a primary incisor. This agrees with LeGeros who found in 1985 that PNF primary tooth enamel had the tighter, better crystallinity that had been thought to be only found in permanent

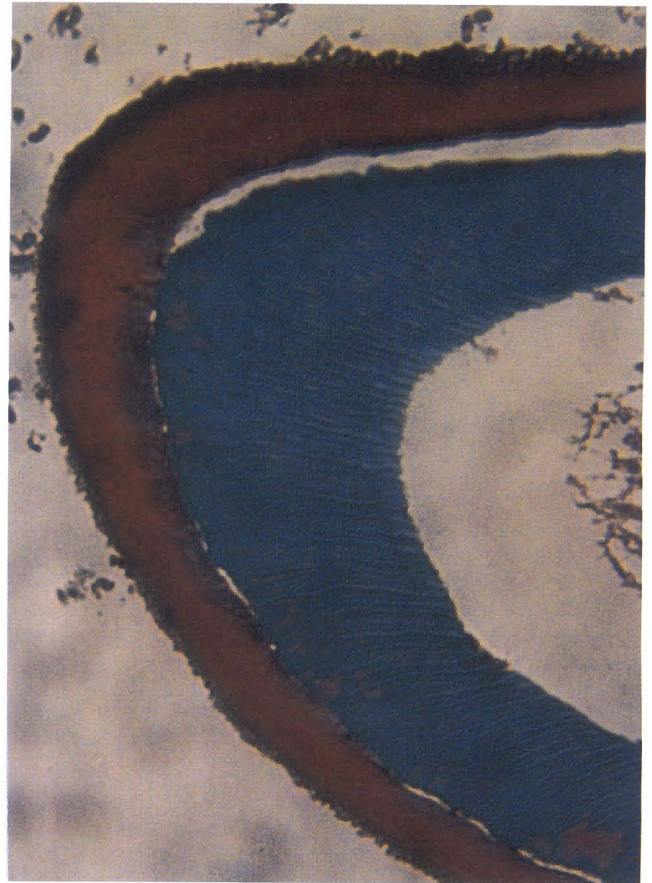


Figure 1. A section of a PNF tooth.

tooth enamel.<sup>7</sup> In the same year in Germany, Kunzel demonstrated the pre-eruptive effect of PNF in primary incisors. Using Australian teeth from children who had all had high dose postnatal F (0.5 mg birth to one year, then 1 mg), he compared incisors which had had 1.5 mg/day PNF to those with no PNF. He found the PNF caused a much greater increase in the F content of the postnatally formed enamel than it did in the prenatally formed enamel.<sup>8,9</sup> The mechanism is assumed to be the same that Speirs demonstrated in pigs.<sup>10</sup>

The fact that teeth containing near maximum sub-fluorosing amounts of F do not melt away from a cariogenic challenge has been recognized for sixty years and should be of interest to those involved with Early Childhood Caries (ECC, formerly bottle rot, nursing caries, baby bottle tooth disease, and soon to be MDSMD-maternally derived streptococcus mutans disease).<sup>11-13</sup> The name changes every few years in hopes that no one will realize that nothing meaningful has been done for prevention except blame mothers for feeding their children.



Figure 2. A section of a non-PNF tooth.

As F has again been demonstrated an essential nutrient for the full development of teeth, and as teeth are just specialized mineralized tissue, it is likely that F is an essential nutrient for the entire human. Animal experiments have shown a deleterious effect on growth when F is withheld, such as retarded growth caused in young rats on a low F diet and then reversed with F supplements.<sup>14</sup> Goats kept on a low F diet (0.3 mg F/kg dry matter) during pregnancy, lactation, and as kids, suffered a 16 percent reduction of the life expectancy of the kids as compared to those given 1.5 to 2.5 mg F/kg dry matter.<sup>15</sup> It is not possible, of course, to perform such studies in humans; but if F, as do the other essential nutrients, permits humans to reach full genetic potential, the effect should be able to be demonstrated during the period of most rapid growth, which is in the fetus and infant.

In 1982, a report in the obstetric literature found improved birth statistics with reduced prematurity, in-

creased birth weight, fewer abnormalities, as well as 97 percent of the children being caries-free at age five years.<sup>16</sup> Low birth weight that was associated with slightly lower F in the body tissues had been noted in the dental literature in 1976.<sup>17</sup> In 1993, the Harvard School of Public Health found improved birth outcomes associated with increased F in the water.<sup>18</sup> The World Health Organization, in 1996, published that increased weight gain was found during the first year of life for PNF infants in Germany and asked for further PNF studies.<sup>19</sup>

The National Institute of Dental Research (NIDR)-Eastman Dental Center PNF trial has been criticized for using a protocol designed to minimize the effect of PNF, mainly by using an inadequate amount of PNF and by eliminating disease in the controls.<sup>20</sup> The caries results of the NIDR trial were originally reported three times in the literature, without any comment or correction by NIDR or Eastman, as mean dfs at age five years of 0.30 for the PNFs and 0.55 for the controls.<sup>20-22</sup> Six years after completion, the trial has now been published in a small European journal known for its lack of appreciation for nutritional F. The dfs means are now given as 0.45 for the PNFs and 0.50 for the controls; the PNFs have gained 50 percent more caries while the controls shed 10 percent of theirs.<sup>23</sup> The Office of Scientific Integrity states that such changes are wholly within the prerogative of the investigator and the directors of extramural research for NIDR and NIH agree. This is unwelcome news to those who depend upon NIH and the Public Health Service for traditional science rather than political science.

All the children were given F supplements from birth using the 1979 American Academy of Pediatrics (AAP) schedule. Leverett *et al* give full credit for the resultant virtual elimination of caries from both groups of children at age five years (92.5 percent caries-free PNF, and 91 percent caries-free controls) to this 1979 postnatal F schedule which makes it most unfortunate that the AAP allowed itself to be persuaded by the American Dental Association to abandon it in 1995. Leverett *et al* make no mention whatsoever of the extraordinary home-care program they orchestrated for all the children, and they broke protocol by not using radiographs. For more complete results of this trial it is necessary to obtain a copy of Leverett's 1992 Final Report written for NIDR.<sup>24</sup> If you ignore the summary and read the body of the report carefully, you will find that the PNFs had 16 percent less prematurity, a slightly longer pregnancy, slightly larger birth weight (partially hidden by adjusting the weight to the length of the pregnancy!), and that 20 per-

cent more controls had caries than did the PNFs. Although some of the five parameters by which the two groups were compared are somewhat related, none are related absolutely, and this multifaceted superiority of the PNF children is statistically significant with  $p=0.03$ . What we can learn from NIDR's PNF trial is that F in pregnancy is an essential nutrient for the entire fetus, that even an inadequate amount of PNF is of some benefit, that the 1979 AAP schedule starting F from birth is still the gold standard for postnatal F supplements, that meticulous home care and diet control delay onset and slow progression of caries, and that radiographs are required for accurate diagnosis. Regrettably, we also learn that a government agency with a thirty-year fixed policy cannot be trusted to test the validity of that policy, and cannot even arrange publication of the results of their test in a full and forthright manner.

In 1994, Brambilla found that PNF of only 1 mg is at the threshold of the amount needed for the F to be expressed in the fetus and states that he has confirmed our earlier observation about dose.<sup>16,25</sup> Our initial reports were with 2 mg of PNF—1 mg in the fluoridated water and 1 mg in a NaF tablet. For the past twelve years we have used 2 mg F (NaF 4.4 mg) as a universal PNF dosage in fluoridated and unfluoridated areas.<sup>26</sup> The PNF must still overcome the gestational physiology that gave rise to the concept of a partial placental barrier.<sup>9,26</sup> The 2 mg PNF supplement is well within the daily adequate intake (AI) of 2.9 to 3.1 mg F for pregnancy, and reassuringly far below the upper limit (UL) for pregnancy of 10 mg, the values just now recognized by the Food and Nutrition Board of the National Academy of Sciences in 1997.<sup>27</sup> A 2 mg PNF supplement is now recommended by a conservative nutritionist.<sup>28</sup> Due to the studies showing benefit to the birth statistics, PNF trials by maternal-fetal medicine departments with 2 to 4 mg F/day are planned, with one underway as of May 1997, utilizing 3 mg F (NaF 6.6 mg)/day.

Postnatally, it is not ethically permissible to withhold an essential nutrient, especially as Leverett *et al* have again demonstrated the efficacy of supplying F from birth. By giving F as PNF, however, when it is extremely difficult to fluorose, it may well be possible to reduce daily F dosage in early childhood, when excess F can fluorose. We suggest that those genuinely concerned with toddler F intake, and not just trying to mislead and draw attention from excess F exposure from F dentifrice, investigate using a dropper marked with a weight scale to permit more accurate dosing for children, especially those under three years of age, when their weight is changing rapidly.

## CONCLUSIONS

Animal and human studies confirm that F is an essential nutrient and that F should be supplied during pregnancy in a bioavailable pulse dose of at least 2 mg/day, and then must be supplied from shortly after birth in a sub-fluorosing daily dose appropriate for the child's weight, with some allowance for the concentration of F in the water and the amount of tap water and water based beverages consumed.

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#### TRENDS IN HEALTH CARE COVERAGE

The nation's preoccupation with the transformation of the health care delivery system to managed care has tended to obscure the importance of a number of other, simultaneous trends. These include the declining ability of health care providers to deliver uncompensated care, the declining proportion of people with private insurance, despite a robust economy, the continued growth in the total number of uninsured people, an expected increase in the rate of inflation in health care costs, and budget reductions in Medicare and Medicaid. Some of these trends, such as the decline in uncompensated care, result directly from widespread managed care; others come from the limitations of managed-care insurance as it has evolved and the false expectations imposed on it; and still others are the fallout of the failure of health care reform.

The 1993-1994 effort to reform health care was an attempt to reverse these trends. Its demise did not signify their reversal; it merely reflected the inability of the political system to mobilize a consensus behind a solution. Indeed, an analysis of the current interaction of these trends suggests that a much more serious crisis may be looming for the American health care system than the one that precipitated the drive for health care reform.

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## BEHAVIOR

# Linguistic maturity as a determinant of child patient behavior in the dental office

Jimmy R. Pinkham, BS, DDS, MS

The dentistry for children movement became a meaningful aspect of American dentistry at the beginning of the 20th century. By 1927 with the formation of the American Society for the Promotion of Dentistry for Children at the American Dental Association meeting in Detroit, Michigan, it was obvious that organized dentistry was taking this responsibility for the oral health of America's children very seriously. From these beginnings the issue of behavior management of the child was an important theme. Those interested in the behavior management of children should be intrigued by the observation that most of today's customary nonpharmacological methods of behavior management of the child patient had been described by the end of the 1920s.

Without question, the dentistry for children movement became a reality at a time when the dental health of almost all American children was compromised, if they were not in regular care. In fact, the dental health of American children in the earlier decades of this century was very poor when compared to today. Dental decay also affected almost all American children and not just those of certain lower socioeconomic groups. The actual amount of dental disease in children further emphasized the importance of behavior management.

It is also important to realize that when evaluating the effectiveness of the management techniques that were devised early in this century that these techniques had to be effective on children who on occasion were genuinely frightened, even by the anticipation of the dental experience. Dentistry was more primitive, more painful, slower, and much less pleasant than today. Needles were not disposable; their lumens were larger; they often had barbs and nicks on them. The local anesthetic agents were not as effective as today. Offices were not air con-

ditioned. Four-handed dentistry was yet to be realized. Drills were very slow and rotated with an obvious irregularity. Many primary teeth needed to be extracted because they could not be restored. Appointments only for the purpose of teaching parents and children prevention techniques were rare, if not totally unheard of. The closest a few dentists came to fulfilling the objectives of such an appointment was to include the teaching in the use of toothbrush and dental floss along with the dental examination, prophylaxis, and dietary instructions. These things were presented casually and with little detail; and no followup. There were no PBS programs describing dentistry as a nice experience nor were there Berenstein Bear books assuring children that the dental experience can actually be fun.

Instead in every family, every neighborhood, every elementary school, in fact just about everywhere children frequented, there were stories about the pain associated with dental appointments. Often these stories originated within children's own families from their own siblings, parents, and grandparents. Without question, given the realities of dentistry in the early 1900s, the techniques that were effective in the management of those frightened children had to be very powerful techniques. Otherwise, the movement would have had no success. Without proper behavior management, restorative and surgical pediatric dentistry is impractical, because treatment without effective management would seem cruel to the child, would be unsatisfactory to the parent, and would be exhausting to the clinician.

Now as we approach a new century, dentistry is much more sophisticated, needles are no longer painful, and there are pleasant stories generated by schools, television, books and families about the dental experience. In many places there are no more horrible stories about dentistry. It can be argued that children's fear of dentistry is now virtually gone in many sectors of our society,

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particularly for children who have never experienced any pain at a dental appointment. One would believe, therefore, that there would be no more need for emphasizing techniques to manage children, because children would not need managing. This is not the case.

This paper argues that the techniques that worked earlier in this century had a linguistic reason for working, which may not be possible for certain children today. This reflects a theme consistent with other publications of this author that conclude that the transition from a postfigurative society that raised its children according to a recognized formula of cultural expectations to a prefigurative society in which the parents generate their own personal philosophy as to how to raise their children can have detrimental effects that show up during dental appointments.<sup>1-4</sup> This has often left dentists dealing in a very complicated social situation with children who linguistically are not prepared for the expectations of a dental appointment, when compared with children of previous decades.

#### **THE "LITTLE BAZ TEST" OF CULTURAL AWARENESS OF WHEN CHILDREN CAN RESPONSIBLY WORK IN THE DOMAIN OF REQUESTS AND PROMISES**

The "Little Baz Test" is one the author has utilized for several years in acquainting audiences and students with the fact that we have become conditioned to believe that there is for children a rather late onset in realizing linguistic maturity and the ability to "dance" in language with responsible adults. This has not always been true. The quotation that follows is taken from a letter in the Joseph M. Reed letters, Kansas Collection, Spencer Library, University of Kansas.<sup>5</sup> This is a large collection of accounts of being a child in the American Midwest frontier.

"Among the young, the demands of the frontier ate away at distinctions of age and gender.

. . . When only a boy or girl was available to do a necessary job, that child did it, or tried to.

. . . Arduous and complicated responsibilities, like plowing to clerking, were turned over to children . . ."

"Little Baz can run all over, fetch up cows out of the stock fields, or oxen, carry in stove wood and climb in the cornerib and feed the hogs and go on errands down to his grandma's" a Kansas farmer wrote of his son in 1863.

The "Little Baz Test" is completed when you guess at what age you honestly can imagine Little Baz to be. Before making a guess it should be noted that Little Baz

does a series of chores each day without apparently being reminded that these are his responsibilities. In other words, he has a recurrent citizenship within his family unit that is renewed by him daily. Feeding hogs and climbing in the cornerib are not that much of an issue, but fetching oxen which are large and stubborn creatures is not something that just anyone can easily do. The errands to his grandma's is a trip much more dramatic in length of time and distance than a walk across the street. The realities of Little Baz's environment are not those of a suburban neighborhood of today by any stretch of the imagination.

Today it would be difficult to find anywhere in the Midwest or for that matter anywhere in The USA a Little Baz. We just do not have work needs for our children any more. Little Baz was the normal preschooler, however, during our push through the prairies and over the Rockies to California and Oregon for the better part of a century. In fact Little Bazs were probably all over the agricultural United States and probably parts of the industrial United States through the 1920s and 30s. In other words the dentistry for children movement was arrived at a time when Little Bazs were getting into the dental chair. The age of Little Baz, by the way, was two years and three months old.<sup>5</sup>

Two years and three months old seems to be virtually impossible to our biased view today. It is a very young age. Piaget concludes that children come into language as part of their natural cognitive development sometime between two and four years of age. So at two years and three months Little Baz was on the early side, but he is not to be regarded as a remarkable finding. The mean and median age of two and four of course is three and that has been the traditional age that dentistry believed that a child should come into the dental experience. (It is obviously a late age to start a prevention program and that is why the infant oral health movement, which is slowly growing in the United States, is so important.)

#### **THE ROLE OF URGENCY IN RAISING CHILDREN**

Why was Little Baz amazingly responsible to the work needs of the farm in which he grew up? It was not because he possessed something that other children do not possess. Little Baz was somewhat amazing in that he came into language before his third birthday. He was nine months ahead of the mean. But that maturation reality is still going on in the United States today. There are certainly other children that develop into language earlier than their third birthday. The thing that is amaz-

## POSTFIGURATIVE, CONFIGURATIVE, AND PREFIGURATIVE: MEANINGS

In an article entitled, "Behavioral Themes in Pediatric Dentistry for Children: 1968-1990" published in the *Journal of Dentistry for Children* in the January-February 1990 issue, these terms, developed by Margaret Mead, were introduced to the dental literature. The following is borrowed from that publication. Readers interested in this theme are encouraged to read the original work by Margaret Mead, the 1990 ASDC publication in its entirety, and the references cited in this publication.

As these highly employable and therefore mobile parents move away from the communities that reared them, another phenomenon also takes part. This phenomenon has been described as a shift in the three possible ways that a society (or part of a society) can implement a strategy to rear its children. These ways as described by Margaret Mead are postfigurative, configurative and prefigurative.<sup>1</sup>

Basically, in very general terms a postfigurative society rears children the way they have always been reared. Little boys get circumcised, because little boys always get circumcised. Little girls are available for courtship at a certain age (and not before), because that has always been the age that little girls could become available for courtship. Little boys get a paper route and start mowing grass at a certain age and little girls start doing dishes or are expected to learn how to cook at a certain age, because that is when it was always done. In a postfigurative society, there is very little head scratching by the parents. If the parents are not totally sure of when and how things should be done, then the larger family, which is usually wrapped around their lives (since they have not moved away from where they were reared), will remind them. Such families are common place in rural areas and some stable urban areas. Many Americans who were reared before World War II were reared according to this strategy.

A configurational process of rearing children (again, in very general terms) means that the parents will do it as they remembered it done for themselves, with modifications as they see fit. Configuration looks at the immediate past and the present to aid in devising a strategy. Such parents usually do not live any longer around a community or family who deliberately guide or coach them as to how they should parent their children. Such parents have often moved away from their hometown (perhaps home state). Their children often are in day-care circumstances, and the grandparents are only visited at major holidays, if at all. This could be a rural event, but for the most part, this is an urban, suburban phenomenon. In a highly mobile society, such as the United States has increasingly become since World War

II, there obviously can be a lot of children reared in a configurative process. There is some head scratching with configurative parenting, because if a certain dilemma occurs (Joey was caught stealing today) the parents, if they did not like the way they were reared through such a crisis (or never experienced it), have the challenge of suggesting something they perceive as better or more effective. In such cases, the past does not provide a useful reference and they must use realities of the present to determine what to do.

The last parenting strategy, prefigurative, means that the parents will solve each of the dilemmas of rearing their child, on a day-to-day basis. According to Mead, the parents are actually learning from their children. There can be a great number of questions and anxieties associated with this strategy. That is not to say that it is not an effective process for our days and times, perhaps even a natural process. The following scenario, however, could be true. The child reared by a postfigurative parent would take his cod liver oil during the cold season, because children always take cod liver oil during the cold season. A configurative parent, on the other hand, may or may not make his child take cod liver oil. It depends in part on his own remembrances of the experience of taking cod liver oil and on present perceptions of how beneficial it will be. The prefigurative parent must determine the pros and cons of taking cod liver oil versus the chances of acceptance or nonacceptance by his child. This parent will look to the child for feedback. The answer could vary from day to day and the parents may hold opposite views. Lastly, the perception of a wrong decision by the prefigurative parent(s) may promote feelings of guilt, an experience the postfigurative and configurative parent may be spared.

The example could be made that postfigurative parents will expect their three-year-old to go through the dental appointment behaving well and do so without parent accompaniment, because that was always the way it has been done. Configurative parents may opt to do it that way, because that was the way it was done for them, and it worked out just fine, or they may have a strong desire to accompany their young child, because they remember it did not go so well for them during their first appointments. They will pair their own remembrances with present convictions. The prefigurative parent must solve this one before arriving at the dental office. Likely, if the child looks anxious, they will want to stay with the child. That is not an absolute assumption, but experience supports it.

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ing to us about Little Baz is not necessarily the two years, three months, because three years, three months would have been amazing too. How about six years and three months?! What is so amazing to us is that there were children that were behaving this responsibly not so long ago, and that they appear to be extinct today.

How did Baz's parents become so effective in rearing a child into what we regard as a person with very mature and responsible behaviors? They were effective because postfiguratives raised their children with great urgency. Prefiguratives have no real reason to raise children with great urgency, because in suburbia, urban America, and even in parts of rural America that have become mechanized and automated, there just simply is not the amount of day-to-day work-needs to demand urgency of children in addressing this work requirement. What is urgently needed in a middle class suburban family that would press parents to make a rigorous attempt to assign their child certain tasks? There is not much, if anything at all.

## LANGUAGE AND DENTISTRY

Social maturity in great part is a function of understanding the linguistic processes of communication. There are five constitutive speech acts. These are *assertions*, *declarations*, *requests*, *promises*, and *offers*. Of the five speech acts two allow for the collaborative interaction of human beings. Two of these speech acts are the reason that we are the great herd animals that we are and have been able to build civilizations. In fact, once homo sapiens came into language nothing has ever been done collaboratively that was done outside the domain of the speech acts of requests and promises.<sup>3</sup> Nothing. Nothing at all.

Dentistry is a collaborative activity between the health-care provider and the patient. The dentist who treats a child begins by requesting the child, either personally or through a staff member, to please come to the operatory. The next request is to get into the chair. This is usually followed by a request of "open please" and then to keep the mouth open, to be still, not to cry, or scream, etc. The dental appointment includes a number of requests, depending on how long and how complicated the child's collaboration needs to be. Remember even biting on articulating paper happens because there is a request followed by a promise to comply with the request. Some of the requests are verbalized, some are nonverbal, and some a combination of the two. Sometimes the child anticipates the request. The ability of a dentist in child patient management is the ability to

frame a request effectively and then, if the request is denied by the child, to rerequest in a much more meaningful, perhaps unavoidable way.

It is submitted that Little Baz would have been a good dental patient even in the 1920s when dentistry was relatively primitive. The reason he would be good is that he is very capable in working with responsible adults when they make responsible requests. Baz would have been intelligent enough to know that the dental appointment was a function of his parents' love for him and of their responsibility for him. Invariably he would have known the stories about dentistry hurting and predictably he might cry during the appointment. He probably would have worked effectively, however, within the framework of all the requests that his dentist made, because he is secure in doing so. He would override tendencies of avoidance, because of his assessments regarding the reasonability of the requests. Little Baz is conditioned in this domain of dancing with other people socially in the linguistic acts of requests and promises.

What is a concern today is that a child coming to the dentist at age three from a home that has had no urgency about raising the child may have arrived at his appointment not realizing the importance of being a responsible committer (promisor) to responsible requests. The three-year-old that has a lot of control over his diet, social behaviors, bedtime, even how he goes to bed . . . e.g., demands a bottle; and behavior in a department store, grocery store or fast-food restaurant may be utterly unsocialized in the domain of working with people in the communicative process of requests and promises. In some homes the child may make more requests than the adults. This is a fact unheard of in postfigurative times but can be a frequent prefigurative finding. Such a child when coming into an environment such as is encountered in dentistry, which is a very intense social interaction of a requester (the dentist) and a promisor (the patient), is going to be at a serious disadvantage as far as any effective social interaction with the dentist is concerned. He will misbehave if the requests are frequent and/or rigorous. To the lay person this may look like fear driven behavior. It is not. Fear may ensue from some of the frustrations of not being able to avoid all these requests. Fear may take on an enormously large role in such a child in that the only salient thing that is being provoked by all these requests is anxiety about how to comply. This is not biologically provoked fear. It is not fear that arises from the stimuli of the dental experience. Rather, it is an anxiety due to the lack of ability to work effectively in language with an adult authority figure who is making requests for certain behaviors of

the child. It can be regarded as a useful fear to the child in that it helps to heighten his avoidance behaviors.<sup>6</sup> Confusion is the mother of many anxieties.

It is probably true that over the years many children learn the importance of requests and promises in the dental office as an adjunct to what their parents were probably trying to do at home. It is also probably true that there are dentists who sense that some children grew up in their respective offices. These accounts are not to be written off casually. The accomplishment of being an actualized human being is the accomplishment of working with other people effectively in language. The realization that a child could have a hit of himself in growing up in the dentistry domain could be a powerful experience and one that would be remembered forever.

## SUMMARY

It is easy to assign fear as the reason for children's misbehavior in the dental office. Misbehavior often occurs, however, when nothing fearful is happening or is going to happen. In fact, dentistry related fears are not much of an issue anymore for most American children. Still misbehavior by certain young children is a consistent finding in the dental office. Why?

It is suggested the "why" is related to a lack of effective initiation of the child in how to work responsibly in collaboration with others in speech, particularly in the speech acts of requests and promises. If the parents have not been urgent and rigorous in developing this skill in their child, this lack of social development will show up during the dental appointment, which is a very intense communication/collaboration experience. There is the chance that with effective guidance by the dentist a child can learn linguistic collaboration during the dental experience.

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## MANY PATIENTS CANNOT READ

In 1992, the Department of Education tested 26,000 adults in the National Adult Literacy Survey to assess the literacy of the U.S. population in the English language. On the basis of the survey results, it was estimated that 40 million to 44 million people, or about one quarter of the adult population in the United States, cannot understand written materials that require only very basic proficiency in reading. These people would generally be unable to read and understand instructions on medication bottles or household cleaning solutions, notes from a child's teacher, or directions on a map.

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## CLINIC

# The pulp capping procedure in primary teeth "revisited"

Hugh M. Kopel, DDS, MS

In 1992, a review of the literature on considerations for the direct pulp capping procedure in primary teeth, appeared in the *Journal of Dentistry for Children* by this author.<sup>1</sup> Among the various considerations stated in the summary were:

- Disinfecting the cavity floor.
- Placing a hard set calcium hydroxide (CaOH) material over an enlarged pulp exposure followed by a fast setting zinc oxide/eugenol cement.
- Placing a stainless steel crown to achieve a hermetic seal to minimize microleakage and at the same time, prevent a fractured tooth or a defective restoration.

The reviewer summarized the evidence, which seemed to support the feasibility of direct pulp capping in primary teeth and merit further investigations before rejecting this procedure, as has been stated in pediatric dental textbooks.<sup>2-4</sup>

The acid-etch technique for bonding composites and glass ionomers to tooth structure is acknowledged to have revolutionized the practice of restorative dentistry and ultimately improve pulpal response to dental materials.<sup>5</sup> This dramatic technical procedure, which is radically different from G.V. Black's operative philosophy, also involves pulp protection and preventive pulp therapy in both the primary and permanent teeth.

While enamel bonding has a place in pediatric dental procedures, e.g. sealants, preventive resin restorations (PRRs), composite resin restorations, and glass ionomer liners and restorations, the use of these materials designed for unique dentin bonding continues to this day.

With the introduction of dentin bonding agents, ramifications that were not touched upon in the 1992 review

of direct and indirect pulp capping in primary teeth, should now be considered in pediatric dental practice.

The purpose of this "revisitation" is to discuss the role of calcium hydroxide [Ca(OH)<sub>2</sub>] in the direct pulp capping technique as seen in a new light, and its replacement by the current generation of dentin bonding agents, to promote effective dentin sealing and less extensive restorations.

Bonding systems were developed to achieve two main objectives:

- To achieve an adhesive bond between enamel, dentin and restorative materials to aid in retention.
- To prevent or reduce microleakage at tooth and restorative interfaces, which would ultimately lead to invasive pulp therapy.

### DIRECT PULP CAPPING

This procedure is defined as the placement of a medicament or a nonmedicated material on a pulp that has been exposed in the course of excavating the last portions of deep dentinal caries or as a result of trauma. A protective lining or cement is then introduced to protect the pulp from a thermal stimulus or from subsequent bacterial invasion and to promote a calcific dentin bridge at the site of the exposure. Pashley and Pashley stated that the rapidly increasing dentin permeability with reduced distance to the pulp means physiologically there is little distance between direct pulp capping and deep preparations with minimal thickness of remaining dentin, in terms of direct toxic effects.<sup>6</sup>

Calcium hydroxide in one dental form or another has been singled out for almost five decades by a myriad of investigators as the medicament of choice in the treatment of pulp exposures.<sup>7-11</sup> The greatest single attribute of calcium hydroxide in this procedure is its ability to stimulate the building of a reparative dentin bridge over

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the exposure, perhaps by providing a high alkaline medium in which calcium phosphate ions precipitate. Also, the antibacterial action of calcium hydroxide is often cited as further benefit in this procedure.<sup>12,13</sup> More recently, as the application of clinical research findings for dentin bonding techniques is found extensively in the dental literature of today, many of the purported benefits of the use of calcium hydroxide for pulpal therapy including near and actual pulp exposures have been called into question.<sup>14,15</sup> Cox and Suzuki succinctly summarized the advantages and disadvantages of calcium hydroxide in pulpal therapy (Table).<sup>14</sup> For example:

- Is calcium hydroxide the only material that will promote a dentin bridge?
- Does calcium hydroxide actually bond to the dentin surface?
- Will calcium hydroxide prevent or reduce microleakage?
- Does calcium hydroxide reduce pulp irritation and pain after pulp capping procedures?
- If a dentin bridge is formed following the application of calcium hydroxide, is it a morphologically sound structure or does it have disruptions or tunnel defects?
- Does a covering of calcium hydroxide as a pulp capping material or as a liner on the dentin floor soften and disintegrate under a restoration such as a composite or an amalgam in the long term?

In summary, what is being asked from a clinical standpoint, will there be an ultimate failure of a calcium hydroxide pulp cap procedure by failing to provide an adequate and long-term microseal through bonding to

the organic and inorganic components of dentin, to prevent what we now know to be the importance of microleakage under and around dental restorations?

Current and more sophisticated research has investigated some of these questions in the attempt to evaluate the optimal procedure today for pulp capping, i.e. calcium hydroxide versus dentin bonding.

Is calcium hydroxide necessary for dentinal bridging? Many investigators have shown that calcium hydroxide does not exclusively stimulate dentin bridging and that a variety of factors or other medications stimulate formation of reparative dentin.<sup>14-17</sup>

Does calcium hydroxide bond to the dentin surface? In a recent SEM investigation, Gorracci and Mori showed that due to the poor adhesion of calcium hydroxide to the dentin surface, the polymerization shrinkage of an overlying resin composite caused a detachment of the calcium hydroxide liner with the formation of an interfacial gap that would lead to subsequent bacterial microleakage.<sup>18</sup> This finding agreed with the previous study of McConnell *et al* who also demonstrated that a light-cured calcium hydroxide product placed under a composite with a bonding agent tended to be pulled away from the dentin surfaces.<sup>19</sup>

The above studies show how calcium hydroxide liners and capping materials can fail in the long term. With the creation of microfissures between the calcium hydroxide and the dentin floor (with or without an exposure) an exudate of pulpal fluids is produced because of an outward hydraulic pressure. This exudate can then lead to a dissolution of calcium hydroxide or other material.<sup>20-22</sup> Ultimately bacterial invasion occurs, causing pulpal in-

Table  Advantages and disadvantages of calcium hydroxide.<sup>14</sup>

Advantages of Ca(OH) <sub>2</sub>	Disadvantages of Ca(OH) <sub>2</sub>
Initially bacteriocidal to bacteriostatic	Does not exclusively stimulate dentinogenesis
Promotes healing and repair	Does not exclusively stimulate reparative dentin
High pH stimulates fibroblasts	Does not exclusively stimulate dentin bridge formation
Neutralizes low pH of acids	Associated with primary tooth root resorption
Stops internal resorption	May dissolve after one year with cavo surface dissolution
Inexpensive and easy to use	Acids may degrade the interface during the etching process
Particles may obturate open tubules	Degrades upon tooth flexure Interfacial failure upon amalgam condensation Associated with recurrent caries upon loss Seen in tunnel defects of bridges after one year Does not adhere to vital dentin Does not adhere to bonding resin composite systems

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inflammation and pain.<sup>15,23</sup> Obviously this situation is not conducive to tertiary dentin bridging, in cases of direct pulp capping.

Many investigators have looked closely at the structure of  $\text{Ca}(\text{OH})_2$  induced dentin bridges over direct pulp exposures caused by caries or mechanical exposure.<sup>24,25</sup> A high percentage reported that the bridges contained multiple defects, porosities (tunnels) leading from the pulp to the medicament interface, which permits bacterial and fluid microleakage.

A provocative question remains after many years of debate on the use of calcium hydroxide in pulp therapy in primary teeth. If calcium hydroxide is still considered the definitive material for direct pulp capping in permanent teeth even with its inability to provide a long-term seal, could this shortcoming be the reason that internal resorption is frequently reported (without significant and statistical evidence) in pulpotomized primary teeth?<sup>22,26,27</sup>

The increasing number of recent microscopic histologic and clinical studies are providing a revised look at the effects and shortcomings of calcium hydroxide, when used as liners or in pulp therapy. It is now suggested that dentin bonding agents may be more efficacious for direct and indirect pulp capping procedures.<sup>14,28-31</sup>

Michael Buonocore in 1955 and subsequently other prominent researchers in dental materials pioneered the concepts of adhesive dentistry, which was mainly devoted to the bonding of restorative materials to enamel.<sup>5,32</sup> But it was the recognition of the difficulties presented in bonding to dentin, a different type of substrate, that has ultimately led in the last decade to so many significant research investigations in the philosophical, histologic, and clinical aspects of dentin adhesion.<sup>33-35</sup>

White *et al* pointed out that most of the current impetus for clinical "total acid etching" and bonding to dentin has come from Japanese researchers and clinicians, led by reports from Professor Fusuyama of the Tokyo Medical and Dental University in 1979.<sup>36</sup> Many of these earlier studies were concerned with demonstrating that "total acid etching" should not be considered harmful to the pulp, causing inflammation and necrosis, as had been previously thought.<sup>35,39-41</sup> Nakabayashi showed that *in vivo* etching of vital dentin will expose a collagen scaffold, which after rinsing and priming with an infiltrated resin, will form a micromechanical layer attached to the dentinal tubule walls, which will then provide an effective seal.<sup>42</sup> This is considered a hydrophilic process, which is followed by the application of a

hydrophobic adhesive material to completely seal off the exposed dentinal tubules and bond to a resin restorative. This micromechanically attached layer was later termed a "hybrid layer" by Nakabayashi.<sup>42</sup> Reduced microleakage along with an antibacterial effect and long-term, high bond strengths have now been shown.<sup>43-46</sup>

Cox demonstrated pulpal healing with some dentin adhesives in teeth with minimal dentin thickness after cavity preparation; but he stated there must also be a cavo surface seal, even with the use of dentin bonding, to be fully effective. Snuggs *et al* also felt that while a dental pulp may possess an inherent healing capacity for cell recognition and dentin bridge formation, a bacterial seal must be provided.<sup>46</sup> These investigators went on to state that perhaps the latest dentinal adhesives may provide a more permanent seal of vital dentin against the affective and effective components of microleakage; but of course only clinical research and time will answer this question. If dentin bonding procedures as applied today, and surely to be modified in the future to provide fewer clinical steps, can fulfill the ideal conditions for pulp protection and healing, i. e. reduced microleakage, antibacterial action, long-term sealing and high bond strengths, then we can expect to apply this procedure for successful direct and indirect pulp cappings. The histologic picture of an exposed primary versus a permanent tooth which was discussed in the 1992 review by Kopel, should not enter into the considerations on the use of dentin bonding agents for pulp capping.<sup>1</sup>

Kashiwada and Takagi; Heitmann and Unterbrink; White *et al*; Cox *et al*; and Tsuneda *et al* have studied histologic and clinical effects of dentin adhesive resins systems placed on direct pulp exposures and each has discussed the various necessary steps in the technique to promote a successful outcome.<sup>30,31,36,47,48</sup> It can be seen from the above studies that there are variations in the chemical components by the manufacturers of these systems as their philosophies differ, and the clinical steps, therefore, may differ slightly.

When confronted by a minimal exposure of a primary pulp, whether it be a mechanical exposure or a carious exposure, the clinician has several factors to consider in bringing about a successful result, when employing a dentin bonding procedure. Most of these considerations have been discussed by the many investigators who are cited in this review and suggestions for clinical practice have been made based on their research findings. A sequence of clinical events based on these investigations must take place, therefore, for a successful outcome in the direct pulp capping procedure, using dentin adhesives.



## CONSIDERATIONS IN THE CLINICAL STEPS

### Hemostasis and disinfecting

Hemostasis of the exposed pulpal horn of course is just as important in the dentin bonding technique as it is when using calcium hydroxide as a pulp capping material to prevent clot necrosis and a substrate for bacteria.<sup>49,50</sup> Three percent hydrogen peroxide or 19 percent sodium hypochlorite have been used for many years for this purpose. The clinician also might consider gently wiping the dentin floor and the exposed pulp with an antibacterial solution such as chlorhexidine or a fixative such as formocresol or a weak glutaraldehyde solution. It has been reported that some manufacturers of dentin priming adhesives are now introducing an antibacterial medicament into the primer.<sup>38</sup>

### The smear layer and acid etching of the dentin

These two considerations represent the most controversial factors in the dental adhesive concept. Does a smear layer hinder adequate bonding and harbor bacteria, and is acid etching of the dentin harmful to the pulp? If these two considerations can be answered in the negative, there is no reason that direct pulp capping cannot be a successful clinical procedure for both permanent and primary teeth. The smear layer is composed of mineral and organic phases of tooth structure that are literally smeared around the cavity walls as a result of mechanical tooth instrumentation, and is regarded as a hydrophobic, amorphous layer with many structural defects. Cox and Suzuki; Walshaw and McComb; Joynt *et al* feel that the smear layer should be either modified or removed through acid conditioning.<sup>15,38,51</sup> Their investigations have shown that low-viscosity-resin-primer penetration into dentinal tubules is enhanced when the smear layer is removed or reduced. There is a more effective "hybrid layer," therefore, when it comes to bond strength and the sealing of the partially demineralized dentin substrate against bacterial invasion.

### Acid conditioning of the dentinal surfaces

The effect of acid application to the dentin surfaces, especially to the floor of a deep cavity preparation, has been investigated very thoroughly. For many years restorative materials that release phosphoric acid in both short-term and long-term intervals were thought to cause thermal sensitivity, pulpal inflammation, and eventual pathosis. Liners of calcium hydroxide or zinc ox-

ide/eugenol or a copal varnish were always suggested for placement under these restorative materials. It has now been shown that materials with considerable amounts of free phosphoric acid may be applied to an exposed pulp without healing impairment, if the area can be kept free of bacterial infection.<sup>46</sup> Another study indicated that acid-etching of vital dentin, using 10 percent maleic acid did not impair pulpal healing in deep Class I cavities.<sup>17</sup>

These studies demonstrated that when an acid is applied to the dentin with a resultant opening of the tubules, there is an outward flow of dentinal and pulpal fluids due to hydraulic pressure with a consequence of a two-way interchange of fluids and bacteria. This interchange produces hypersensitivity, eventual bacterial infection, recurrent caries, and pulp pathology. Bergenholtz *et al* have contended that this bacterial invasion underneath nonadhesive restorations is even more likely to occur, under an amalgam for example.<sup>52</sup> Cox and Suzuki point out that it is for these reasons that any successful treatment of the dentin after cavity preparation must provide permanent sealing or "hybridization" at the dentin interface.<sup>15</sup>

To produce this hybrid layer it is necessary to acid etch the dentin, remove the smear layer and effect a surface demineralization, followed by the application of a hydrophilic "primer" to bond micromechanically with the tubule surfaces; and then to be covered with a hydrophobic adhesive resin. In this way, with the production of a resinous barrier, bacterial microleakage, thermal sensitivity and shrinkage stresses are reduced.<sup>38</sup> It should make no difference, therefore, whether it is the dentin of a primary or permanent tooth.

Even with the acceptance of the above concepts in the treatment of vital dentin in preparation for an adhesive restoration, most manufacturers of adhesive systems, which include such acids as phosphoric, citric, maleic, and nitric, recognize that the long-term acceptance of calcium hydroxide as a pulp protectant holds some advantageous biologic properties. While this may or may not be recognized now as much as in the past, the suggestion is still made to use a calcium hydroxide liner on vital dentin before etching. But as previously mentioned, calcium hydroxide liners are known to "break down" when the acid is applied. It has been suggested that if calcium hydroxide is used for pulp capping, it should be covered with a dentin adhesive for optimal healing potential.<sup>15</sup> Christensen stated that hybridization of deep dentinal surfaces is now replacing the traditional calcium hydroxide techniques, as evidenced by the growing decrease in the sales of this material.<sup>53</sup> In this connection, he feels that the so called "hybrid layer" appears

to seal a pulp exposure or near exposure adequately. Weiner *et al* in a recent survey of North American dental schools, found that only 25 percent of the schools now teach the use of calcium hydroxide for deep cavity preparations, which indicates its declining use in favor of other sealing agents.<sup>54</sup> Cox and Suzuki feel that dentin adhesive systems should now be reevaluated for routine clinical augmentation, to take the place of calcium hydroxide liners as a new concept in pulp protection and therapy. If effective sealing and hybridization can be achieved, could not this same concept be applied to minimal pulp exposures in primary teeth? Several recent investigations that deal with direct pulp capping and adhesive dental restorations have been reported.

### CLINICAL INVESTIGATIONS

Kashiwada and Takagi capped the exposed pulps of sixty-four permanent molars for eighteen months with an adhesive composite resin system.<sup>30</sup> Clinical and histologic results showed no clinical discomfort in sixty of the teeth. Histopathological examination did not demonstrate inflammatory or necrotic changes, and in fact thin dentin bridges were seen in six of the extracted teeth. Tsuneda *et al*, in a study of direct pulp capping in rats, used four resin adhesive systems with different chemical components, three of Japanese manufacture and one a clone of the Scotchbond Multipurpose system.<sup>45</sup> Pulp responses to these materials were examined histologically, and the gap formation between dentin and the bonder was observed. Acid etching was not used in this study before the insertion of the dentin bonding agent, but was used before the insertion of the restorative material. Pulpal responses such as hyperemia, inflammatory cell infiltration, reticular atrophy, and vacuolar degeneration were evaluated. The histologic responses of the exposed pulp were correlated positively with microleakage formation. The authors agreed with other studies that point out a material biocompatibility and that a lack of pulp pathosis occurs only when microleakage and bacterial infection can be prevented at the enamel/dentin/restoration interface.<sup>46,47</sup> Heitmann and Unterbrink conducted an *in vivo* pilot study of direct pulp capping in permanent human teeth, using a glutaraldehyde containing dental adhesive.<sup>31</sup> Clinical photographs of each step were provided in this report. During the observation period of two to six months, all of the teeth demonstrated normal clinical and radiologic findings. The investigators stated that the potential advantages of direct pulp capping with a dentin adhesive and a resin composite include an improved seal at the exposure pe-

riphery for prevention of reinfection, but of course long-term clinical observations would be necessary. Bazzucchi *et al* also conducted a clinical trial in order to observe pulpal reactions after direct pulp capping with three adhesive bonding systems.<sup>55</sup> Histologic examinations after ninety days revealed that no pulp necrosis or gangrene was seen. In many samples, only a mild vascular dilation was limited to the zone of the exposure and complete dentin bridges were observed after the ninety days. Cox *et al* conducted an *in vivo* study of mechanically exposed monkey pulps to examine the healing of the pulp under various dental materials (one of which was a self-cured composite resin) with and without a surface seal.<sup>47</sup> It was concluded from the results after thirty-five days, that dental pulps possess an inherent healing capacity permitting cell reorganization and dentin bridge formation. This investigation reinforced previous studies of Cox *et al* that dental pulps will heal with minimal or no inflammation, either with or without dentin bridge formation, providing a bacterial surface seal is maintained.<sup>39</sup> Kanca used a dentin bonding system to bond a fractured fragment of an anterior tooth over a pulp exposure and found a vital posttreated tooth.<sup>56</sup> He stated that the key to success with these types of light-curing polymeric resins is the provision of a biologic seal of the restoration.

The caveat concerning the need for a long-term seal brings up several concerns as to the ability of dentin adhesives to maintain this seal, and their potential toxicity. As previously mentioned, it is now well known that calcium hydroxide liners and bases do fail in the long term when adhesion to the dentin is lost and eventual dissolution occurs, providing a pathway for microbial leakage.<sup>15,18</sup> Regarding the longevity of dentin bonding systems *in vivo*, several investigators in dental material studies have expressed the concern that the dentin substrate is subject to dynamic changes that may affect the maintenance of the bond.<sup>57,58</sup>

Schuster *et al* in discussing the biocompatibility of third generation dentin bonding agents implied toxicity to the pulp; but researchers are seemingly divided on this issue.<sup>59</sup> It was shown in some studies, they stated, that interactions between certain components may cause the dentin bonding agents to be more or less toxic with prolonged duration. Several other animal studies suggest, however, the dentin bonding agents only have minimal effect on pulp tissue. It is obvious that more clinical, laboratory, and histologic studies are necessary over a long term to evaluate these third and probably fourth generation bonding agents, especially in their use for direct pulp capping techniques. And it should be kept in mind that their components differ from manu-

facturer to manufacturer, and not all are suitable for direct pulp capping. At this time though, the use of dentin bonding agents for direct pulp capping in both primary and permanent teeth does look favorable and may completely supplant the use of calcium hydroxide or at least be used in combination.

## CONCLUSION

In the last decade it is well recognized that bacterial invasion through microleakage at the enamel/restoration interfaces and the dentin/pulp interfaces is responsible for postoperative sensitivity, thermal stimuli, and pulpal inflammation or pathosis, and not by various dental restorative materials.

The role of calcium hydroxide in the treatment of deep dentinal caries and pulp exposures is being questioned, because of its moisture susceptibility, failure to bond with dentin, and its contribution to imperfect tertiary dentin, which ultimately will lead to bacterial invasion.

The newer dentinal bonding agents are now suggested in a number of clinical investigations as a means to achieve a hermetic seal at the dentinal/pulpal interface by means of a resinous "hybrid" layer. With a hermetic seal being achieved at a minimal exposure site in a primary tooth, direct pulp capping is feasible without the disadvantages of calcium hydroxide.

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#### NATURE'S SWISS ARMY KNIFE

A class of drugs with an unusual mechanism for fighting disease has breathed new hope into AIDS research during the past year. At least for some patients, these compounds, which block the activity of a protein-snipping enzyme that the AIDS virus needs to complete its life cycle, are turning what was once a death sentence into a chronic condition. But AIDS isn't the only disease that may be treatable by blocking the activity of these enzymes, called proteases. Researchers are now exploring the use of protease inhibitors against everything from infections, including the common cold and the parasitic disease schistosomiasis, to inflammatory conditions like asthma and rheumatoid arthritis, and even cancer.

Proteases are such an inviting target for therapies because they play key roles in disease development. James McKerrow, a molecular biochemist at the University of California, San Francisco (UCSF), describes them as "Mother Nature's Swiss army knife. They have many different functions, even though they often have nearly identical structures."

Seife, C.: Blunting nature's swiss army knife.  
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# Comparison of two tooth-saving preparation techniques in a treatment approach of one-surface cavities: Design of a study

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**D**ental caries is a multifactorial disease that has afflicted the human race since ancient times.<sup>1-5</sup> Its prevalence has shown changing patterns in different parts of the world. The WHO global oral data bank indicates improvements in most industrialized nations and deterioration for most developing countries, where it is becoming a public health problem.<sup>2</sup> Dental caries is virtually left untreated in the majority of populations in these economically underdeveloped countries, often leading to many large and painful cavities.<sup>6-10</sup> If any treatment is provided at all, it is in the form of extraction. The main reason for not providing care revolves around the need for expensive dental equipment and extensively trained personnel. There has been a general lack of appropriate techniques to allow for primary health care under conditions that provide no electricity or dental equipment (mobile or fixed). For Pakistan, the prevalence of dental caries could be worse; a national survey in 1988 showed a mean

DMFT level of 1.2 for twelve-year-olds, one of the indicator ages, and 3.1 for the entire population.<sup>11</sup> This level according to WHO is very low. The global goal for oral health, for the year 2000, is 3 DMF teeth at twelve years of age.<sup>12</sup> This may not remain true, however, for all times: the WHO global database in Geneva indicates that changes have frequently occurred in national caries figures: for some countries it has grown worse, due to increased consumption of sugar and sweets or after more accurate caries data have been recorded.<sup>13</sup> Furthermore an analysis of the Pakistan DMFT figure for twelve-year-olds shows a very high score, D=1.05, suggesting a lack of treatment due either to public unawareness or nonavailability of dental services. Pakistan's demographic data show that for a population of 120 million there are about 2,600 registered dentists.<sup>14</sup>

Seventy percent of the oral health personnel serve the population living in urban areas, 30 percent of the entire population. For a developing country with a low and an unevenly distributed number of oral health care providers, the dental situation, therefore, can be expected to deteriorate readily into a major healthcare problem.

Scientific research and advanced technological developments have provided new restorative materials, opening the discussion about new concepts in the conservative treatment of caries. One of these concepts is the Atraumatic Restorative Technique—ART. This treatment approach was developed in the mid-1980s and introduced clinically in Malawi some years later.<sup>15</sup> It is based on removing infected tooth material, using only hand instru-

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ments and filling the subsequently clean cavity with adhesive material such as glass ionomer.<sup>16</sup> This development has led to a shift from the concept of "disease" (filling holes in teeth) toward that of "health" (trying to preserve teeth and gums through small interventions and oral health promotion activities), and it can improve not only the oral health of people living where electricity is not available, but also of those who live where nobody can afford to buy and maintain expensive dental equipment.<sup>17</sup> The ART has been evaluated under realistic field conditions, and results suggest that it is very promising for the treatment of one-surface lesions especially in permanent teeth.<sup>18-22</sup>

Advantages of the approach to patient care should include simplicity, good patient acceptance, fluoride leaching capacity, and good marginal seal of the cariostatic and adhesive filling material.<sup>23-30</sup> Disadvantages can be the fatigue of preparing cavities with hand instruments, increasing the chances of leaving residual caries; the requirement for accurately handling the material; and inadequate strength of the filling materials.<sup>27,31-35</sup> All studies on ART have evaluated the longevity of restorations using glass ionomer cement (GIC) as a restorative and fissure filling material. The atraumatic aspect of ART and the effect of operator variance have not yet been evaluated extensively. Other materials and techniques have not been tested under similar field conditions.

The purpose of this study is to evaluate under field conditions various aspects of ART, using different materials such as amalgam and GIC, and to compare this method with a similar approach using rotating instruments instead of hand instruments. This approach, eliminating the principle of "extension for prevention" is referred to as the "minimal cavity preparation technique" (MCP).

## OBJECTIVES OF THE STUDY

- To test clinically the quality of glass ionomer restorative material compared with amalgam in one-surface cavities prepared using the ART technique.
- To compare the efficacy of ART with MCP.
- To compare the treatment time needed in both ART and MCP.
- To investigate the influence of possible wrist fatigue on the size of the preparation.
- To investigate the operative and postoperative sensitivity in both techniques.
- To investigate the operator effect, based upon:
  - Preparation size differences in both techniques.
  - Preparation and restoration time required in both techniques.

- Quality of the restorations.
- Operative and postoperative sensitivity.

## MATERIAL AND METHODS

Overall design:

Two clinical studies were designed to achieve the objectives.

Study 1: Treatment of one-surface carious lesions with the ART technique, using glass ionomer and amalgam as restorative materials.

Study 2: Treatment of one-surface carious lesions with a minimal cavity preparation technique, using glass ionomer and amalgam as restorative materials.

## Materials

Tytin (Kerr) was used for all amalgam restorations, because of good clinical results during a previous long-term amalgam study.<sup>37</sup>

Fuji IX glass ionomer (GC) material was used for all glass ionomer restorations based upon improved physical properties and because this material was developed by the manufacturer especially for the ART technique.<sup>38-40</sup>

Dycal (Dentsply, Caulk) was used as a base in deep cavities and Vaseline Petroleum Jelly was used as an expedient to apply to the glass ionomer fillings. All restorations from each brand were from one batch to avoid variations in material properties.

## Trial design

In this study glass ionomer restorations serve as a test group and amalgam restorations as a control. It was preferred to use test and control restorations within one dentition, using a split mouth design to obtain similar study conditions. A minimum of two and a maximum of four restorations were placed in one dentition. Depending upon the number of restorations, a patient could participate in either study 1 or study 2 or both. Only one-surface cavities in the occlusal, buccal or lingual surfaces of permanent molars and premolars were selected. In order to enter the cavities with hand instruments, the selected cavities should have a diameter of at least 1 mm. Based on a clinical trial in Thailand, the selection was focussed on small cavities, with a maximum initial entrance of about 2 mm.<sup>19</sup>

Five operators took part in the study and all were trained and calibrated regarding selection, treatment procedures and practice before the start of the study.

### Population of study

Four hundred patients with low and middle socioeconomic status were selected from seven schools of Karachi. The age ranged from six to sixteen years, mean age, 11.4 years. The mean DMFT in this study was 3.06 (SD: 1.29).

The distribution of patients according to gender was 47.3 percent males and 52.7 percent females.

Each patient was treated by any of five operators. All treatments were done on-site (at school) and informed consent was obtained from school authorities with agreement to conduct evaluation sessions in the future. The table shows the distribution of restorations per dentist, per restorative material, per study. A total of 914 restorations were placed, 555 with Fuji IX and 359 with Tytin. Of these restorations 461 were made according to the ART procedure and 453 with the MCP technique.

The distribution of restorations according to the tooth surface was 685 (74.9 percent) on the occlusal surface, 195 (21.3 percent) on the buccal, and 34 (3.7 percent) on the lingual.

### Restorative procedures

All restorative procedures were described in detail to ensure consensus by all operators. The materials used were handled as recommended by the manufacturers. In study 1, one-surface restorations were made using hand instruments. Access to the cavity was made by increasing the access with a hatchet or hoe. Soft carious dentin was removed, using spoon excavators, while care was taken to remove all the unsupported enamel.

In study 2, one-surface restorations were made, using an air turbine. Access to the cavity was made by widening the opening with a high-speed cylindrical diamond stone bur; the remaining soft carious dentin was removed by using a stainless steel round bur and checked with a spoon excavator. In both studies, special attention was given to cleaning the dentinoenamel junction and removing all unsupported enamel.

If necessary a Ca(OH)<sub>2</sub> base was applied to the deepest areas of the cavity. In case of glass ionomer restorations the conditioning of the cavity was done with a drop of Fuji IX liquid on a mixing pad. A cotton wool pellet moistened with water was dipped in the drop of liquid, after removing excess water by touching the pellet against a cotton roll. The conditioner was brushed on the entire cavity surface, including the remaining fissures, for ten seconds. After washing three times with clean cotton pellets dipped in water, the cavity was dried with dry pellets.

The liquid and powder were dispensed and mixed, strictly following the manufacturer's instructions. The mixture was then applied to the cavity and the remaining fissures. A small amount of Vaseline was applied on the gloved forefinger and the material was brought under pressure so that the glass ionomer could flow into the cavity and fissures. After a few seconds the finger was removed sideways so as not to dislodge the filling materials. Some Vaseline was applied on a ball burnisher and the material was pressed again by moving through the fissure, starting in the center of the occlusal surface. Excess of material was displaced to the slopes of the cusps and removed with a large excavator after which the bite was checked and adjusted till the patient could close normally. Some more Vaseline was applied with a cotton pellet, and the patient was asked not to eat for one hour. In case of amalgam restorations, single spill Tytin capsules were mixed in an amalgamator, following manufacturer's instructions. The amalgam was carried into the cavity using an amalgam carrier, and condensed with pluggers, slightly overfilling the cavity. The excess was removed with an Ash 6 Special plastic instrument after which the patient was asked to rinse with water. The occlusion was checked and adjusted if necessary with a large spoon excavator, and the patient was asked not to eat for one hour.

Before restoration the cavity size was measured (width of the entrance) using specially designed cavity measuring instruments having a width from 1 mm to 6 mm with stops of 0.5 mm.

The treatment time was measured, using a stopwatch. It was divided into:

- Preparation time, the time necessary to prepare the cavity and remove all the decayed tissue. It included the period from the actual start of cavity preparation, until the cavity was ready for filling.
- Restoration time, starting from placing the base in the already dried cavity (if necessary), conditioning, placement of the filling, and the finishing of the filling.

Table 1 Distribution of restorations per dentist per restorative material per study.

Operator	Fuji IX (GIC)		Tytin (amalgam)		Totals
	ART	MCP	ART	MCP	
1	57	54	57	54	222
2	63	61	62	62	248
3	48	48	—	—	96
4	62	62	62	62	248
5	50	50	—	—	100
Totals	280	275	181	178	914

## EVALUATION PROCEDURES

Separate formats were developed for the collection of baseline and evaluation data. The baseline data were recorded by the operator, while the later evaluation data were recorded by two other dentists. These baseline and evaluation records are based on the guidelines for clinical studies of ART, in order to make some comparison with other ART studies possible, and on clinical studies on the behavior of posterior resin composite restorations by Kreulen *et al.*<sup>41,42</sup>

### Baseline evaluation

This was divided in four parts:

- General information was collected, e.g. number of the study, number of the evaluation, patient trial number, tooth number, restoration number for patient etc.
- Information about the patient was collected, such as age, gender, DMFT, and the presence of possible abrasion on the tooth.
- Clinical information was recorded, such as location of the restoration, condition of the remaining fissures, the use of a base, the size of the cavity, treatment time, day number of each restoration, and operative sensitivity (pain felt during preparation or placement of the restoration).
- A diagram was made to mark the place and outline of the restoration.

The baseline evaluation was done at the time of placement of restoration. Following evaluations were planned for three months, one year and two years.

### Postoperative evaluation

In addition to the general information, postoperative evaluation was divided into two parts:

- Clinical information was collected e.g. DMFT, postoperative sensitivity (pain felt after the restoration was finished).
- The quality of the restoration was assessed according to the following criteria:
  - 0 = Present, correct.
  - 1 = Marginal defect or surface wear less than 0.5 mm.
  - 2 = Wear of surface  $\geq 0.5$  mm.
  - 3 = Defect at margin  $\geq 0.5$  mm or more.
  - 4 = Combination of 2 and 3.
  - 5 = Restoration has (almost) completely dis-

peared.

6 = Restoration not present because other treatment has been performed for whatever reason.

7 = Tooth absent.

9 = Unable to diagnose.

When a restoration was replaced or repaired the reason was registered.

- In case of glass ionomer, the fissure filling portion was assessed according to the ensuing criteria:
  - 0 = Present, correct.
  - 1 = Fissure filling partly disappeared.
  - 5 = Fissure filling has (almost) completely disappeared.
  - 6 = Not present because other treatment has been performed.
  - 7 = Tooth absent.
  - 9 = Unable to diagnose.
- For the assessment of caries, related to either the restoration or the fissure filling, the following criteria were used:
  - 0 = Sound, no discoloration.
  - 1 = Discoloration at surface, but it is hard.
  - 2 = Discoloration (in-depth) but hardness cannot be assessed.
  - 3 = Caries connected to the restoration.
  - 4 = Caries related to the pit and fissures on the same surface of the tooth.
  - 5 = Combination of 3 and 4.
  - 8 = Caries anywhere else on the tooth surface.
  - 9 = Unable to diagnose.
- A drawing was made showing the outline of the remaining restoration and fissure filling.

The evaluation was done on-site (in school), using a ball ended CPITN periodontal probe.<sup>40</sup> Caries for the purpose of this study was defined as "a break in the enamel or a cavity in the tooth; the dentine in the cavity had to be softer than the surrounding dentine."<sup>41</sup>

## DISCUSSION

The framework of the study presents an experimental design in which the restorative material, along with the restorative technique, is the primary variable. The secondary variables are the dentist and the tooth in which the restoration was placed. Even though it is impractical to expect standard oral conditions among the study population, patients were selected according to stringent criteria in order to achieve some degree of equivalency. The mean DMFT found in this study was (3.07) higher than that for twelve-year-olds in a previous study (1.2).<sup>11</sup> This can be attributed to the fact that the population in this



study was selected on the basis of having at least two one-surface carious lesions. Consequently children with fewer cavities could not participate in the study. Alternately it may indicate a further deterioration in the oral health status of the population.

The number of GIC restorations was larger than the number of amalgam restorations, as all the restorations had to be made in a two-month period in order to avoid a lengthening of the period of the subsequent evaluations. Because two dentists joined the study at a later stage, it was decided for them to participate in both the studies, rather than to make restorations with different materials.

The "atraumatic restorative technique" as its name suggests, is intended to be atraumatic not only for the tooth but also psychologically for the patient; it was considered important, therefore, to test the perception of operative sensitivity (pain felt during the procedure), as this is an important determinant of the acceptance of treatment procedure by the patient. Another such determinant is the postoperative sensitivity. This can be related to the trauma a restorative procedure or a restorative material causes to the pulp, or to the failure to obtain a proper marginal integrity.

Because the assessment of the quality of the restorations is planned to be done at field setting, it is important to keep the assessment procedure simple. As in other ART studies, a CPITN probe has been selected as a tool for assessment in order to compare the possible results.<sup>43</sup>

The CPITN probe has a standard ball end of 0.5 mm in diameter, has different markings for lengths and can be used to access the filling without causing any damage to the margins or disturbing any recalcification process occurring on the tooth surface.

Compared to other methods, the use of the CPITN probe is a rather rough means for the assessment of the quality of a restoration. The results of this study will consequently have a more indicative character related to the quality of the restoration.

The first postoperative evaluation is planned at an average interval of three months from placement of all restorations. This interval is based upon logistic reasons. Especially the quality of the fissure filling is expected to be influenced by this decision because of the limited retention capacity of glass ionomers to enamel.<sup>44</sup>

The diagram of the extent of the restoration and fissure filling is a rather approximate measurement, but compared with other methods such as impression and plaster model techniques, it is much simpler and easier to perform with the minimum of material and facilities in a field setting.

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## SYMPTOMS ASSOCIATED WITH WATER FLUORIDATION

Fluoridation of water is a controversial measure because of the suspicion that it has harmful effects on health. Opinions differ as to the reality of these fears. In Kuopio, after distressing disputes over the fluoridation issue, the City Council decided to stop fluoridation at the end of 1992. In fact, however, it was discontinued at the end of November, one month early, without the public being told. The aim of this study was to find out whether the occurrence of 25 selected symptoms was connected with exposure to fluoridated water. In order to do this we compared the prevalence of symptoms during the months before and after the undisclosed cessation of fluoridation and after the cessation had been officially announced. Postal inquiries concerning symptoms were sent to 1000 randomly selected adults in November, to a further 1000 in December 1992 and again to the same 2000 people in March 1993. The response rates were 40-26 percent. The percentage of those with two or more symptoms was the same (45%) in November and in December but decreased to 32 percent in March. The mean number of symptoms per respondent decreased from 1.9 in November to 1.4 in March ( $P<0.001$ ) and in December-March from 1.8 to 1.2. The decrease was most significant for symptoms related to the skin. Since the occurrence and mean number of symptoms were fairly similar during actual and supposed fluoridation, the results do not support the theory that the symptoms considered in this study are caused by the physical effect of fluoridated water. On the other hand, the significant reduction in the number of symptoms only after the respondents had become aware of the discontinuation of fluoridation reveals that fluoridation may have psychological effects which present as perceived symptoms.

Lamberg, M; Hausen, H; Vartiainen, T: Symptoms experienced during periods of actual and supposed water fluoridation.

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# Uprighting the mandibular molars stimulates mandibular growth during treatment of Class II malocclusion

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**F**avorable correction of a Class II malocclusion includes not only a dental change, but also a skeletal improvement. One of the modalities to correct the Class II molar relationship includes the forward movement of the mandible. Björk and Skieller suggested, however, that as the mandible moves forward the maxillary teeth move forward as well, because of the interdigitation.<sup>1</sup> Paradoxically, there is evidence that growth per se does not correct a malocclusion, because tight interdigitation would maintain the established jaw relationship. "Unlocking" of the occlusal interdigitation is required, therefore, for effective distalization of the maxillary molars with head gear. The use of head gear with functional appliances, including activators and biteplanes, enhances distalization of the maxillary molars and mandibular forward growth, because of the unlocking of the occlusion.<sup>2-4</sup> Utility arches on the mandibular dentition and cervical head gear are suggested to effect a forward growth. This is called "reverse response."<sup>5</sup> Besides head gear, intermaxillary Class II elastics also have been used to correct a Class II molar relationship. A side effect of the elastics

is, however, mandibular backward rotation by means of the mandibular molar elongation, which causes the pogonion to move downward and backward.<sup>6,7</sup> In order to prevent this side effect, tip-back bend is prepared to "anchor" mandibular molars, which may unlock the molar interdigitation, resulting in favorable mandibular growth.<sup>4</sup>

We have observed that among similar aged patients some of the Class II patients experienced good mandibular growth during the treatment, whereas others did not. We considered, therefore, that unlocking the posterior interdigitation with uprighting the mandibular first molars during Class II treatment may be critical. We hypothesized, further, that uprighting the mandibular molar creates a counterclockwise rotation of the mandible and stimulates mandibular forward growth during the Class II treatment.

## MATERIALS AND METHODS

This investigation used the longitudinal lateral cephalometric radiographs of 33 Class II, Division 1 female patients. Patients were selected to assure case uniformity and to match the initial and posttreatment mean ages, as well as mean treatment term and treatment modality. All cases were treated without extraction by one author, and cephalograms were traced by another author.

Patients were started in early adolescence; mean age

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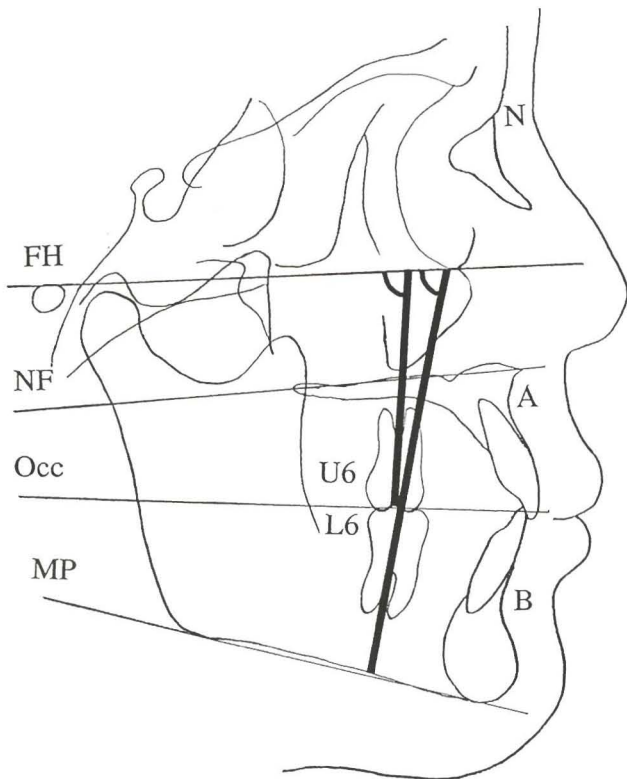


Figure 1. Tracing of lateral cephalogram illustrating tooth axes of the maxillary (U6) and mandibular first molars (L6).

was ten years, ten months. All the patients were treated with .018 slot edgewise Alexander appliances for averages of two years and five months. High-pull head gear and Class II elastics were used. The degree of tip-back bend in the wire at the mandibular first molars varied from 0 to 20 degrees with .016 × .022 stainless steel arch wires, depending on the initial axial inclination of the mandibular first molar. No attempt was made in the selection of patients to consider their potential level of cooperation. The amount of uprighting of the mandibular first molars was first measured cephalometrically. Seventeen cases that showed more than five degrees of uprighting were selected as the uprighted group. Cases that showed less than five degrees of uprighting were selected as the non-uprighted group.

Cephalometric measurements used for this investigation were SNA, nasal floor to FH plane (NFFH), SNB, mandibular plane to FH plane (Mp-FH), ANB, occlusal plane to FH plane (Occ-FH), tooth axis of the maxillary first molar to FH plane (U6-FH), and tooth axis of the mandibular first molar to FH plane (L6FH).

Table 1 □ Cephalometric comparison between two groups.

Variable	Group	Uprighted n = 17		Non-uprighted n = 16		
		Mean	S.D.	Mean	S.D.	
Age	Initial	10y 8m	1.0y	11y 3m	0.8y	
	Final	14y 5m	1.4y	14y 9m	1.5y	
	Change	3y 10m	1.3y	3y 5m	1.0y	
Maxilla	SNA	(°) Initial	80.7	3.8	81.6	3.6
		Final	79.2	3.7	80.1	3.4
		Change	-1.5	1.1	-1.6	1.3
NF - FH	(°)	Initial	1.4	1.9	1.1	3.1
		Final	2.3	2.1	2.1	1.9
		Change	1.0	2.1	1.0	1.8
Mandible	SNB	(°) Initial	75.9	3.6	76.9	3.1
		Final	76.2	3.6	76.2	3.1
		Change	0.3*	1.2	-0.8	1.2
Mp - FH	(°)	Initial	31.1	6.0	31.8	4.5
		Final	29.2	6.3	32.3	4.3
		Change	-1.9**	2.4	0.5	1.3
Mandible to Maxilla	ANB	(°) Initial	4.8	1.7	4.7	1.4
		Final	3.0	1.6	3.9	1.7
		Change	-1.8*	1.2	-0.8	1.3
Dentition	Occ - FH	(°) Initial	11.2	3.1	11.6	3.3
		Final	10.8	3.1	12.7	3.6
		Change	-0.4	2.7	1.1	2.5
U6 - FH	(°)	Initial	74.0	5.1	74.4	4.4
		Final	82.2**	4.9	76.6	4.3
		Change	8.2**	5.4	2.2	4.0
L6 - FH	(°)	Initial	60.5***	5.0	65.0	3.2
		Final	70.5***	3.7	64.7	3.3
		Change	10.0***	3.4	-0.3	1.9

\*\*\* p < 0.001 \*\* p < 0.01 \* p < 0.05

Table 2 □ Coefficient matrix.

	SNA	NF-FH	SNB	Mp-FH	ANB	Occ-FH	U6-FH	L6-FH
SNA	1.00							
NF-FH	-0.12	1.00						
SNB	0.46**	-0.12	1.00					
Mp-FH	-0.02	0.23	-0.51**	1.00				
ANB	0.44*	0.01	-0.60***	0.50***	1.00			
Occ-FH	-0.26	0.18	-0.41*	0.58***	0.18	1.00		
U6-FH	-0.10	-0.13	0.26	-0.30	-0.36*	-0.11	1.00	
L6-FH	-0.05	-0.10	0.34	-0.55***	-0.39*	-0.33	0.52**	1.00

\*P < 0.05; \*\*P < 0.01; \*\*\*P < 0.001

All the variables have differences between the initial and the final values

As a statistical analysis, the means and standard deviations for each measurement were calculated. T-statistic was performed to determine the mean differences in each measurement between the individual groups. Correlation coefficients were also calculated to learn whether the uprighting of the mandibular first molars affected the coefficient obtained with the other measurements.

## RESULTS

The average amount of uprighting the mandibular first molars of the uprighted group was 10.0 degrees with 3.4 degrees of standard deviation, against -0.3 degrees with

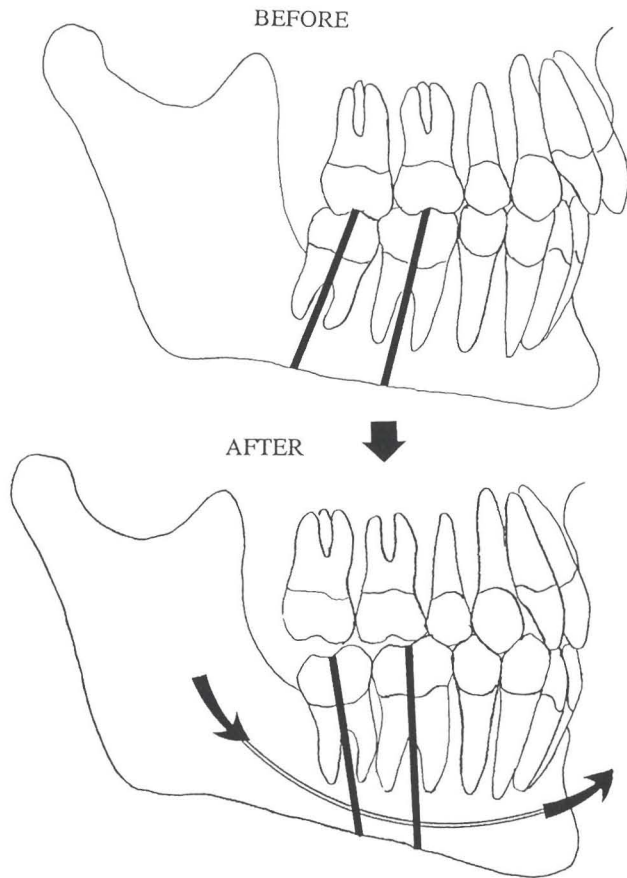


Figure 2. Hypothesis of mandibular growth; as the mandibular molars are uprighted distally, the mandible shows favorable growth in Class II cases. BEFORE: before treatment, and AFTER: after treatment.

1.9 degrees of standard deviation in the non-uprighted group as shown in Table 1.

Average initial ages of the uprighted and non-uprighted groups were ten years, eight months and eleven years, three months, respectively. Treatment terms for the uprighted and non-uprighted groups were three years, ten months and three years, five months, respectively. There were no significant differences between the two groups in the initial and posttreatment ages and its interval term (Table 1).

The maxillary position (SNA) of the two groups at the initial and posttreatment visits was similar to that shown in Table 1. Both groups showed a reduction of point A during the treatment. There were also no differences among groups in cant of nasal floor at initial, posttreat-

ment, and their changes. Regarding mandibular position (SNB), the only difference between the uprighted and non-uprighted groups was the treatment change ( $P < 0.05$ ). The uprighted group showed more forward movement of the mandible than the non-uprighted group ( $p < 0.05$ ). The mandibular plane closed more in the uprighted group than in the non-uprighted group ( $P < 0.01$ ). Both groups showed equal improvement in the anteroposterior skeletal relationship (ANB). Occlusal plane (Occ to FH) did not change much in the two groups. The maxillary first molars showed more tipping in the uprighted group of the mandibular first molars than in the non-uprighted group.

There were significant correlation coefficients between L6-FH and Mp-FH ( $p < 0.001$ ), L6-FH and ANB ( $p < 0.05$ ), and L6-FH and U6 to FH ( $p < 0.01$ ) as shown in Table 2.

## DISCUSSION

The mandibular plane showed significantly more counterclockwise rotation in the uprighted samples than in the non-uprighted ones in the present study. SNB also showed significantly more increase in the uprighted than in the non-uprighted samples. The uprighting of the mandibular first molar appears to cause, therefore, counterclockwise rotation of the mandible and stimulates mandibular forward growth during the Class II treatment, resulting in significant improvement of the anteroposterior jaw relationship (ANB). There was a significant correlation coefficient between the uprighted degree of the mandibular first molars and the degree of clockwise rotation of the mandibular plane to FH.

These data suggest that the uprighting of the mandibular first molars had a favorable effect on the mandibular plane angle (counterclockwise rotation) and forward movement of the mandible. Moreover, the large amount of uprighting may have served to unlock the interdigitation, thereby allowing Class II mechanics to effect the forward movement of the mandible. Another possible source of stimulation of mandibular growth may be in the fact that direction of the chewing force on the mandibular molars changes anteriorly, in accordance with the uprighting of those teeth.

It is clear from the data that uprighting of mandibular molars causes counterclockwise rotation of the mandible and stimulates mandibular forward growth during the Class II treatment. It is suggested, therefore, that the mandibular molars be tipped backward, especially in the initial phase of Class II treatment.

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## ATTITUDES TO DENTAL PAIN AND CONTROL

Women appeared to be at a greater disadvantage than men in their perceived ability to cope with the dental situation. Their greater desire for control but lower perception of actual control is likely to create psychological tension. Older subjects, on the other hand, were shown to be better able than their younger counterparts to cope with dental visits in that they desired less control and felt more in control, making expectation and experience synchronous.

In conclusion, we were able to demonstrate that attitudes to dental pain and dental control have some gender and age specificities. The individuals in our sample were older and better educated than the general population from which they came. Dental anxiety was measured on a continuum of problematic fear to the intensity akin to the level found in some clinical samples. However, no-one was clinically diagnosed as odontophobic. Nevertheless, we feel that the overall dental anxiety levels and the relationship between age and gender with fear of pain and desire for control are valid and that the sample biases do not deter substantially from accepting the generality of our findings. We are unable to say from this study whether the attitudes in question are caused by dental experiences but are able to say that an understanding of cognitive factors would help dentists and psychologists alike in the management of dentally anxious individuals. Knowing about the occurrence of painful experiences alone without knowing how they were internalized can only remain of limited value.

Liddell, A. and Locker, D.: Gender and age differences in attitudes to dental pain and dental control.

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# Effect of acid-etching on fluoride-treated caries-like lesions of enamel: A SEM study

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**A**cid etching of enamel is a means to increasing its surface porosity, while maintaining its integrity. The surface morphologies of sound enamel and of early white-spot enamel were observed to be very similar, hence the effects of acid-etching of enamel lesions could be expected to be similar to those seen with sound enamel. Reports have shown that acid-etching used in conjunction with fluoride will allow a more rapid rate of remineralization due to the presence of microporosities.<sup>1</sup> If true, it is conceivable that the caries lesions of enamel could benefit from the caries-resistant characteristics of fluoride treatment and sealant placement. The present study was undertaken to evaluate the effect of acid-etching on surface topographies of caries-like lesions of enamel (white spots) treated with fluoride. The scanning electron microscope (SEM) was used to study this effect with respect to the etching patterns produced and the suitability of those patterns for resin-bonding, based upon morphological characteristics.

## MATERIALS AND METHODS

Sixty healthy premolars extracted for orthodontic purposes were collected from children with an average age of fourteen years. All the teeth were examined under the magnifying lens to exclude the possibility of any developmental

defect, and then cleaned and polished with pumice paste and rubber cup, using a slow speed handpiece.

An acid-resistant varnish was applied to each tooth, leaving windows of 4 mm<sup>2</sup> of sound enamel on the buccal and lingual surfaces. Caries-like lesions were created in sound enamel, by exposing each test surface to 3 ml of a demineralizing solution containing acidified gelatin gel at 37°C for twenty-four days. The solution was changed twice weekly. The sample was divided into two main groups, control and experimental, each consisting of thirty teeth. The teeth in the control group were assigned to three subgroups in equal numbers and treated with 20 percent phosphoric acid for 30, 60 and 120 seconds, respectively. The experimental group was divided similarly; but before etching with phosphoric acid for the various time durations, the teeth were treated with 0.4 percent acidulated phosphate fluoride (APF) for a single four-minute application. This concentration of APF was chosen, because from an earlier study we found it as effective as 1.23 percent APF.<sup>2</sup> The fluoride application was followed by sixty-second rinses in distilled water, to remove any readily soluble reaction product. All teeth of both the control and the experimental groups were washed with distilled water for sixty seconds, followed by drying with a gentle stream of compressed air for sixty seconds. The topography of all teeth in the sample were examined under SEM by mounting the specimen on metallic stubs, using silver paste, which served as a vacuum-resistant adhesive exposing buccal and lingual surfaces alternatively. They were placed in the vacuum chamber of SEM; the voltage, angle, and ap-

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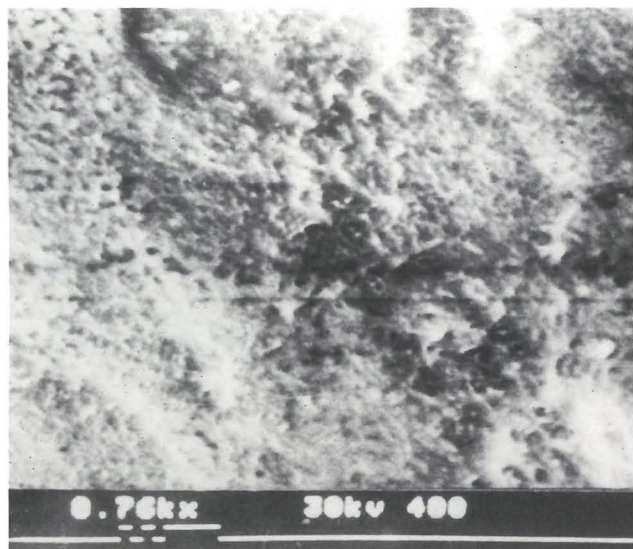


Figure 1. Normal enamel under SEM.

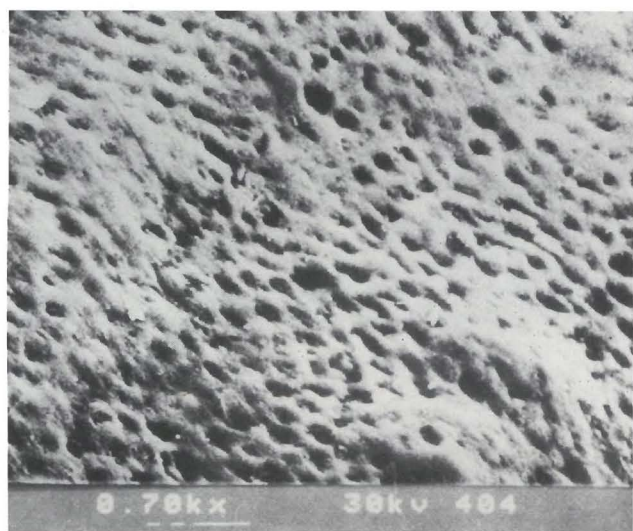


Figure 2. Enamel after demineralization.

erture were adjusted and the surface was scanned at different magnifications. Topographic details were photographed and the etch-patterns noted, based on the study by Silverstone *et al.*<sup>3</sup>

## RESULTS AND DISCUSSION

Topographic details of normal enamel are seen in Figure 1. Caries-like lesions of enamel after demineralization

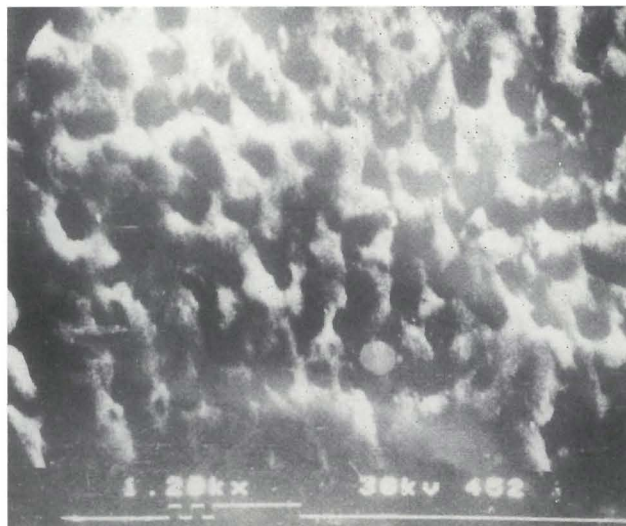


Figure 3. Enamel after APF application.

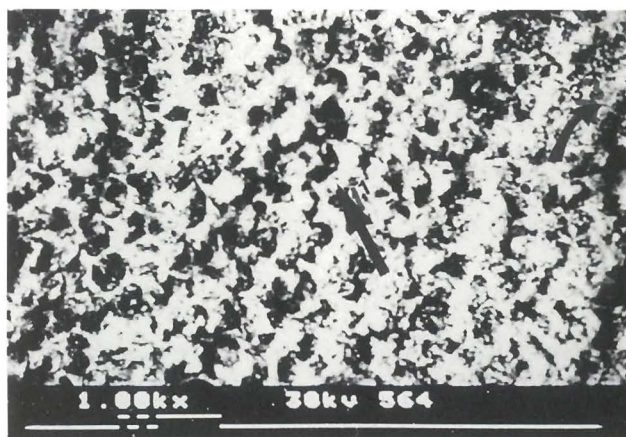


Figure 4. Enamel etched for thirty seconds with phosphoric acid. Arrow 1 shows type I etch-pattern. Arrow (3) shows type III etch-pattern.

resemble somewhat the pattern in sound enamel, except they have a slightly larger pore volume (Figure 2). The surfaces of lesions were indistinguishable from sound enamel, being relatively smooth and free of defects. Surface coatings were observed in caries-like lesions treated with APF and rinsed with deionized water, but not etched (Figure 3).

The surface morphologies of acid-etched lesions varied according to the etching times. Caries-like lesions etched for thirty seconds demonstrated slightly roughened surface morphologies with loss of prisms resem-





Figure 5. Enamel etched for sixty seconds with phosphoric acid. Arrow (1) indicates type I etch-pattern. Arrow (right) shows type III etch-pattern.

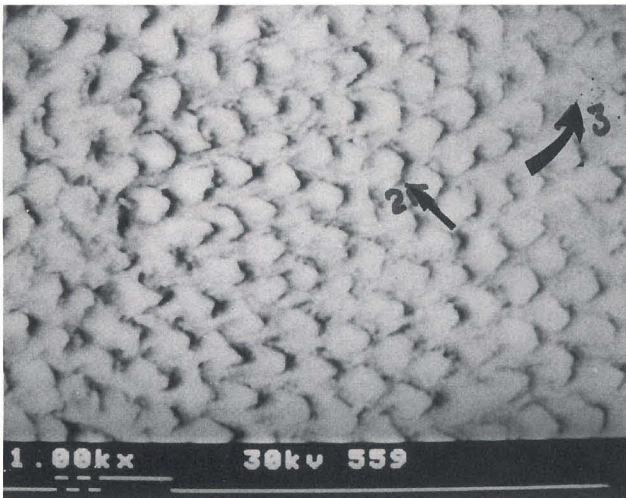


Figure 6. Enamel etched for 120 seconds with phosphoric acid. Arrow (2) shows type II pattern and Arrow (3) shows type III pattern.

bling the type III pattern described by Silverstone.<sup>3</sup> When the etching time was increased to sixty seconds, a distinct type I etching pattern was observed in the major portion of the lesion and type III in the localized area. The typical type II etching pattern was observed when the etching time was 120 seconds (Figures 4,5,6).

According to Hicks *et al*, creating of etching patterns type I and type II suggests two possible methods of treatment for the early white spots.<sup>4</sup> Firstly, in clinically

Table 1 □ Pattern of etching observed in experimental and control groups.

Groups	Type I	Type II	Type III
<i>Control group</i> (20% phosphoric acid)			
30 seconds	±	-	++
60 seconds	++	-	±
120 seconds	-	++	±
<i>Experimental group</i> (0.4% APF + 20% phosphoric acid)			
30 seconds	±	-	++
60 seconds	++	-	±
120 seconds	-	++	±

± present in few isolated areas  
 - not present  
 ++ present as predominant pattern in majority of the areas

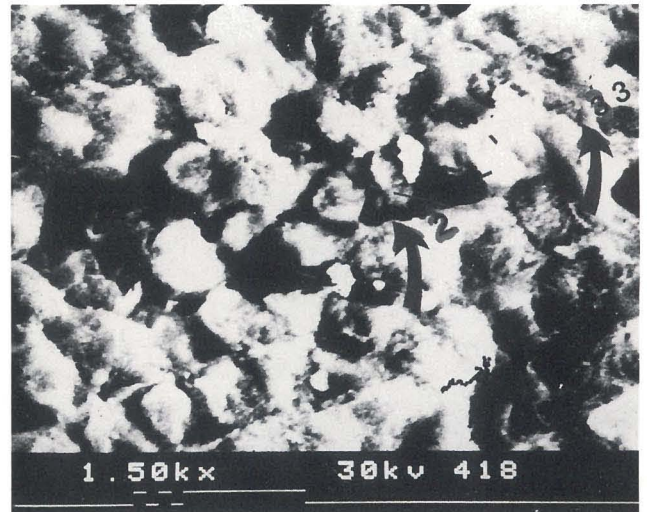


Figure 7. Enamel etched for thirty seconds after 1.23 percent APF application. Arrow (3) indicates type III etch-pattern and Arrow (2) type I etch-pattern.

accessible areas, white spots could be etched for 60-120 seconds, and sealed with resins that will prevent further progression of the lesion. A second mode of treatment involves creation of a more porous surface with minimum surface loss. It was observed that etching of a white spot (caries-like lesion) with 20 percent phosphoric acid for thirty seconds produced a type III pattern that has a relatively porous surface and could provide a more reactive surface for treatment with remineralization fluids, and perhaps enhance the rate of remineralization (Table 1).

Prior treatment of the enamel with APF results in the surface appearing more porous, due to the acidity of APF. A surface coating composed of numerous small

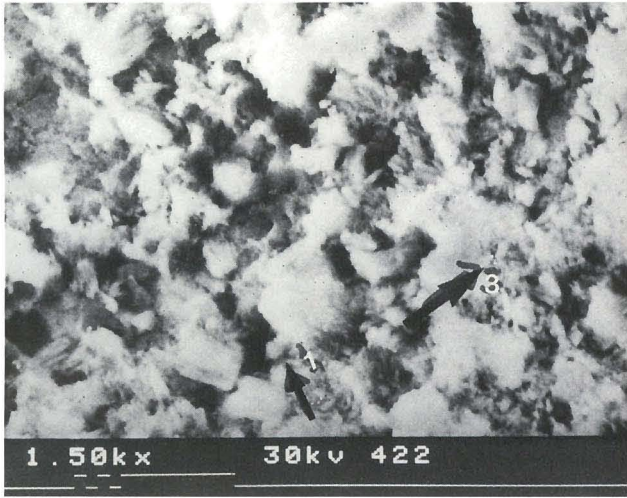


Figure 8. Enamel etched for thirty seconds after 0.4 percent APF application. Arrow mark (3) shows type III and Arrow (1) shows type I etch-pattern.

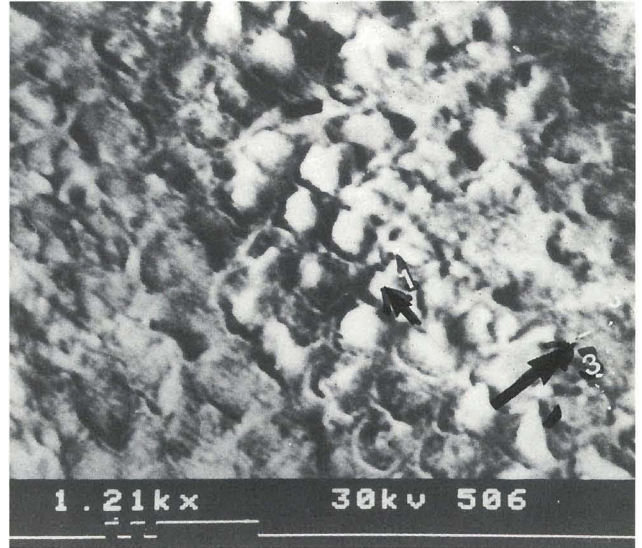


Figure 10. Enamel etched for sixty seconds after 0.4 percent APF application. Arrow (1) shows type I etch-pattern and Arrow (3) shows type III etch-pattern.

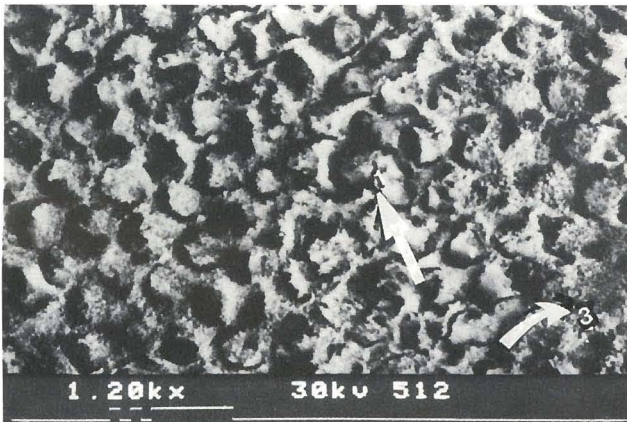


Figure 9. Enamel etched for sixty seconds after 1.23 percent APF application. Arrow (1) shows type I etch-pattern and Arrow (3) shows type III etch-pattern.

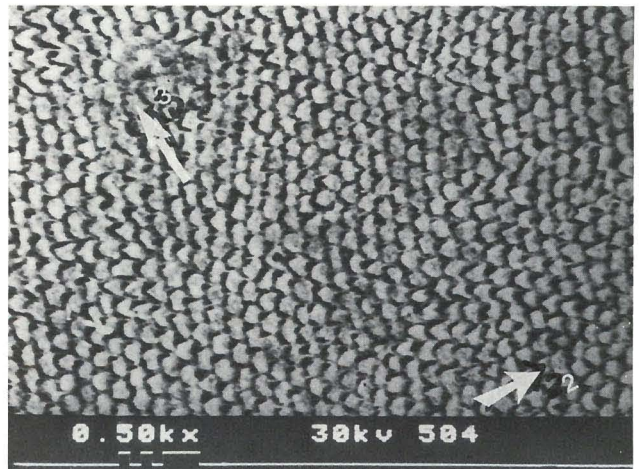


Figure 11. Enamel etched for 120 seconds after 1.23 percent APF application. Arrow (2) indicates type II and Arrow (3) indicated type III etch-pattern.

globules representing calcium fluoride spheres also appears. In the present study, caries-like lesions that were exposed to APF were found to have similar surface topographies.

APF-treated lesions etched with 20 percent phosphoric acid showed characteristic etching patterns similar to those reported by Silverstone and Retief in sound enamel (Figures 7-12).<sup>3,5</sup> Spherical products suggestive of calcium fluoride were found partially obscuring the etched enamel prisms on lesion surfaces etched for 30

seconds and 120 seconds. This type of surface coating may provide a protective function by allowing for incorporation of fluoride into the lesion, acting as a diffusion barrier, reducing enamel solubility, and acting as reservoirs for fluoride-rich reaction products.

When etched with 20 percent phosphoric acid alone (control group), small sized pores at all etching times

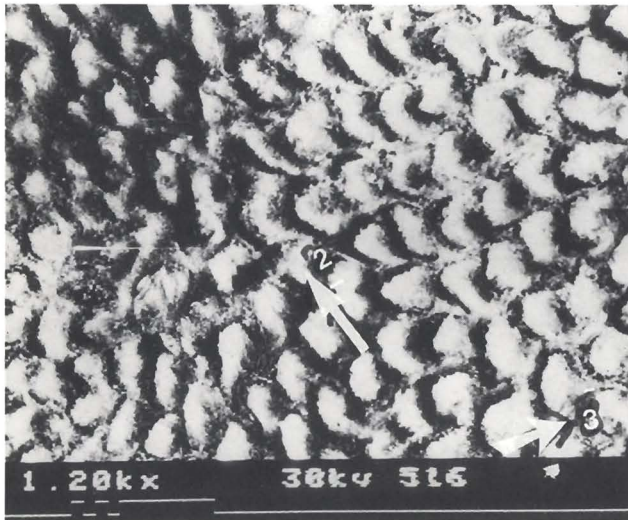


Figure 12. Enamel etched for 120 seconds after 0.4 percent APF application. Arrow (2) type II etch-pattern and Arrow (3) type III etch-pattern.

were observed; whereas in the APF treated teeth, when etched with phosphoric acid, an increase in size of pores was observed (Table 2). This might have been due to the etching already caused by phosphoric acid present in APF. This is evidence that etching with 20 percent phosphoric acid produces effective etch-patterns on APF treated teeth.

Recently an ultrastructural study showed that the internal morphology of the surface zone, following acid-etching, resulted in the creation of funnel-shaped structures that extend from the lesion surface for a considerable distance. In the present study it appears that remineralization was limited to the superficial aspect of the body of the lesion and a surface zone occurred due to incorporation of reaction products available from a surface coating. The etching solution must have acted as a carrier for calcium phosphate and fluoride from surface coating and etched zone.

The present findings suggest acid-etching of APF treated lesions may allow a more rapid rate and increased degree of remineralization, due to the presence of microporosities and increased fluoride levels in the lesions. Prior to sealant application, fluoride may make a lesion more suitable for the placement of resin follow-

Table 2 □ Distribution of samples according to the size of pores at different durations with 20 percent phosphoric acid in control and experimental groups.

Etchant	Duration of etching in seconds	No. of samples	Size of pores		
			+	++	-
<i>Control group</i>					
20% phosphoric acid	30	10	10	0	0
	60	10	10	0	0
	120	10	10	0	0
<i>Experimental group</i>					
0.4% APF + 20% phosphoric acid	30	10	2	8	0
	60	10	0	10	0
	120	10	0	10	0

Score + Denotes surface roughened with small size pores.  
 Score ++ Denotes surface roughened with large size pores.  
 Score - Denotes surface not significantly roughened without any visible pores.

ing acid-etching, and it may also be possible to arrest the progression of the lesion. Sealing of the fluoride lesion with the resin sealant may isolate the lesion from a cariogenic environment and produce a stable mineral phase, due to prolonged action of fluoride with the phosphate and calcium.

Although the results of the present study are quite encouraging, they emphasize the need for clinical investigation to avail the benefit of continued utilization of relatively low levels of topical fluoride at regular intervals, in order to prevent dental caries.

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# DEMOGRAPHICS

## Children of divorce

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

A child in a single-parent situation was about as likely to be with a parent who had never been married (36. . . percent) as with a parent who was divorced (37 . . . percent) in 1994. Another 23. . . percent lived with a parent who was separated from their spouse because of marital discord or some other reason.<sup>1\*</sup>

A seeming unending stream of reports in the lay and professional literature have emphasized:

- The increasing proportion of children born to unwed mothers (Table 1).
- The decline (since 1960) in the proportion of children living with two parents—particularly in minority population families (Figure). (Note: Bureau of the Census reports for two-parent families do not differentiate between biological, step or adoptive parents.) Between 1970 and the mid-1990s, this proportion decreased from 85 percent to 69 percent. In 1994, 27 percent of children lived with one parent (up from 12 percent in 1970). The majority of these children (88 percent) lived with their mother, but an increasing percent lived with their father (9 percent in 1970, 12 percent in 1994).<sup>\*\*</sup>

Limited attention, however, has been directed in the dental literature to the emotional, economic and associated consequences of divorces on the:

- More than one million children involved in the over 1.1 million annual divorces.<sup>4</sup>
- More than 5.8 million children, who as a result of a divorce, live in single-parent families with only a mother present.
- Almost 1.1 million children, who as a result of a divorce, live in single-parent families with only a father present (Table 2).

In an effort to provide a general introduction to the children of divorce, the following presentation will

- Review the numbers of children involved in divorces in different single-parent population groups.
- Emphasize the emotional impact of divorce on children.
- Consider the potential significance for pediatric dental practices.

### CHILDREN IN DIVORCED FAMILIES

#### Number

In 1994, approximately 1.5 million children less than six years of age, 2.5 million children six through eleven years of age and 3.0 million children between twelve and seventeen years of age lived in single-parent divorced families (four out of five families where only the mother was present). More than two-thirds (68 percent) were white nonHispanics, 19 percent were African-Americans

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\*Unless specifically noted, statistical data for this presentation were drawn from the Bureau of the Census extensive 1996 report on marital status and living arrangements.<sup>1</sup>

\*\*For detailed review of changing family living arrangements, see a previous presentation in the *Journal of Dentistry for Children*<sup>3</sup>

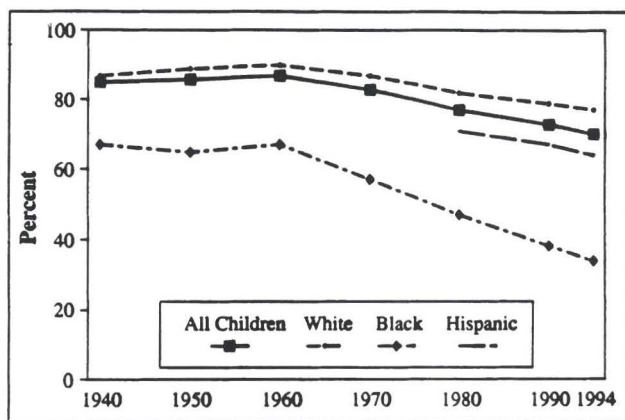


Figure. Percent of children with two parents in household: 1940-1994.<sup>2</sup>

and 10 percent were Hispanics (may be of any race) (Table 2).

- Mother-only divorced families had an average of 1.3 children less than six years of age and 1.2 chil-

dren less than eighteen years of age, compared to 1.0 children less than eighteen years of age in father-only divorced families. On average, minority divorced families included more children than non-minority divorced families (Table 3).

- There were two to three times more children in metropolitan than nonmetropolitan areas in both female and male parent divorced families (for both minority and nonminority populations) (Table 4).

### Income

Father-only divorced families had median incomes 1.5 times to almost double the income of mother divorced families (Table 5).

- More than half (53 percent) of female-only divorced families with children less than six years of age, and 38 percent with children less than eighteen years of age, lived in poverty, including more minority families than nonminority families.
- The rates of father-only divorced families living in poverty were half that of mother-only divorced

Table 1 □ Proportion of children in single-parent situations living with a separated, divorced or never married parent: selected years 1960-1994.<sup>1</sup>

	Children living with		
	Separated parent	Divorced parent	Never married parent
1960	27.6%	23.0%	4.2%
1970	30.3	30.2	6.8
1980	26.7	42.4	14.6
1990	20.3	38.6	30.6
1994	18.4	37.0	35.8

Table 2 □ Number of children in divorced families by age of child(ren), race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

Living arrangement	Age			
	< 6 yrs	6-11 yrs	12-17 yrs	Totals < 18 yrs
<b>White</b>				
Mother only	.93	1.66	1.88	4.47
Father only	.19	.28	.40	.87
<b>African American</b>				
Mother only	.22	.39	.53	1.14
Father only	.07	.04	.04	.15
<b>Hispanic*</b>				
Mother only	.12	.23	.23	.58
Father only	.02	.04	.04	.11
<b>White, not Hispanic</b>				
Mother only	.81	1.44	1.67	3.93
Father only	.17	.24	.36	.77
<b>Totals</b>				
Mother only	1.17	2.14	2.49	5.80
Father only	.27	.34	.47	1.08

Note: Totals differ due to rounding and include "other" races. All numbers in millions.

\*May be of any race.

Table 3 □ Mean number of children in divorced families by age, race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

	Mother only		Father only
	< 6 yrs	< 18 yrs	< 18 yrs
White	1.14	1.15	.92
African-American	1.50	1.59	.92
Hispanic*	1.62	1.46	1.26
White, not Hispanic	1.07	1.10	.87
Totals	1.31	1.23	1.01

\*May be of any race.

Table 4 □ Number of children in divorced families by residence, race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

	Mother only		Father only	
	Metropolitan areas	Non-metropolitan areas	Metropolitan areas	Non-metropolitan areas
White	3.3	1.2	.6	.2
African-American	.9	.2	< .1	< .01
Hispanic*	.5	< .1	< .1	< .1
White, not Hispanic	2.8	1.1	.6	.2
Totals	4.4	1.4	.8	.3

Note: Numbers are in millions.

Totals differ due to rounding.

\*May be of any race.

Table 5 □ Median income of divorced families with children by age of child(ren), race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

	< 6 yrs		< 18 yrs	
	Mother only	Father only	Mother only	Father only
White	\$12,293	\$23,304	\$18,916	\$27,758
African-American	9,744	na	13,125	23,372
Hispanic*	9,739	na	12,244	23,166
White, not Hispanic	12,989	23,591	19,552	28,280
Totals	\$11,775	\$21,532	\$17,951	\$26,604

\*May be of any race.

Table 6 □ Percent of divorced families with children with incomes below the poverty level by age of child(ren), race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

	< 6 yrs		< 18 yrs	
	Mother only	Father only	Mother only	Father only
White	50.5%	16.5%	35.2%	11.1%
African-American	62.6	na	48.0	31.4
Hispanic*	71.3	na	53.2	19.9
White, not Hispanic	47.6	17.5	32.8	10.2
Totals	52.7%	23.8%	37.6%	15.0%

\*May be of any race.

Table 7 □ Percent of divorced parents not in labor force by age of child(ren), race, Hispanic origin and living in single-parent arrangements: 1994.<sup>1</sup>

	< 18 yrs	
	Mother only	Father only
White	22.9%	9.8%
African-American	26.9	19.5
Hispanic*	36.5	14.8
White, not Hispanic	21.1	9.3
Totals	23.7%	12.2%

\*May be of any race.

Table 8 □ Divorced persons 18 years of age and older: 1970, 1994.<sup>1</sup>

	Number		Percent	
	1970	1994	1970	1994
White	3.7	14.5	3.1%	9.1%
African-American	.6	2.3	4.4	10.8
Hispanic*	.2	1.3	3.9	7.5
Total	4.3	17.4	3.2	9.1

\*May be of any race.

families (Table 6).

- Almost one quarter (23 percent) of mothers and 12 percent of fathers in single-parent divorced families were not in the labor force (Table 7).

### An increasing problem

If "what's past is prologue" then the number of children affected by divorce may well continue to increase in the future. For example,

- Between 1970 and 1994, the number of divorced persons (eighteen years and over) increased from 4.3 million to 17.4 million persons (an increase from 3.2 percent of 9.1 percent of the population) with the white population reporting the greatest rate of increase (about a three-fold increase) (Table 8).
- In the more recent past, between 1990 and 1994, the number of divorced persons increased by more than eight million.

### Summary

Divorcees and children of divorce are (and apparently will continue to be) an all pervasive reality in our communities.

### IMPACT ON CHILDREN

There is evidence that, relative to children from intact families, children of divorced families display greater adjustment problems, such as anxiety, depression, non-compliance, aggression, and academic difficulties.<sup>5,6</sup> Frequently cited child personality characteristics include, guilt (the child perceives his/herself as the cause of the family breakup), decreased sociability, increased withdrawal and decreased self-confidence.<sup>7</sup>

The degree of emotional trauma that the child may face during or after the parental divorce is related to:

- Personality of both parents.
- Quality of the relationship between the child and the parents.
- Parenting styles.
- The general resilience of the child.<sup>8</sup>

Children ages eight to thirteen years tend to show the strongest reactions to information about their parents' divorce.<sup>9</sup>

In addition, compared to married mothers, divorced mothers may provide less stimulation and less intimate support for their children.<sup>10</sup> Divorce, however, does not necessarily have harmful effects on all children, nor are all single-parent families "broken" or somehow "doomed" to develop problems for children, engendering guilt,

thereby, in divorcing parents.<sup>11,12</sup> Some of the variables that appear to explain differences in the adjustment to divorce include:

- Age of the child at the time of divorce.
- Gender of the child.
- Parent's and children's social support network in the general family and among social acquaintances.
- Relationship between the child(ren) and parent with whom they live.
- Instability of the postdivorce environment.
- Parental adjustment after the divorce.
- Continuing relationship with the parent with whom the child(ren) do not live.<sup>13,14</sup>
- Interparental conflict and "using" children in the process.<sup>13,15,16</sup>
- Changes in the standard of living.<sup>13</sup> Parental pre- and postdivorce relationships can have significant effect on maintaining necessary financial support for the child. Difficulties arise most often when fathers see themselves as victims of their wives and of the social and legal system that supports wives/mothers at the expense of husbands/fathers associated with the ward of custody.<sup>17</sup>

Changes in marriage and child-rearing have different consequences for women and men. For women, marriage and parenthood are distinct institutions. Women provide for children's needs, whether or not the women are married to their children's father. For men, marriage defines responsibilities to children. At divorce, men typically disengage from their biological children. When men remarry they may acquire new children whom they help to support.<sup>18</sup>

"... (If child support (court) orders were established for all children with living non-custodial fathers and these orders were fully enforced, aggregate child support payments would have been \$47.6 billion in 1990. . . ."<sup>19\*\*\*</sup>

In actuality, only \$13.9 billion were collected, resulting from

- Lack of enforcement.
- Inadequate awards that did not reflect changes over time in the ability of the parent to make payments.
- Custodial parents that did not have legal child support awards.<sup>19\*\*\*</sup>

### Stepfamilies

Further difficulties may arise as a result of increasing

numbers of children living in stepfamilies. The majority of such children are living with their biological mothers and a stepfather. When compared to children from non-divorced families, they are over-represented amongst the numbers of children manifesting social, emotional and behavioral problems. Many of the children report that they feel less affection and warmth from their mothers than do children from nondivorced families.<sup>21</sup>

### Adopted children

Is there a difference in the reaction by biological and adopted children to parental separation and divorce? There are some indications that the stress associated with marital disruption are comparable for both populations of children.<sup>22</sup>

### Minorities

Most studies of separation have been conducted with white middle class samples. But African-American parents separate at a higher rate than any other group in this country and are less likely than white parents to remarry following divorce.<sup>23-25</sup>

Yet the few empirical reports on separation and divorce in African-American families consider the reality that African-American mothers and children may adjust more successfully to life in single-parent families than white women and their offsprings.<sup>26</sup>

### Homosexual and transsexual families

One major concern of family courts charged with assessing the fitness of homosexuals and transsexuals to parent (in both divorce and nondivorce cases) is whether a child will suffer emotional distress as a result of an increased likelihood of psychopathology from such factors as: social stigmatization, peer rejection and decreased parent-child interaction as a consequence of his/her parent's sexual orientation. Questions continue to be raised regarding the differences in children reared by divorced or never married homosexuals and transsexual parents.<sup>27,28</sup>

### IMPACT ON PEDIATRIC DENTAL PRACTICE

Considering the millions of youngsters involved, surely all pediatric dental practitioners have provided services to children from families that have experienced separation and/or divorce. In many instances, the forwarding

\*\*\*See a previous presentation in the *Journal of Dentistry for Children* for further details on the inadequacy of child support payments.<sup>20</sup>

of billings to an absent parent may have been the sum total of the awareness of a family breakup. In other cases, financial problems may have arisen with the changed economic status of the custodial parent.

But how many times have you noticed a new child to your practice who exhibits signs of "anxiety, depression, noncompliance or aggression" or a returning patient who for no apparent reason presents similar signs and symptoms? Reference to this returning patient's chart (completed only six months or a year earlier) presents no obvious reasons for the transformation from that of compliant, receptive and friendly youngster to the "changed" difficult child. It is all too easy to assume that the problem lies with the dental procedure or some associated set of conditions, rather than with the developments in the living condition of the family.

The training in most dental schools and graduate programs emphasizes the necessity of in-depth and complete medical histories before treatment is begun. Family settings and conditions often are considered (if at all) in a rather perfunctory manner, including such items as the number of siblings, noteworthy medical conditions in the family, phone numbers of persons to be contacted in case of an emergency, etc.

How often do you consider the family living arrangements of the youngster you treat (except to ask about home care follow-up) and the potential impact on the child's development and personality—and by extension, your ability to provide care?

Successfully treating any patient requires the continuing balance of technical abilities with personal relationships, understanding, communication and any number of other intangibles. Most dentists acknowledge this balancing act with a passing nod during their years of formal dental education and during practice. But the treatment of children demands a significantly greater appreciation of factors that impact on a child's development. Surely an awareness of a family separation and/or divorce and an understanding of the potential consequences for the involved child must be a significant component of a pediatric dentist's armamentarium.

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# Minority children in single-parent families

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

“**I**n 1970, 12 percent of all children lived with one parent; by 1995, 27 percent did.”<sup>1</sup> The increasing numbers of single-parent families, the growing diversity of family structures and seeming “disappearance” of the “typical family” in which most middle-age and older dentists were raised has been emphasized repeatedly in the *Journal of Dentistry for Children*.<sup>2-4</sup>

In an effort to document these many changes in family structure, the Bureau of the Census is producing indepth reports in its Current Population Series, which provides a view of single-parent families, with particular emphasis on the demographics of both parents and children.<sup>5-7</sup>

The following presentation will highlight some of the developments in single-parent families in an effort to provide pediatric dentists with a greater understanding of the families within which increasing numbers of their patients are (and will be) raised. The emphasis in this report will be on the variations by race and ethnicity, in line with, “A new report by the Census Bureau (which) documents explosive growth in the nation’s Hispanic population and projects that by the year 2005 Hispanic-Americans will surpass blacks as the largest minority.”<sup>1</sup>

## HOW MANY CHILDREN LIVE WITH SINGLE PARENTS?

In 1995, almost 19 million children lived in single-parent families—16.4 million in mother-only families and 2.5 million in father-only families.

Mother-only families included:

- 16 percent of all white children.
- 52 percent of all African-American children.
- 28 percent of all Hispanic children.\*

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\*Throughout this presentation, the category “Hispanic” includes individuals of any race. The category “white” does not include individuals who are within the “Hispanic” category.

Father-only families included:

- 3 percent of all white children.
- 4 percent of all African-American children.
- 4 percent of all Hispanic children (Table 1).

“Rising divorce rates and the delaying of first marriages among adults are two of the major factors contributing to the growing proportion of children in one-parent living arrangements.”<sup>7</sup>

## Preschool children (less than six years of age)

The majority of the 2.4 million African-American and 1.3 million Hispanic younger children in single-parent families lived with mothers or fathers who were never married.

- African-American children: the parents of 69 percent of children in father-only families and 73 percent of children in mother-only families were never married.
- Hispanic children: the parents of 80 percent of children in father-only families and 54 percent of children in mother-only families were never married.\*\*

Smaller proportions of the 2.8 million white children in single-parent families lived with mothers or fathers who never married (48 percent of children in father-only families and 41 percent of mother-only families) (Table 2).

## Grade school children (6 to 11 years of age)

A significantly lower proportion of grade school age children in single-parent families lived with mothers or fathers who never married (ranging from 10 percent of white father-only families to 53 percent of African-American mother-only families) (Table 2).

\*\*Because of the predominance of children in mother-only, single-parent families, the emphasis in a number of sections of this report will be on these single-parent families.

Table 1 □ Number and percent of children (less than 18 years) living in single-parent families by race and ethnicity: March 1995.<sup>5</sup>

	Age						Totals <18 yrs
	< 1 yr	1 & 2 yrs	3-5 yrs	6-9 yrs	10-14 yrs	15-17 yrs	
<b>Number of children in single-parent families (in 000s)</b>							
White	401	931	1,487	1,964	2,594	1,598	8,975
African-American	358	838	1,245	1,322	1,682	894	6,339
Hispanic	215	417	648	643	840	414	3,215
Totals*	998	2,279	3,450	4,040	5,215	2,958	18,938
<b>Percent of all children in Mother-only families</b>							
White	12.7%	15.5%	15.2%	15.9%	16.6%	16.8%	15.9%
African-American	57.2	55.2	57.1	48.5	50.4	49.9	52.1
Hispanic	28.6	28.5	30.8	26.5	28.5	27.8	28.4
<b>Percent of all children in Father-only families</b>							
White	3.1	2.6	3.2	2.8	3.2	4.4	3.2
African-American	2.3	5.8	3.8	3.9	4.5	2.9	4.1
Hispanic	5.0	5.1	3.1	3.9	4.9	3.8	4.2
<b>Total percent of all children</b>	<b>25.9%</b>	<b>28.0%</b>	<b>27.7%</b>	<b>25.9%</b>	<b>27.0%</b>	<b>27.2%</b>	<b>26.9%</b>

\*Includes other races not listed separately.

### Increasing age of children (through 14 years of age)

As children aged:

- For all racial and ethnic groups, the proportion of children living in single-parent families with mothers or fathers who never married decreased significantly, particularly for white and Hispanic families.
- The proportion of children in "spouse absent" single-parent families remained constant for white and Hispanic families (about 1 in 5 children), but increased from approximately 5 percent to 28 percent in African-American families.
- For all groups, the proportion of children in divorced single-parent families increased, particularly for white children (reaching two-thirds in the 10-14 age-group) (Table 3).
- For all groups, there was a progressive decrease in the proportion of children living in single-parent families with a grandmother as the head of the household (Table 4).

There were limited differences in the ratio of male and female children of all ages living in mother-only, single-parent families and for young children (less than 6 years) living in father-only, single-parent families. Among older children in father-only families, there was a greater proportion of male children in father-only, single-parent families (Table 5).

### FAMILY DEMOGRAPHIC

Children living with one parent are likely to grow-up in circumstances far different from children living with two parents. Children living with one parent are less likely:

- To be in a home with an educated and employed parent.
- To be in a family with an income that is well above the poverty level.
- To be in an owner-occupied housing unit.<sup>6</sup>

Almost the same number of children (less than 18 years) lived in mother-only, single-parent families, where either mothers were never married or were divorced (5.9 million and 6.0 million). 1.2 million children lived with divorced, single-parent fathers and .7 million children lived with never-married fathers. When this distribution is considered by race and ethnicity, however, there are significant differences. A greater proportion of white children lived in single-parent divorced families, while a greater proportion of African-American and Hispanic children lived in never-married, single-parent families.

	Divorced (in millions)	Never- married
White	3.9	1.5
African-American	1.2	3.3
Hispanic	.8	1.0

Table 2 □ Living arrangements of children less than 12 years of age by race and ethnicity: March 1995.<sup>5</sup>

	Less than 6 years			6-11 years		
	White	African-American	Hispanic	White	African-American	Hispanic
	Number (in 000s)					
Total living with one or both parents	15,338	3,611	3,767	15,322	3,353	2,996
<u>Mother-only family</u>	2,351	2,270	1,157	2,539	1,832	825
Never married	970	1,663	622	353	980	255
<u>Father-only family</u>	468	177	159	452	157	133
Never married	225	123	127	47	62	47
	Percent					
<u>Mother-only family</u>						
(Percent of all children)	15.3	62.9	30.7	16.5	54.6	27.5
Never-married						
(Percent of mother-only family)	41.3	73.2	53.7	13.9	53.5	30.9
<u>Father-only family</u>						
(Percent of all children)	3.1	4.9	4.2	0.3	1.8	1.6
Never-married						
(Percent of father-only family)	48.0	69.4	79.9	10.4	39.4	35.3

Table 3 □ Percent of children (less than 15 years) living with mother-only, single-parent families by marital status, race and ethnicity: March 1995.<sup>5</sup>

	Age				
	< 1 yr	1&2 yrs	3-5 yrs	6-9 yrs	10-14 yrs
<u>Never married</u>					
White	66.4%	53.4%	26.7%	15.8%	8.3%
African-American	84.9	77.9	66.8	57.1	41.2
Hispanic	62.8	56.2	49.2	32.2	23.0
<u>Spouse absent</u>					
White	20.1	20.8	27.6	26.2	21.5
African-American	5.5	10.8	17.6	19.1	27.8
Hispanic	20.1	20.8	27.6	26.2	21.5
<u>Divorced</u>					
White	13.3	24.8	42.9	54.4	64.4
African-American	9.5	10.3	13.5	20.8	24.1
Hispanic	9.8	11.1	20.9	34.8	36.7

Note: In almost all instances, children living with widowed mothers represented less than 5 percent of single-parent, mother-only families.

Consider some of the differences between white, African-American, and Hispanic children (less than 12 years) in never-married, single-parent families. African-American and Hispanic children:

- Had greater numbers of siblings in their respective households.
- Had a smaller percent of mothers who were less than twenty years of age.
- Had a smaller proportion of mothers who graduated from high school. Note: approximately 65 percent of African-American and 40 percent of Hispanic single-parent, never-married mothers were high school graduates. By contrast, 87 percent of all African-Americans and 57 percent of all His-

Table 4 □ Percent of children (less than 15 years) living in single-parent, mother-only families with grandmothers as head of household by race and ethnicity: March 1995.<sup>5</sup>

	Age				
	< 1 yr	1&2 yrs	3-5 yrs	6-9 yrs	10-14 yrs
White	40.7%	27.9%	13.4%	7.9%	3.9%
African-American	30.8	26.9	15.2	9.9	7.5
Hispanic	36.0	18.4	8.8	9.7	3.5

panics between twenty-five and twenty-nine years of age graduated from high school.<sup>7,8</sup>

- Had a smaller percent of mothers who were employed.
- Were more likely to live in inner city areas and in public housing.
- Had a lower mean and median family income. (The median income of single-parent, minority families ranged from \$8 thousand to \$10 thousand, compared to \$14 thousand for their white family counterparts.)
- Had a greater percent of families below the poverty level. (Approximately seven to ten African-American and Hispanic single-parent children lived in poverty, compared to about one-half of white children) (Table 6). Note: among all children, "...the overall poverty rate for related children under six years of age was 23.7 percent."<sup>7</sup>

"Children under 18 continue to represent a very large segment of the poor (40 percent) (sic) even though they make up only about one-fourth of the total population."<sup>7</sup>

Table 5 □ Percent of children (less than 18 years) by gender in single-parent families: March 1995.<sup>5</sup>

Gender of children	Mother-only families				Father-only families			
	< 1 yr	< 6 yrs	6-11 yrs	12-17 yrs	< 1 yr	< 6 yrs	6-11 yrs	12-17 yrs
<b>White</b>								
Male	46.5%	47.2%	50.1%	50.1%	50.6%	50.0%	60.8%	55.9%
Female	53.5	52.8	49.9	49.9	49.4	50.0	39.2	44.1
<b>African-American</b>								
Male	54.7	52.7	48.3	49.9	50.0	53.2	69.4	59.2
Female	45.3	47.3	51.7	50.1	50.0	46.8	30.6	40.8
<b>Hispanic</b>								
Male	48.1	49.8	49.5	52.8	46.8	50.3	57.1	46.8
Female	51.9	50.2	50.5	47.2	53.2	49.7	42.9	53.2

Table 6 □ Living arrangements of children (less than 12 years) with a single-parent, never-married mother by selected characteristics of parent: March 1995.<sup>5</sup>

	Less than 6 years			6-11 years		
	White	African-American	Hispanic	White	African-American	Hispanic
<b>Number of siblings in household</b>						
0-1	87.7	60.4	68.8	73.4	51.0	49.0
2-3	11.0	31.0	27.2	22.9	38.2	41.0
4+	1.3	8.6	4.0	3.7	10.7	10.0
Mean number of siblings	.52	1.38	1.14	.96	1.69	1.66
<b>Age of mother</b>						
Percent less than 20 years	18.9%	12.4%	13.5%	na	na	0.8%
<b>Education of mother</b>						
Percent less than 9th grade	3.9%	4.6%	23.2%	1.1%	1.9%	29.4%
Percent high-school graduates	70.6%	61.4%	39.9%	84.3%	67.7%	42.7%
<b>Mother employed</b>						
	51.9%	31.9%	27.7%	55.5%	43.6%	39.6%
<b>Family income</b>						
Mean income	\$23,520	\$14,156	\$16,521	\$20,626	\$14,784	\$14,422
Median income	\$13,811	\$7,939	\$9,643	\$14,414	\$8,636	\$9,956
Percent below poverty level	45.3%	71.6%	72.2%	47.4%	69.6%	65.1%
<b>Residence</b>						
Public housing	18.6%	39.9%	17.0%	20.4%	38.6%	28.6%
<b>Area of residence</b>						
Inside metropolitan areas	76.6%	85.0%	92.4%	79.9%	91.5%	94.5%
Inside central cities	28.1%	64.1%	54.5%	26.1%	72.4%	65.1%
Outside metropolitan areas	23.4%	15.0%	7.6%	20.1%	8.5%	5.5%

## SUMMARY AND COMMENTS

If there are "more obstacles for children living with single parent who's never been married," then the impediments for minority children in these circumstances seem almost insurmountable.<sup>6</sup>

The 1996 welfare reform legislation included a number of efforts to discourage teen pregnancies and single-parent families, including requirements that in order to collect welfare benefits, unmarried mothers (under age 18):

- Must live with an adult and attend school.
- Are required to work after two years of receiving benefits.

□ Must identify the father of the child(ren).†

Whether these efforts will stem the continued escalation in the number of never-married, single-parent families can only be determined in the future. But in the meantime, millions of children continue to be raised in family circumstances that jeopardize (or at least limit) their potential as adults. The reports in the news media tend to emphasize never-married, teenage mothers. There is limited attention to the current and potential future impact on the almost 6 million children in never-

†See a previous presentation in the *Journal of Dentistry for Children* for a more detailed review of the legislation.<sup>9</sup>

married, mother-only, single-parent families and the .7 million children in father-only, single-parent families (both with particularly high representation of minority children).

As emphasized repeatedly in presentations in the *Journal of Dentistry for Children*, pediatric dentists increasingly are providing and will provide services to both minority and nonminority children who are being raised in single-parent families and in settings about which practitioners and their staffs have had limited personal experience.<sup>2-4</sup> If pediatric dentists are to provide care, however, to this growing segment of our communities, then an appreciation of their family circumstances and difficulties is essential!

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#### THE CHILDREN OF DIVORCE

Amato found that, compared with kids in intact families, young children of divorce had lower academic achievement, more behavioral problems, poorer psychological adjustments, more negative self-concepts, greater social difficulties, and more problematic relationships with both mothers and fathers.

This led him to conclude that "the view that children of divorce adapt readily and reveal no lasting negative consequences is simply not supported by the cumulative data in this area."

Amato's examination of how divorce affects children in their adult years confirms Wallerstein's findings: The pain does not subside but in many areas becomes more intense.

Amato found that, compared with adults from intact homes, people who grew up in broken homes had lower job status, poorer psychological well-being, a lower standard of living, less marital satisfaction, a heightened risk of divorce, a greater risk of being a single parent, and poorer physical health.

Based on his research, Amato concludes that "the long-term consequences of parental divorce for adult attainment and quality of life may prove to be more serious than the short-term emotional and social problems in children that are more frequently studied."

In general, then, although all the facts may not yet be in, the picture that is emerging of the new "divorce culture" from the available research is one of troubling grimness, the effects of which may hit America with waves of social and economic problems for generations to come.

Stanton, G.T.: The children of divorce. *The World and I*, October 1997, pp 54-59.

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# EPIDEMIOLOGY

## Caries prevalence in Ashkelon children in 1994

Shlomo P. Zusman, DMD, MSc, DDPH, RCS  
Helena Natapov, DMD

**D**ental health and caries prevalence have changed tremendously in the last decade.<sup>1-3</sup> In Israel the latest surveys show a reduction in caries prevalence in Israeli children.<sup>4,5</sup> In Ashkelon several surveys were done in the last fifteen years.

The first survey was done in 1980, when a three-chair dental clinic was established as part of the community dental service. The survey of child dental health was conducted shortly after the clinic opened, to provide baseline information and to enable the impact of the clinic on child dental health in the town to be assessed at a future date. Diagnostic criteria, method of examination and data processing procedures were as described by Whittle and Downer.<sup>6</sup> In 1982 a further survey used similar methods, children were chosen at random and examined at the same schools as in 1980.

In 1993 the community dental service was closed down, and in 1994 a concluding survey was done to assess the impact of the clinic and the changes in child dental health in this interval. This survey too examined a sample of the same age-groups, according to the same criteria as the two former surveys.<sup>7</sup> This makes the comparison of the results with other data from surveys done according to WHO methods difficult, if not impossible.

In 1989 children were examined in Ashkelon as part

of a national child dental health survey.<sup>5</sup> This survey was conducted according to WHO methods.<sup>8</sup> The sample was chosen at random nationally, but few were from Ashkelon.

The present survey was conducted parallel to the aforementioned 1994 survey in order to provide current information about caries prevalence in Ashkelon children, according to WHO survey criteria, information that can be compared with other national and international data.

### MATERIAL AND METHODS

#### The sample

A stratified, random, cluster, convenience sample was used. The study of the five-year-old group was undertaken in the compulsory kindergarten. From the municipality's list of preschool kindergartens, eight classes were chosen at random from different parts of the town. All children present in the class were examined.

The twelve-year-olds in the study came from four secondary junior schools. According to the new integration policy in the Ashkelon education system, there is no difference between the secondary junior schools. All four schools are located in close vicinity of each other, and children from all parts of the town study in them. From each school two classes were chosen at random. All children present in the class were examined. This is a sample of 20 percent of this age-group.

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Table 1 □ Caries prevalence in five-year-olds in Ashkelon.

Gender	N	Caries-free	dmf		d		m		f	
			mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.		
Male	90	41 (46%)	1.79 ± 2.00	1.40 ± 2.02	0.39 ± 0.82	0.00				
Female	92	38 (41%)	2.37 ± 2.00	1.83 ± 2.70	0.54 ± 1.10	0.00				
Totals	182	79 (43%)	2.08 ± 2.64	1.62 ± 2.39	0.47 ± 0.97	0.00				

Table 2 □ Caries prevalence in twelve-year-olds in Ashkelon.

Gender	N	Caries-free	DMF		D		M		F		S	
			mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.	mean ± S.D.		
Male	129	50 (39%)	1.50 ± 1.75	0.78 ± 1.09	0.03 ± 0.25	0.69 ± 1.20	0.26 ± 1.38					
Female	132	57 (43%)	1.35 ± 1.65	0.62 ± 1.20	0.0	0.73 ± 1.15	0.57 ± 2.01					
Totals	261	107 (41%)	1.43 ± 1.70	0.70 ± 1.15	0.02 ± 0.17	0.71 ± 1.18	0.41 ± 1.73					

S = number of teeth with pit and fissure sealants

## Survey method

The children were examined in the class room, seated facing the window, under natural light conditions. Survey criteria were according to WHO method.<sup>7</sup> All examinations were done by the same examiner (NH), calibrated to an experienced examiner (ZSP) who participated in the 1989 national survey. Twelve percent of the children were examined by both examiners, and interexaminer variability was calculated.

The data were encoded and processed by an IBM clone PC-type computer, using appropriate software.

## RESULTS

### Examiner variability

The examiner variability was satisfactory. Cohen's Kappa of interexaminer variability was 0.77, which is regarded as satisfactory, almost good.

### Dental health

In the group of five-year-old children, in eight classes, 190 children were present. Eight children (6 males and 2 females) declined examination. One hundred eighty-two children were examined, ninety males and ninety-two females. Caries prevalence in this group is detailed in Table 1. Forty-three percent of the children were found to be caries-free with a *dmf(t)* of  $2.08 \pm 2.64$  (mean ± S.D.). More boys than girls are caries-free (46 percent vs 41 percent). In general, caries prevalence is lower and dental health is better in boys than in girls. The *f(t)* component is 0. Children at this age are generally not treated, according to the school service protocol.

In the group of twelve-year-old children, 129 boys and 132 girls (total of 261) were examined. No children declined examination. Caries prevalence in this group is detailed in Table 2. Forty-one percent of the children were found to be caries-free with a *DMF(T)* of  $1.43 \pm 1.70$  (mean ± S.D.). In this group more girls than boys were caries-free (43 percent vs 39 percent). In general caries prevalence is higher, treatment levels are lower in boys than in girls in this age-group.

In the group of five-year-old children, the percentage of caries-free children is slightly higher than nationally (42 percent). The *dmft* is also lower (2.2). The difference is mainly due to lower disease prevalence: the *dt* component is less by a third (1.6 vs 2.3). The *mt* and *ft* components, however, are also lower in Ashkelon than in the national average. The 1989 survey in Ashkelon comprised a very small sample and gave no good estimate of caries prevalence in Ashkelon (Table 3). (No doubt the dental health improved since 1989.)

Among the twelve-year-olds there was also a marked difference. The percentage of caries-free children is 41 percent, much higher than in 1989 both in Ashkelon and nationally (Table 4). *DMFT* in Ashkelon is half that in the rest of Israel (1.4 vs 2.8), as is the *DT* component (0.7 vs 1.45), and the *FT* component. There is less dental disease and much less untreated disease in Ashkelon than in any comparable population in Israel.

## DISCUSSION

Dental disease prevalence is decreasing in Israel, as reported by Zadic, Zusman and Kelman, Zadic *et al* and Zadic, Lederman and Moskona, contrary to reports of Gordon *et al*.<sup>4,5,9,10</sup> The prevalence of dental disease is decreasing in Ashkelon too.<sup>7</sup>

Table 3 □ Number of children examined in different surveys.

Age	1994			Survey year 1989 (national)			1989		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
5	90	94	182			279	16	17	33
12	129	132	261			280	13	15	28

For 1989 (national) the data in partially fluoridated areas are given.

Table 4 □ Caries prevalence in Ashkelon children—comparison.

Age	Survey year	% caries-free	dmft ± S.D.	dt	mt	ft
5	1994	43	1.79 ± 2.8	1.62	0.47	0.0
	1989N	39	2.8 ± 3.3	2.3	0.1	0.4
	1989	42	2.2 ± 3.0	1.3	0.2	0.8
	Survey year	% caries-free	DMFT ± S.D.	DT	MT	FT
12	1994	41	1.4 ± 1.7	0.7	0.02	0.7
	1989N	23	2.8 ± 2.5	1.45	0.0	1.31
	1989	33	2.4 ± 2.2	0.9	0.0	1.5

There are 42 percent caries-free five-year-old children in Ashkelon today. The drinking water in Ashkelon is defined as partly fluoridated; fluoride levels vary according to the season from 0.3 to 0.7 ppm. In the national survey, in the partly fluoridated areas, among five-year-olds there were 39 percent caries-free, with a *dift*\* of 2.8 (compared to 2.2 in Ashkelon).

Among the twelve-year-olds, nationwide 23 percent were caries-free with a *DMFT* of 2.8 compared to 33 percent caries-free with a *DMFT* of 2.4 in Ashkelon. Regarding untreated disease, the *dt* in Ashkelon in 1989 was 1.3, compared to the national average of 2.3, while *DT* dropped to 0.9 in Ashkelon compared to 1.5 nationally. The results show that caries prevalence in Ashkelon children is less than in other partly fluoridated areas in Israel.

\*The difference between *dmft* and *dift* is mainly semantic. The letter "i" includes teeth indicated for extraction.

For comparison, in the ten years from 1978 to 1988 in Jerusalem, the percentage of caries-free five-year-old children increased from 16 percent to 28 percent with a decrease in *dift* from 4.7 to 3.65.<sup>4</sup> Jerusalem water supply has been fluoridated since 1978.<sup>11</sup> Dental health among the five-year-olds is better in the partly fluoridated Ashkelon than in fluoridated Jerusalem.

Dental treatment levels are higher and caries prevalence is lower in Ashkelon than the national average for partly fluoridated areas. The WHO goals for year 2000 have already been achieved.<sup>12</sup> The possible reasons for the better dental health in Ashkelon are the subject of further study.

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Figure 1. Frontal view of facial features, showing depressed nasal bridge, sparse hair, and eyebrows.

## Ectodermal dysplasia with associated double tooth

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The ectodermal dysplasias are a large and heterogeneous group of disorders. The most common of all the ectodermal dysplasias is X-linked hypohidrotic ectodermal dysplasia (XHED).<sup>1</sup> It was described in 1948 by Thurnam, and it is usually transmitted through an X-linked recessive gene so that the frequency and the severity of the condition are more pronounced in male offspring.<sup>2-4</sup> The main features are hypohidrosis, hypotrichosis, anodontia or hypodontia.<sup>1-5</sup> The clinical findings are hyperpigmentation, frontal bossing, depressed nasal bridge, delicate, translucent, smooth and dry skin, often thick and protruding lips.<sup>2</sup> The tooth crowns are often conical shape. The roots are short and pulp chambers are large.<sup>1-5</sup> Due to the hypodontia the alveolar bone growth is decreased and the alveolar ridges are not fully developed, resulting in a loss of vertical dimension. Prosthetic treatment, therefore, is recommended.<sup>6-8</sup> The following report describes an interesting finding of a "double" tooth in a young child with hypohidrotic ectodermal dysplasia.

### CASE REPORT

A seven-year-old girl was referred to the Hacettepe University Faculty of Dentistry Department of Pediatric

Dentistry complaining of malformed teeth and delay in the eruption of other teeth. The patient had received no previous dental treatment. In examination, a depressed nasal bridge, sparse hair, eyebrows, and eyelashes, as well as dry skin were noted (Figure 1). There was suspicion of ectodermal dysplasia, so she was referred to the Hacettepe University Faculty of Medicine, Department of Pediatrics. Hypohidrotic type ectodermal dysplasia was diagnosed by skin biopsy and sweat tests.

Intraoral (Figures 2,3,4) and radiological (Figures 5,6) examinations revealed conically shaped maxillary and mandibular incisors, absence of

5	V	4	II	2	1	1	2	II	4	V	6
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			II	I	2	1	1	2	I	II	5

and a double molar tooth in the left primary second molar region of the maxilla.

The double molar tooth exhibited four buccal and four lingual cusps and vertical buccal and lingual grooves (Figure 7). The periapical radiographs showed two roots and one pulp chamber (Figures 5,6).

The parents related that the patient had lost her primary central incisor tooth as a result of an accident. It was decided to rehabilitate the child with partial dentures to provide a degree of function, occlusion, and aesthetics (Figure 8). Since there was no problem related to the double tooth, all caries-susceptible grooves were sealed with a fissure sealant (Figure 9). Periodic recall visits were advised, to monitor the dentures during pe-

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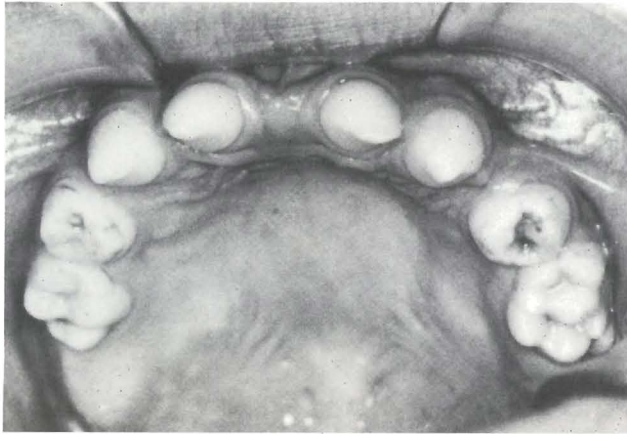


Figure 2. View of maxillary arch and conical incisors.

riods of growth and development, and eruption of the permanent teeth.

## DISCUSSION

Hypohidrotic ectodermal dysplasia, which is a type of ectodermal dysplasia, is characterized by the triad, hypohidrosis, hypotrichosis and hypodontia. In addition, the tooth crowns are often conical in shape.<sup>3,7,9</sup> All of these features were found in our patient, as well as a large double molar tooth in the left primary second molar region of the maxilla.

Double tooth is a term used to describe joined teeth.<sup>10</sup> In a review of the literature, some authors report that the anomaly of conjoined teeth has also been termed "fusion," "gemination," and "schizodontia."<sup>11-13</sup> Recently, Yuen *et al* contended that when the etiology was not established, the term "double tooth" was more appropriate than terms such as fusion and gemination.<sup>13</sup> Fusion and gemination may occur at different stages of dental development and consequently present in varied clinical forms causing doubt when making a diagnosis and proving difficult to clarify in spite of the use of radiographs. Evaluation of the total number of teeth in the arch only adds information when the process is not associated with agenesis or supernumerary teeth.<sup>13</sup> When these pathologies are present (case presented in this paper), a sure diagnosis is not possible and many authors prefer the term "double tooth."

Double tooth has been reported to occur more frequently in the primary dentition, an incidence in the range of 0.5-5.0 percent.<sup>2,14</sup> The condition is seen predominantly in the incisor and canine regions and rarely

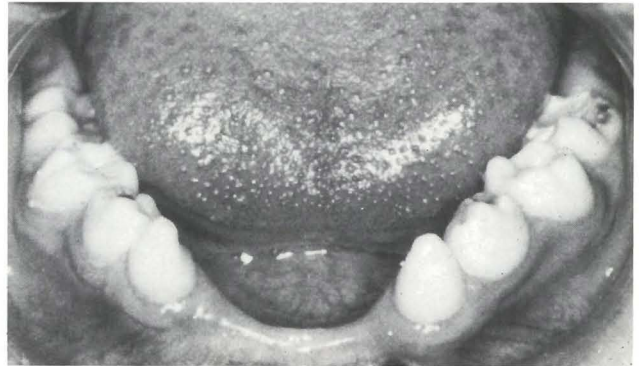


Figure 3. View of mandibular arch and conical incisors.

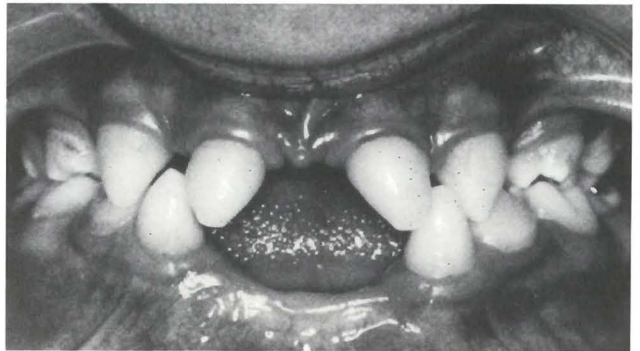


Figure 4. Anterior view of the teeth and occlusion.

in the posterior region.<sup>15</sup> Yuen *et al* reported 376 children with double primary teeth, but reported no cases involving the primary molars.<sup>13</sup> Hagman reported that although primary double teeth are common in the anterior region, they are rare in the posterior region.<sup>15,16</sup>

In our patient there was clear asymmetry in tooth widths, with the maxillary primary second molar on the left side of the mouth being larger than its counterpart on the right side. The double molar tooth crown morphology, root formation and number do not clearly indicate this tooth to be a permanent molar or primary molar or two conjugated teeth. Because she also had hypodontia, it was difficult to define her atypical tooth and we preferred using the term "double tooth."

The most common concerns when double teeth exist in the anterior region are aesthetic and functional.<sup>17</sup> If they exist in the posterior region and do not cause occlusion problems, clinicians can keep them in the arch. As the double tooth in our patient with ectodermal dysplasia was in the posterior region, we decided to keep it

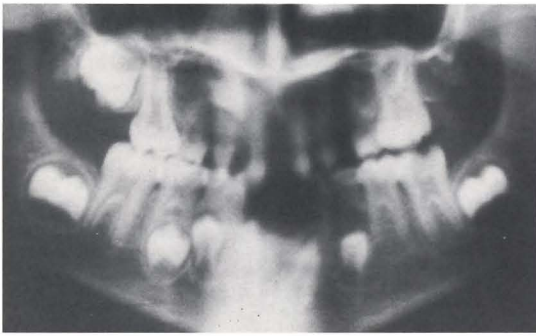


Figure 5, 6. Panoramic and periapical radiographs show absence of teeth and double tooth in the maxillary left primary second molar region.

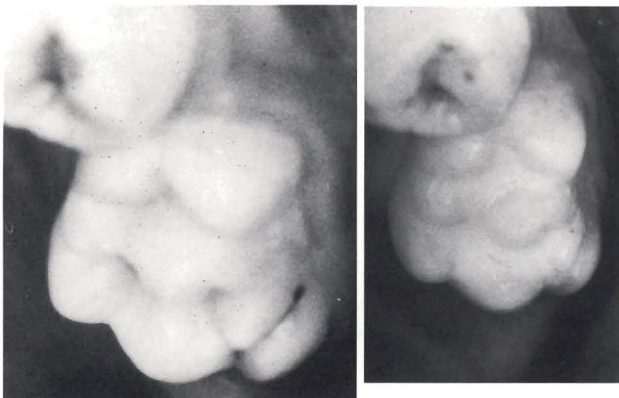


Figure 7 (left). Double tooth before sealing caries-susceptible grooves. Figure 9 (right) after sealing.

in the arch and seal the caries-susceptible grooves with a fissure sealant.

The presence of double teeth has been reported previously with Otodontal syndrome and Russel-Silver syndrome; our review of the literature failed to find, however, a report of ectodermal dysplasia with associated double tooth.<sup>12,18</sup>

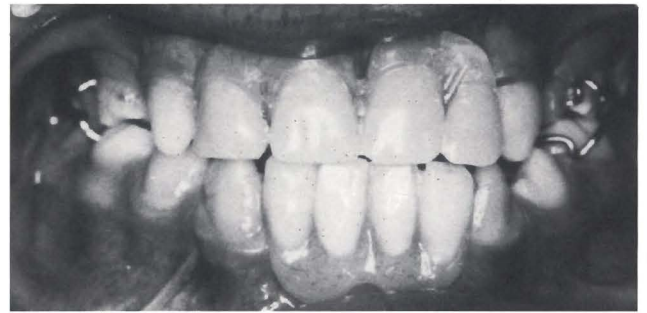


Figure 8. Intraoral view of partial dentures.

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# ABSTRACTS

**Glenn, Frances B. and Glenn, III, William D.: Prenatal fluoride for growth and development: Part X. J Dent Child, 64:317-321, September-October 1997.**

Examinations of prenatal fluoride supplemented (PNF) teeth in an animal model and in a five-month human fetus find these teeth to be more developed than the non-supplemented controls. The fact that PNF allows teeth to develop to their full potential suggests that PNF could be an essential nutrient for the entire human and this could be demonstrated most easily during rapid fetal growth. A review of the recent literature, including trials by NIH and The World Health Organization, provide evidence that fluoride (F) does allow the fetus to grow and develop to its full potential. The authors conclude that PNF must be supplied in at least a 2 mg/day pulse dose, and then F must be given from shortly after birth in a daily amount appropriate for the weight of the child with some consideration for the amount of F water utilized.

**Prenatal fluoride; Growth and development**

**Pinkham, Jimmy R.: Linguistic maturity as a determinant of child patient behavior in the dental office. J Dent Child, 64:322-326, September-October 1997.**

Progressively during the 20th century dentistry for children has become more efficient, less painful, and more prevention oriented. In the last quarter of the 20th century there was a dramatic decrease in dental decay for many American children. These two facts paired with the fact that stories about dentistry being painful are gone in many American communities and have been replaced with stories about how pleasant the dental appointment can be would seem to predict that child patient management and the interception of inappropriate behavior would not be a critical skill for the dental clinician that treats children today. This finding how-

ever is not the case. It is submitted that misbehavior now stems from the fact that today's parents are not encouraged to raise their children as urgently as in the earlier part of the century. It is offered that the child's incompetence in working with other people in the constituent speech acts of requests and promises causes the child confusion, frustration, and perhaps anxiety. The child's dental experience is a complex conversation between the dentists as requester and the child patient as the promisor of effective actions to the dentist's reasonable requests.

**Child behavior; Linguistic maturity**

**Kopel, Hugh M.: The pulp capping procedure in primary teeth "revisited." J Dent Child, 64:327-333, September-October 1997.**

The purpose of this review is to "revisit" an earlier paper (1992) on the subject of direct pulp capping in primary teeth and bring some new considerations for the procedure by the use of dentin bonding adhesives. It has come to be recognized that the customary employment of calcium hydroxide for this therapy has some shortcomings that reduce the prognosis for a favorable outcome. For at least a decade, many investigations have found that postoperative sensitivity, thermal stimuli, pulp inflammation and pathosis can be attributed not to the composition of various dental materials and their insertion techniques, but to microleakage with subsequent bacterial invasion at the enamel/restoration and the dentin/pulp interfaces. It is imperative, as pointed out, that there be an impervious resinous bond between the dentin and the dentinopulpal complex which can be achieved by the use of dentinal adhesive agents to eliminate microleakage outward movement of pulpal fluids. Various steps in the bonding technique for the treatment of deep dentin caries and/or a pulp exposure has raised some concerns for their effect on the pulp. This review discusses these concerns, which can lead to the conclu-

sion that the use of dentinal bonding adhesives is a safe and biologically feasible procedure, whether it be in permanent or primary teeth.

**Direct pulp capping; Calcium hydroxide; Bacterial microleakage; Dentinal bonding adhesives**

**Miyajima, Kuniaki; Yoshimoto, Junichiro; Murata, Satoru et al: Uprighting the mandibular molars stimulates mandibular growth during treatment of Class II malocclusion. J Dent Child, 64:340-343, September-October 1997.**

We hypothesized that uprighting of the mandibular molars creates a counter-clockwise rotation of the mandible and stimulates mandibular forward growth during the treatment of a Class II malocclusion. This investigation used 33 longitudinal lateral cephalometric radiographs of Class II, Division 1 female patients. All cases were treated with non-extraction. Treatment was started in early adolescence with .018 slot edge-wise Alexander appliances. High-pull head-gear and Class II elastics were used. Seventeen cases that showed more than 5 degrees of uprighting of the mandibular first molars were selected as the uprighted group. Cases that showed less than 5 degrees of uprighting of the mandibular first molars were selected as the non-uprighted group.

There was a significant correlation coefficient between the uprighted degree of the mandibular first molars and the degree of clockwise rotation of the mandibular plane to FH.

**Mandibular molar uprighting; Class II treatment; Mandibular growth; Cephalometrics**

**Tandon, Shobha; Mathew, Tissy Ann: Effect of acid-etching on fluoride treated caries-like lesions of enamel: A SEM study. J Dent Child, 64:344-348, September-October 1997.** Etching patterns by 20 percent phosphoric acid on caries-like lesions of en-

amel (white spot) untreated and treated with 0.4 APF were studied at 30, 60, 120 seconds of etch-times using the Scanning Electron Microscope (SEM). The surface topography of acid-etched teeth varied according to the etch time. Acid etching of caries-like lesions treated with fluoride showed etching patterns similar to sound enamel. Based on Silverstone's classification, thirty seconds etch-time produced type III pattern of surface morphology, while type I and type II were observed with 60 and 120 seconds of etch time. Fluoride treated lesions showed increased porosity and in addition to a surface coating of numerous small globules of calcium fluoride. Low level of topical fluoride before sealant application should be beneficial, since this allows a more rapid rate and increased degree of remineralization and possible arrest in the progress of caries lesions.

**Acid-etching; White spots in enamel**

**Waldman, H. Barry: Children of divorce. J Dent Child, 64:349-353, September-October 1997.**

Limited attention has been directed in the dental literature to the emotional, economic and associated consequences of divorces on children. A general introduction is provided on 1) the numbers of children involved in divorces in different single-parent population groups, with 2) emphasis on the emotional im-

pact of divorce on children and 3) the potential significance for pediatric dental practices.

**Divorce; Emotional impact on children; Impact on dental care**

**Waldman, H. Barry: Minority children in single-parent families. J Dent Child, 64:354-358, September-October 1997.**

Information is now available from the Bureau of the Census with details about the increasing number of single-parent families. A summary review is provided with particular emphasis on minority families.

**Minority children; Single-parent family**

**Zusman, Shlomo P. and Natapov, Helena: Caries prevalence in Ashkelon children in 1994. J Dent Child, 64:359-361, September-October 1997.**

In the five-year-old group, 182 children were examined, ninety males and ninety-two females. Forty-three percent of the children were found to be caries-free with a *dmf(t)* of  $2.08 \pm 2.64$  (mean  $\pm$  S.D.). More boys than girls were caries-free (46 percent vs 41 percent). In general, caries prevalence is lower and dental health is better in boys than girls. The *f(t)* component is 0. Children at this age are not treated.

In the twelve-year-olds group, 129 boys and 132 girls (total of 261) were examined. Forty-one percent of the children were found to be caries-free with a DMF(T) of  $1.43 \pm 1.70$ . In this group more girls than boys were caries-free (43 percent vs 39 percent). In general caries prevalence is higher, treatment levels are lower in boys than in girls in this age-group.

The results show that dental health is better in Ashkelon children than in other partly fluoridated areas in Israel. Dental treatment levels are higher and caries prevalence is lower in Ashkelon than in comparable places in the country. The WHO goals for 2000 were achieved in Ashkelon by 1994.

**Caries prevalence; Child dental health**

**Atar, Gülay; Uzamiş, Meryem; Ölmez, Seval: Ectodermal dysplasia with associated double tooth. J Dent Child, 64:362-364, September-October 1997.**

The case describes a double molar tooth in a seven-year-old girl who has ectodermal dysplasia. The most characteristic dental findings in ectodermal dysplasia are hypodontia and conically shaped crowns. In our case a double tooth was also present in the primary molar region, in addition to these characteristic findings.

**Ectodermal dysplasia; Double tooth**

**ERRATUM**

Mary Jane White, RN should have been listed as the third author of the article, "CHARGE syndrome: Review of literature and report of case," which appeared in the May-June 1997 issue of the Journal, pages 218-221.