

## Early Childhood Caries and Prevention in Florida

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### Introduction

Children are one of society's most vulnerable, but at the same time most valuable populations. Maximizing their chances of achieving good physical and cognitive development is key to the continuation of a healthy and vibrant society. A child's first five years are a crucial time in their physical and cognitive development. Early childhood is marked by tremendous growth and development. During this time, a child is susceptible to a host of diseases, including oral disease, which if left untreated can have severe ramifications on a child's development. A lack of investment in a child's oral health and welfare made during this crucial time, whether by parents, guardians, or the public, can often have long-term severe ramifications affecting their physical, social-emotional, and educational development.

Oral disease, especially dental decay or caries, is a complicated and multifactorial disease that often begins in infancy and can continue throughout a person's lifetime and cause long-term negative economic, social, and systemic health consequences.<sup>1,2</sup> The 2000 Surgeon General's report, *Oral Health in America: A Report of the Surgeon General*, stated that oral health is a significant component of general health and well being.<sup>3</sup> The Centers for Disease Control and Prevention (CDC) reports dental caries is the most prevalent infectious disease of U.S. children.<sup>3</sup> Studies have shown most children do not receive dental care until they are at least three years old.<sup>4</sup> Regrettably, these same studies found that more than 30 percent of children from lower socioeconomic groups already have caries by that age.<sup>4</sup>

The American Dental Association (ADA) recognizes that Early Childhood Caries (ECC) is a significant public health problem in not only select populations, but throughout the general population as well.<sup>5</sup> Nationally, 80 percent of carious lesions are found in 20 percent of the nation's children.<sup>3,6,7</sup> The ADA and the American Academy of Pediatric Dentistry (AAPD) define ECC as "the presence of one or more decayed (non-cavitated or cavitated lesions) missing (due to caries), or filled tooth surfaces in any primary tooth in a preschool-aged child between birth and 71 months of age."<sup>1,2,5</sup> Nationally, six out of ten children by age five will have one or more decayed or filled primary teeth.<sup>3</sup> Twenty-five percent of children entering kindergarten have never visited a dentist.<sup>6</sup> Additionally, studies have shown the children with the most advanced oral disease are primarily found among America's most vulnerable groups.<sup>3</sup> These vulnerable groups include the poor, American Indians, Alaskan Natives, Asians, and Pacific Islanders, Hispanics, African Americans, homeless and migrant populations, the disabled, and those individuals who are medically compromised with disease such as HIV.<sup>3,6,7</sup> These populations in whom the prevalence of caries is the highest, the very young, the poor, and those in the minority, all present with unique challenges, face numerous barriers to care<sup>3,6,7</sup> and are the fastest growing portions of the nation's child population.<sup>6</sup>

Despite its high prevalence, dental caries is preventable. However, while certain primary etiologic risk factors are associated with the development of dental caries in children, it is difficult to consistently identify infants at greatest risk for dental caries and other dental disease in later life because many other factors influence these primary etiologic factors.<sup>7</sup> For this reason, contemporary guidelines on the management of oral disease recommend that more emphasis be placed on primary prevention.<sup>1,2</sup>

Historically, the approach to oral disease (dental caries, periodontal disease, and acquired or hereditary oral conditions) consisted of treating the destructive effects of the disease and then, at a later time, initiating a preventive program.<sup>7</sup> Contemporary guidelines now place an emphasis on prevention – to stop the onset of oral disease or to interfere with its progression before more complex and expensive treatment becomes necessary.<sup>1-3, 8</sup> Preventive practices include the early establishment of a dental home and early professional intervention.<sup>1, 2, 8, 9</sup> Early professional intervention consists of oral screenings and examinations of infants and parents, risk assessment of infants, anticipatory guidance of infants and parents, and oral health education and oral hygiene instruction for parents.<sup>1, 2, 7, 8, 10</sup>

## **Etiology and Primary Risk Factors**

ECC is an infectious, transmissible, bacterial disease of the primary teeth.<sup>2, 3, 8, 9</sup> Bacteria, predominantly the Lactobacillus and mutans Streptococci (*Streptococcus mutans* and *Streptococcus sobinus*) species, metabolize monosaccharide and disaccharide sugars to produce acid which can demineralize teeth and cause cavities.<sup>3, 8</sup> This demineralization process is reversible.<sup>11</sup> However, the mineral loss may result in cavities when the attack is prolonged and exceeds an individual's resistance and ability to heal.<sup>11</sup> Physiology (and genetics) and health behaviors determine an individual's resistance and ability to heal.<sup>11</sup>

Typically, acquisition of cariogenic bacteria occurs during a well-delineated age range, generally thought to from 19 to 31 months age.<sup>3</sup> Bacterial colonization usually requires a hard, nondequamating surface such as the teeth.<sup>7</sup> However, if certain risk factors are present - such as sibling caries, maternal caries, poor feeding habits, poor dietary habits, limited exposure to fluoride, and poor oral hygiene practices – cariogenic bacterial colonization may occur predate and caries can develop as soon as teeth erupt – from approximately 6 months for incisors and 30 months for molars.<sup>3, 12</sup> Recent studies have indicated that mutans Streptococci may be able to colonize the mouths of predate infants, primarily in the furrows of the tongue.<sup>12</sup> Early acquisition of cariogenic bacteria is a major risk factor for early childhood caries and future caries experience.<sup>12</sup>

ECC in children characteristically first appears at the gumline on the maxillary incisors as white spots or lines.<sup>8</sup> If left untreated these white spots can rapidly progress into yellow-brown cavities and can also spread to adjacent teeth.<sup>8</sup> Teeth that erupt with enamel defects are at a greater risk of developing caries.<sup>3, 8</sup> Defects are more prevalent in children who are born prematurely, or have a low birth weight, and in children of low socioeconomic status.<sup>3, 8</sup>

*S. Mutans* most often colonizes in infants through saliva contact.<sup>3, 8, 12</sup> Colonization primarily occurs vertically from mother to infant.<sup>3, 8, 12</sup> Vertical transmission is the transmission of microbes from caregiver to child.<sup>12</sup> High maternal levels of mutans streptococci, due to active or untreated maternal caries, increase the risk of transmission of these cariogenic bacteria from mother to child and increase the rate of childhood caries.<sup>8</sup> High rates of caries tend to occur in families and from generation to generation.<sup>9</sup> Recent reports indicate that horizontal transmission also occurs.<sup>12</sup> Horizontal transmission is the transmission of microbes between members of a group (e.g. family members of a similar age or students in a classroom).<sup>12</sup>

Exposure to fermentable carbohydrates or sugar is the main dietary variable in caries etiology. Frequency of consumption, length of time the sugars are in contact with the teeth, and the type of sugar consumed all play a role in caries development.<sup>3, 8, 9</sup> The frequency to which teeth are exposed to cariogenic (acidic) environments affects the likelihood of caries development.<sup>3, 8, 9</sup> After meals or snacks containing sugars, the bacteria in the mouth metabolize the sugar, resulting in acidic by-products which decreases pH.<sup>3, 8, 9</sup> With time, the pH returns to normal due to the

buffering capacity of saliva - it takes 20 to 40 minutes for saliva to neutralize or wash acid away.<sup>3, 8, 9</sup> During every exposure to the acidic environment, portions of the inorganic mineral content at the surface of teeth dissolves.<sup>3, 8, 9</sup> This demineralized state can remain for up to 2 hours.<sup>3, 8, 9</sup> Since teeth are vulnerable during these periods of acidic environments, the development and severity of dental caries is related to the frequency of these occurrences.<sup>3, 8, 9</sup> Although mutans Streptococci can metabolize many different carbohydrates to produce acid, they most efficiently metabolize sugars, especially sucrose.<sup>3, 8, 9</sup> Lactose is also one of the least cariogenic sugars.<sup>3, 8, 9</sup> Sugars located in the cellular structure of foods, such as fructose, are thought to be less cariogenic than sugars artificially introduced into foods.<sup>3, 8, 9</sup>

## **Secondary Risk Factors**

The interplay of the primary etiological risk factors – host physiology, teeth, bacteria, sugar, and time - determine the severity of the disease.<sup>8</sup> However, other behaviors and factors influence these primary etiological risk factors and thus, affect the severity of the disease.<sup>3</sup> These secondary behaviors and factors include: race or ethnicity, socioeconomic status, insurance, maternal oral and systemic health, parents' oral health knowledge and education, birth weight, diet and nutrition, exposure to fluoride, salivary composition and salivary flow, nursing habits, access to professional oral health care, oral hygiene, arrested development of tooth enamel, chronic illness, and mouth breathing.<sup>3</sup>

### *Race or Ethnicity*

Minorities suffer a disproportionate amount of dental disease burden that can begin early in life.<sup>13</sup> As a result, minority children are at an increased risk for developing future oral and systemic problems.<sup>13</sup> American Indian and Alaskan Native, Asian, and Pacific Islander children suffer the most tooth decay followed by Hispanic, African American, and white children, respectively.<sup>14</sup> Healthy People 2010 found 15 percent of White, 24 percent of Black, 27 percent of Mexican Americans, 34 percent of Asian, and 76 percent of Native American children aged two to four had experienced dental decay.<sup>15</sup>

### *Socioeconomic Status and Income*

Children from low income families suffer twice the amount of decay and are twice as likely to go without dental care compared to children who are not poor.<sup>3</sup> Children from families whose income is below 200 percent of the federal poverty level are three times as likely to have unmet dental needs as children from families with incomes at or above 200 percent of the federal poverty level.<sup>6</sup> Moreover, poverty in minorities increases the chances of poor oral health.<sup>3</sup> In Florida, income is predictive of visiting a dentist. Higher incomes increase the chances of having seen a dentist within the current year.<sup>16</sup> Eighty-three percent for persons with incomes greater than \$50,000, 71.2 percent for persons with incomes between \$25,000 and \$50,000, and 53.7 percent for persons with incomes below \$25,000.<sup>16</sup> For the years 2000-2002 the percentage of Florida children at or below 200 percent of poverty was 41.2 percent.<sup>17</sup> Unfortunately, this problem is not going away. Florida is one of only nine states in the nation where poverty is on the rise.<sup>17</sup>

### *Insurance*

Insurance is associated with a person's ability to access oral health care services.<sup>3</sup> Dental insurance coverage varies by race, income, and educational levels.<sup>3</sup> Whites (41.8 percent), people with 13 years or more of education (51.4 percent), and families with annual incomes of \$35,000 or more (60.8 percent) have the highest percentage of insurance coverage in their demographic

categories.<sup>3</sup> In 2004, approximately 50 percent of Florida's adults reported having some form of private insurance that included dental care.<sup>18</sup>

Additionally, having access to medical insurance may include dental coverage in some cases. Comparatively, approximately 108 million Americans lack dental insurance and approximately 44 million Americans lack medical insurance.<sup>19</sup> Perversely, those persons with insurance coverage that has the better scope of care have the least treatment needs and those persons with the greatest needs have insurance coverage with the worst scope of care, if any coverage at all.<sup>20</sup>

Fifty-five percent of American children birth to age five have no private dental insurance.<sup>21</sup> Minority children of the same age fare worse - 70 percent of Hispanic children and 65 percent of African-American children lack private insurance.<sup>21</sup> Factors contributing to this disparity include cost, availability of dental insurance, willingness or inability of providers to provide uncompensated care, and the effectiveness of and stigma attached to using public assistance programs. Most spending on dental services is out-of-pocket or covered by private dental insurance. Since minority and low-income populations have lower rates of private dental insurance coverage, these individuals bear more of the costs for dental services which can often times be prohibitive. Thus, minority children and children from low income families go without care or rely on the Medicaid system for access to care.

### *Medicaid Services*

Medicaid utilization of dental services has traditionally been very low. Nationally and in Florida, approximately 1 in 5 Medicaid eligible children have at least one dental visit in a year.<sup>3</sup> In fiscal year 2002-03, 1.6 million Florida children were eligible for Medicaid.<sup>22</sup> However, only 20.0 percent of Florida eligible children (284,167) utilized Medicaid dental services.<sup>22</sup> Comparatively, a child in Medicaid is 4 times more likely to have a medical visit (~80% utilization) than a dental visit (~20% utilization).<sup>3</sup>

In most states, including Florida, less than one percent of all Medicaid spending goes to children's dental care, however, nearly 30 percent of all child health expenditures are spent on children's oral health care.<sup>3</sup> In fiscal year 2002-03, Florida Medicaid expended a total of \$9.9 billion on all health care services, but only paid a total of \$84.3 million for dental care in fiscal year 2002-03.<sup>3, 23</sup>

The reasons for low utilization of Medicaid dental services are complex. Economic, attitudinal, geographic, administrative, transportation, language, and cultural issues along with the lack of available participating dental providers all play a role in Medicaid-eligibles' low utilization of Medicaid dental services.<sup>3, 18</sup>

The Well Child Checkup (previously known as the Early and Periodic Screening, Diagnostic, and Treatment (EPSDT)) program is Medicaid's comprehensive and preventive child health program for individuals under the age of 21.<sup>13, 14, 24</sup> Under the Well Child Checkup program, all states must provide comprehensive dental coverage to children, including emergency, preventive, diagnostic, restorative, and more complex care when required.<sup>13, 14, 24</sup> Well Child Checkup also mandates "any service that states are permitted to cover under Medicaid that is necessary to treat or ameliorate a defect, physical or mental illness or condition identified by a screen must be provided to eligible children, regardless of whether the service or item is otherwise included in the state's Medicaid plan."<sup>13, 14, 24</sup> The determination of medical necessity is based on accepted standards of dental and oral health practice, and relevant policies developed by recognized dental organizations involved in children's oral health care.<sup>13, 14, 24</sup>

## *Access to Professional Care*

Access to professional oral health care is an especially serious problem for very young children. In 2003, the ADA reported only 2.6 percent of all patients that dentists saw were children less than five years of age even though these children represented 7.4 percent of the population.<sup>6</sup> Among the factors contributing to children's access problems to professional dental care are: declining numbers and a maldistribution of dental professionals; a shortage of clinically active/practicing pediatric dentists; Medicaid and State Children's Health Insurance Program (SCHIP) related problems involving reimbursement rates and levels of participation among dentists; and state dental practice acts that, arguably, may unduly limit dental and other professional healthcare workforce from providing oral health services (through licensing, supervision, and scope of practice requirements).<sup>3, 14, 25</sup>

The dental workforce is declining as more dentists retire than graduate.<sup>3, 25</sup> The ratio of dentists to population has fallen from 59.1 per 100,000 population in 1990 to 54.8 per 100,000 in 1996 and is expected to fall further to 53.7 per 100,000 by 2020.<sup>3</sup> Florida has a dentist to population ratio of approximately 51.8 per 100,000 population (based on 2003 Florida population census estimates and 2004 active dentist figures). As a result of the reduction in dental class sizes and the outright closure of six dental schools, 40 percent fewer dentists are graduating per year than in the mid 1980's.<sup>3</sup> Moreover, many dentists are nearing retirement age.<sup>3</sup>

Additionally, according to the Health Resources and Services Administration (HRSA), Florida has over 150 Dental Health Professional Shortage Areas (D-HPSAs).<sup>26</sup> This amounts to a dentally unserved population of over 2 million Floridians.<sup>3</sup> HRSA estimates that Florida needs over 700 new dentists to alleviate this dental provider shortage.<sup>26</sup>

Conversely, new technology and treatments have caused a trend of improving oral health status for the general population.<sup>25</sup> Thus, fewer dentists may be necessary to manage the oral health care needs of the general population.<sup>25</sup>

Moreover, the Institute of Medicine Committee on the Future of Dental Education and the Pew Commission on the Health Professions found the history of stimulating the supply of health care providers from the mid-1960's to the late 1970's showed little effect on reducing shortage areas or improving access to care for special needs or underserved populations.<sup>25</sup> Thus, an adequate number of private dentists does not necessarily relate to the accessibility of dental services to the disadvantaged and underserved. About 90 percent of the dental workforce is in private practice.<sup>3</sup> They do not work in inner city or rural areas where a large majority of poor and underserved people live or treat special needs patients or children less than 3 years of age.<sup>3</sup> Even with adequate numbers of dentists, distribution of providers will remain a problem. Isolated populations will always have difficulties recruiting and retaining general and pediatric oral health care providers.

Consequently, increasing the number of dentists alone will not remedy all of the shortage issues. Distribution of oral health providers is also an issue. Statistics show the more rural a county, the less the number of dentists who practice there, and the lower the dentist to population ratio.<sup>27, 28</sup>

## Perception and Historical Structure of the Dental and Medical Systems<sup>6</sup>

Organized dentistry constitutes an entire oral health care system with its own characteristic educational, organizational, financing, regulatory, accountability, research, care delivery, and social components. The dental profession generally views dental care for very young children as the

responsibility of pediatric dentists and interested general dentists. These dentists work in close concert with dental hygienists and dental assistants to help families establish a “dental home”.

In contrast, the medical profession generally views systemic health care for very young children, which can include oral health supervision, as falling exclusively within the purview of family and pediatric medicine. Primary care physicians, including family practitioners and pediatricians, often engage nurse practitioners, physician assistants, and nurses to provide systemic health care services through a “medical home” model. This model encourages provision of comprehensive, preventive-oriented, continuous, and coordinated care. The coordinative function includes referral of children for specialty services as necessary. Primary care physicians generally consider oral health care for very young children to be specialty care. Thus, they see dentists to be more like specialists than primary care providers.

Medicine and dentistry tend to be two distinct and separate professions, with little integration between the two. Recent policy has professional dentistry stressing that oral health is integral to general health and well-being.<sup>29</sup> However, both the dental and medical communities have been slow to incorporate and integrate each other into a concept of “team care”.

#### Lack of Pediatric Dentists

As private practice dentistry has become very profitable, fewer graduating dentists seek entry into specialties and academia creating a shortage of pediatric dentists.<sup>3</sup> Nationally, less than 4,000 dentists (approximately 2.4 percent) specialize in pediatric dentistry.<sup>30</sup> To further complicate this shortage, pediatric dentists are an aging population - 51 percent of pediatric dentists in the U.S. are 50 years of age or older and 27 percent are 55 years of age or older. In Florida there are approximately 250 pediatric dentists.<sup>31</sup> In June, 2001 there were approximately 3.1 million children age 0 – 14 living in Florida.<sup>32</sup> This resulted in a ratio of approximately 12,400 children per pediatric dentist. Florida has only two pediatric dentistry residency programs.<sup>33</sup> The University of Florida College of Dentistry (UFCD) accepts five new residents a year while Nova Southeastern College of Dental Medicine accepts six new residents a year.<sup>33</sup> Training of residents in Florida is no guarantee that the residents will remain in Florida after graduation. This shortage of pediatric dentists makes it difficult for children of all ages, let alone very young children or children with special needs, to access specialty dental care.

#### Lack of General Dentists who Treat Infants

Until recently, the ADA, AAPD, and American Academy of Pediatrics (AAP) recommended that children receive their first dental examination by three years of age.<sup>6,7</sup> The rationale for choosing this age was based upon effectiveness - that children were more manageable and treatment was more efficient at a later age.<sup>7</sup> Current ADA and AAPD guidelines recommend that a dentist examine children by at least one year of age<sup>1</sup> (while similar, the AAP recommends that a pediatrician or other qualified pediatric health care provider provide an oral health assessment of infants by six months of age, with children at high risk for dental caries being referred to a dental home no later than six months after the eruption of the first tooth or by 12 months).<sup>9</sup> However, many general dentists are poorly trained to treat and also uncomfortable treating very young children.<sup>6,34</sup> The scope of competencies of an immediate graduate, one without postgraduate training, is limited in meeting the needs of populations who need complex care, including the very young.<sup>25</sup> Graduates with advanced dental education and clinical experience are better prepared to immediately meet the needs of a broader range of persons.<sup>25</sup>

#### Lack of Dentists who Accept Medicaid

Many dentists do not participate in Medicaid for a variety of reasons including: low reimbursement rates (Florida ranks among the lowest), administrative issues relating to the Medicaid program, perceived attitudes towards low-income patients, and broken appointments.<sup>3, 35</sup> According to the Florida Board of Dentistry (BOD), there were 8869 licensed dentists with Florida mailing addresses in active status as of March 7, 2004.<sup>36</sup> However, a recent study found that only 11.7 percent of Florida licensed dentist submitted any type of Medicaid claim (preventive or restorative) in either 2001 or 2002.<sup>18</sup> Disturbingly, that proportion declined to 10.9 percent in 2003.<sup>18</sup> Moreover, the proportion of Florida licensed dentists who submitted at least one preventive service claim declined from 9.3 percent in 2001 to 9.1 percent in 2002 and only 8.5 percent in 2003.<sup>18</sup>

### Dental Allied Personnel

The current dental workforce is thought to have a reserve capacity in large part through its supply of allied dental personnel.<sup>25</sup> Dental hygienists and assistants can expand access to oral health care by improving office time management and productivity through the provision of supportive and preventive services such as fluoride treatments, oral hygiene instruction, oral hygiene education and dental sealants.<sup>37</sup> The Florida Dental Practice Act (FDPA) regulates dental hygienists and assistants through scope of practice and supervisory requirements.<sup>37</sup> However, some in the dental industry think state dental practice acts impede access to oral health care by limiting allied dental personnel.<sup>3, 14, 25</sup> For example, the Florida Dental Hygiene Association (FDHA) has argued that the FDPA restricts access to oral health care by mandating dental hygienists provide preventive oral health services only under the supervision of a dentist.<sup>37</sup> Thus, dental hygienists may not provide preventive oral health services under the supervision of any other medical professional, such as a physician, which could arguably improve access.<sup>37</sup> Examination of new roles and responsibilities in a less restrictive delivery system could increase the output of the dental team and extend the availability of oral health care.<sup>25</sup> In 2006, the Florida legislature passed a law which allows dental hygienists to provide dental charting without the supervision of a dentist in limited situations.<sup>38</sup>

### Medical School Oral Health Training

Physicians, particularly pediatricians, routinely examine young children for well-child visits and often see children in the course of treating childhood illnesses. Thus, they have an important opportunity to intervene, offer anticipatory guidance, and to protect a child's oral health. In Florida, as in most states, there are no legal restrictions on physicians who feel competent to provide oral health services (physicians are regulated by state medical practice acts and medical malpractice laws).<sup>37</sup>

The American Medical Association (AMA) does not require oral health education for accreditation of medical schools.<sup>6</sup> The average pediatrician received less than two hours of training in oral health.<sup>14</sup> However, the Accreditation Council of Graduate Medical Education's (ACGME) Resident Review Committee for pediatric residents lists oral examinations as an assessment tool required for knowledge and provision of patient care in its Pediatric General Competencies.<sup>39</sup> Additionally, preliminary data from the state of North Carolina suggests that additional training can be effective in preparing medical providers to make appropriate assessments of children, their oral health care needs, and when to make appropriate referrals for more specialized care.<sup>14, 40-42</sup>

### Other Workforce Issues

Other workforce issues which may have an affect on access to oral health care services are: minorities are underrepresented in most dental school classes;<sup>3, 25</sup> major difficulties attracting and retaining dental school faculty due to low salaries (specifically into clinical disciplines, research, and

public health)<sup>3, 25</sup>; and whether there are possible roles for other professionals who frequently interact with young children, such as educators, social workers, counselors, nutritionists, and dieticians to name a few.<sup>6</sup>

### *Maternal and Paternal Behaviors, Dental Health, and Literacy*

Safe and effective disease prevention measures exist that everyone can adopt to improve oral health and prevent disease. On an individual basis these measures include daily oral hygiene procedures, diet and nutrition and other lifestyle behavior modifications, and regular professional care.<sup>3</sup> Whether a person implements these preventative measures depends on that person's knowledge of and personal belief in the importance of dental health.

Maternal and sibling oral health affects not only an infant's future oral health, but also the infant's overall health.<sup>1, 3, 7-9</sup> Maternal mutans streptococci levels have been associated with infant mutans streptococci colonization and subsequent caries risk.<sup>8</sup> Transmission occurs through saliva contact such as through sharing spoons or licking pacifiers.<sup>8</sup> Additionally, recent evidence suggests that exposure to tobacco smoke increases the likelihood of streptococci colonization.<sup>8</sup>

Moreover, unmet dental care needs were higher in households where the head of the household had a lower level of education.<sup>19</sup> Additionally, parents are the primary source of a child's dental knowledge. Failure to educate parents at an early stage in a child's development can lead to unhealthy personal behaviors and subsequent dental problems in children.<sup>7</sup>

Children that have established a dental home and who receive semiannual dental visits (examinations, professional cleanings, fluoride treatments, and instruction in proper oral hygiene procedures) can expect to keep their natural teeth for their entire lifetime.<sup>3</sup> Moreover, these individuals will experience very little tooth decay or periodontal diseases.<sup>3</sup>

### *Access to Fluoride, Saliva Composition, and Salivary Flow*

Fluoride and the buffering ability of saliva reduce the incidence of dental caries and slows or reverses the progression of existing lesions.<sup>3</sup> Mineral stores in saliva affect enamel remineralization through the replacement of lost calcium and phosphates.<sup>3</sup> Ingested fluoride is also incorporated into the dentin and enamel of unerupted teeth.<sup>7</sup> Moreover, topical fluoride therapies increase fluoride content in the enamel of newly erupted teeth.<sup>7</sup> Several studies have demonstrated that remineralization results in an increase in tooth hardness and mineral content, rendering the tooth surface more resistant to subsequent acid attack.<sup>3, 7</sup> Moreover, fluoride in saliva and dental plaque along with other components of saliva can directly attack cariogenic bacteria producing a bacteriostatic affect.<sup>3, 7, 8</sup>

When used appropriately, fluoride has been demonstrated to be both safe and effective in preventing and controlling dental caries. Several scientific and public health organizations (Institute of Medicine (IOM) 1997, National Research Council (NRC) 1993, Newbrun 1996, U.S. Department of Health and Human Services (USDHHS) 1991, World Health Organization (WHO) 1984) have reviewed fluoride and its affects comprehensively.<sup>3</sup> The children who benefit the most from fluoride are those at highest risk for dental decay.<sup>43</sup>

There are many methods of fluoride delivery.<sup>3</sup> These methods include community water fluoridation, fluoride mouthrinses, fluoridated toothpastes, and professional treatments with fluoride solutions, gels, and varnishes.<sup>3</sup> Fluoride is also present in a variety of processed foods and beverages and supplements.<sup>3</sup> However, fluoridation of public water is the most efficient and cost-

effective method of reducing tooth decay since it reaches all residents regardless of income level and educational status.<sup>3</sup> The ADA, AAPD, APA, and the Centers for Disease Control and Prevention (CDC) recommend that all children receive appropriate systemic and topical fluoride beginning at six months of age.<sup>44</sup>

However, while all infants benefit significantly from being provided the appropriate amounts of systemic fluoride, too much fluoride increases the risk for development of enamel fluorosis. In March 2006, the National Academies' National Research Council report, "*Fluoride in Drinking Water: A Scientific Review of EPA's Standards*" noted the possibility that some infants may receive more than the optimal amount of fluoride through infant formula reconstituted with fluoridated water (either naturally occurring or systemically introduced community fluoridated public water or fluoridated bottled water).<sup>45</sup> There are three basic types of infant formula: ready-to-feed, powdered, and liquid concentrate.<sup>46</sup> Both the powdered and liquid concentrate (which constitutes 80% of infant formula sold) must be mixed with water and thus, pose potential risks.<sup>46</sup>

The ADA, along with other respected health organizations and agencies, is currently conducting an evidence-based review of the scientific literature, holding symposiums to explore the issues surrounding children and fluoride, and considering recommendations on this subject.<sup>46, 47</sup> Currently, the American Dental Association has provided the following interim guidance for parents, caregivers and health professionals to reduce fluoride intake from infant formula while more research is conducted:

- feeding infants breast milk, widely acknowledged as the most complete form of nutrition for infants;
- for infants who get most of their nutrition from formula during the first 12 months, choosing ready-to-feed formula over formula mixed with fluoridated water to help ensure that infants do not exceed the optimal amount of fluoride intake;
- if liquid or powdered concentrate infant formulas is the primary source of nutrition, it should be mixed with water that is fluoride free (or contains low levels of fluoride) to decrease the risk of fluorosis, including water that is labeled purified, demineralized, deionized, distilled or reverse osmosis filtered water to reduce the risk of fluorosis.<sup>47</sup>

The guidance also notes that fluoride mouthrinses and dietary fluoride supplements should not be used for young children unless a dentist or other health professional recommends its use.<sup>47</sup> Moreover, the ADA guidance, recommends that parents should not use fluoride toothpaste for children less than two years of age, unless a dentist or other health professional advises them to do so.<sup>47</sup> However, the ADA continues to endorse fluoridation of community water supplies as safe and effective for preventing tooth decay.<sup>47</sup>

In the state of Florida, public water systems supply fluoridated water to 76.9 percent of the state's population that receives its water from public water systems.<sup>48</sup> In all, 71.2 percent of Florida's population receives optimally fluoridated water.<sup>48</sup>

Fluoride varnish is a form of topical fluoride that is applied in a provider's office. It has been documented to be safe and effective to fight dental decay through a long history of use in Europe.<sup>43</sup> The advantages of varnish are: it is easy and quick to apply to the teeth; it decreases the potential amount of fluoride digested; and it continues to "soak" fluoride into the enamel for approximately 24 hours after the original application.<sup>43</sup> This method is especially useful in young patients and those with special needs that may not tolerate fluoride trays comfortably.<sup>43</sup> The ADA, AAPD, and APA recommend that children who are moderate to high risk of caries development receive fluoride

varnish applications more than twice a year.<sup>1, 5, 7-9, 44</sup> Moreover the ADA considers fluoride varnish to be a safe and efficacious part of caries prevention.<sup>49</sup>

### *Other Potential Risk Factors*

As noted, any behavior that allows frequent sugar consumption in the presence of mutans streptococci may result in caries formation. Common contributing risk factors in children include propped bottles containing sweetened liquids (the terms “baby bottle tooth decay” and “nursing caries” came about from the practice of putting babies to bed with bottles containing sugary liquids – “baby bottle tooth decay” and “nursing caries” are now considered a distinct subset of ECC<sup>50</sup>), frequent consumption of sweetened liquids, and frequent snacking.<sup>8</sup> However, the caries risk generated by on-demand breastfeeding is unclear as lactose is poorly metabolized by mutans Streptococci.<sup>8</sup>

The likelihood of developing caries in primary teeth is increased in those children that do not eat breakfast daily or who eat fewer than five servings of fruit and vegetables per day.<sup>11</sup>

Clinical observations indicate that later order offspring of a mother with a mildly to moderately high caries rate may be at an increased risk of caries than are offspring born earlier.<sup>9</sup>

Certain chronic diseases or medications or treatments can impede salivary flow, produce developmental defects of the teeth, or cause deleterious behaviors such as mouth breathing.<sup>21</sup> Children born prematurely or with low birth weights are more prevalent to enamel and tooth defects.<sup>8, 21</sup> Moreover, developmental defects and genetic disorders may predispose certain children to increased caries risk (e.g. special needs children).<sup>3, 21</sup>

## **Consequences of ECC**

The consequences of ECC are numerous and significant.

### *Economics*

The cost to treat ECC averages \$1000 to \$2000 per child.<sup>11</sup> If hospitalization is required, with restorative treatment in an operating room under general anesthesia, the costs increase substantially.<sup>11</sup>

### *Pain*

Severe cases of ECC can cause pain and infection.<sup>11</sup> Pain can affect all aspects of a child’s life, from the ability to eat, to causing the child to be distracted and dysfunctional.<sup>3, 14</sup> Worse yet, very young children are generally unable to verbalize their pain.<sup>51</sup>

### *Nutrition*

If a child has tooth pain, they will have difficulties eating.<sup>3, 14, 51</sup> Problems with proper nutrition can lead to growth and developmental delays and defects that can cause not only physical problems, but social problems as well.<sup>3, 14</sup>

### *Stigma*

ECC is associated with problems with social behavior and a failure to thrive with other healthy toddlers.<sup>3</sup> Children with ECC can develop low self-esteem due to tooth and facial deformities and unsightly restorations.<sup>3, 14, 51</sup> Long-term, ECC is associated with teen delinquency and adolescent pregnancy.<sup>14</sup>

### *School and Learning*

Pain from severe cases of ECC can cause a child to miss school. Children lose an estimated 51 million school hours due to oral health related illnesses.<sup>51</sup> Moreover, poor nutrition and pain is associated with difficulties concentrating and learning.<sup>3, 11, 14, 51</sup>

### *Future Disease*

ECC dramatically increases a child's risk of future dental caries and systemic health effects.<sup>3, 14, 21</sup>

## **Prevention Strategies and Guidelines**

The ADA, AAPD, and the APA all recognize that a multidisciplinary process that utilizes both dental and medical professionals is an efficient and even necessary approach to combat ECC.<sup>1, 5, 9</sup> Early risk assessment, early intervention and the early establishment of a dental home are essential components of a ECC prevention protocol.<sup>1, 5, 9</sup> There are two goals of early risk assessment, intervention, and the establishment of a dental home: to screen for parent-infant groups who are at risk of ECC and who would benefit from early, aggressive, intervention; and the timely delivery of educational information to populations at high risk for developing caries to prevent the need for later surgical intervention.<sup>1, 5, 9</sup>

### *Infant Risk Assessment*

Every child should receive an oral health risk assessment by six months of age from a qualified health professional for infants.<sup>1, 5, 7-9</sup> This assessment will provide a caries risk potential for the infant and should include evaluation of clinical conditions, environmental characteristics, and general health conditions.<sup>1, 5, 7-9</sup> Infants at high risk of ECC should receive early ECC prevention and management through the establishment of a dental home.<sup>1, 5, 7-9</sup> High risk of caries includes: children with special health care needs; children of mothers with a high caries rate; children with demonstrable caries, plaque, demineralization, and/or staining; children who sleep with a bottle or breastfeed throughout the night; later-order offspring; children in families of low socioeconomic status.<sup>9</sup>

### *Parental Risk Assessment and Anticipatory Guidance*

Since ECC is an infectious and preventable disease that is transmitted vertically from mother (or other care givers and siblings) to infants risk assessment and anticipatory guidance directed at the mother (and other caregivers and siblings) can impact the prevalence of ECC.<sup>1, 5, 7-9</sup> Modification and treatment of a mother's (and other caregivers' and siblings') oral health status, oral health literacy, oral hygiene, diet, and the use of topical fluoride can have a significant impact on an infant's oral health.<sup>1, 5, 7-9</sup>

### *Infant Anticipatory Guidance*

Anticipatory guidance for every child should occur upon the eruption of the first tooth or at least before one year of age.<sup>1, 5, 7-9</sup> A risk assessment and education and instruction on oral hygiene, diet

and nutrition, and fluoride should continue throughout well-child visits for children at risk of ECC.<sup>1, 5, 7-9</sup>

### *Establishment of a Dental Home*

The AAPD defines the “dental home” as the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way.<sup>1</sup> The AAP defines the “dental home” as a specialized primary dental care provider within the philosophical complex of the medical home.<sup>9</sup> While the AAPD and AAP disagree slightly on the definition and timing of the establishment of a dental home, both agree that early establishment of the dental home is the ideal approach to ECC prevention and management.<sup>1, 9</sup>

## **State Actions**

### *Other States*

Other states have implemented numerous programs or policies in an effort to combat ECC. Most programs or policies are either centered on expanding the workforce or educating the public.

Programs and policies that are designed to expand the workforce include: implementing medical provider caries risk assessment and fluoride varnish prevention programs with associated Medicaid reimbursement – currently 12 states have such programs; increasing Medicaid reimbursement rates in order to attract more dentists to participate in the Medicaid program (Moreover, Utah increased reimbursement rates an extra 20 percent over standard reimbursement rates if rural dentists see Medicaid patients.<sup>52</sup>); loan repayment programs; loan forgiveness programs for practicing in rural or underserved areas or on underserved patients; exempting volunteer dentists from liability for work in state health facilities; mobile dentistry; teledentistry; pediatric screening programs in community health centers that screen newborns to 2-year olds; mandated community water fluoridation; new dental schools or new dental school curriculums; school screening programs by hygienists; and screening programs at faith-based centers.<sup>52</sup> The majority of educational programs are focused on educating parents or soon to be parents such as expanded prevention programs for low-income pregnant women and young children and prenatal oral health education programs in Women, Infants and Children (WIC) programs and other prenatal programs.<sup>52</sup>

### *Florida*

In the state of Florida, various state programs are currently addressing ECC. However, most of these programs are local and fragmented with little statewide coordination.

The Florida Department of Health (DOH) has joined the American Dental Hygiene Association (ADHA) and the FDHA to celebrate October as National Dental Hygiene Month (NDHM) and through the theme “A Healthy Smile Lasts a Lifetime,” will focus on proper early childhood oral health care. Throughout the month of October 2006, NDHM participants (health officials, dental professionals and others) will highlight the many techniques that parents can use to help their children maintain a healthy smile and will educate the community about the relationship of oral health to overall health.

The Florida DOH also has planned to implement an initiative in which DOH County Health Department (CHD) medical staff are trained in preventive and educational oral health services. The DOH will research and devise a training program and protocol for this project utilizing similar

programs that currently exist in other states, existing federal and state web-based training modules, and experts and stakeholders within the state of Florida.

Additionally, UFCD, in collaboration with the DOH, received a grant from HRSA concerning implement two pilot projects (one in Duval and one in the Southwest counties of Collier, Lee, and Charlotte) investigating and training private practice physicians in preventive and educational oral health services over the next one to three years. While similar to the DOH initiative, this grant involves private practice physicians. The program will form an advisory group to help in the planning of training and protocols for the grant program. The educational program for the physicians will address at least five key topics:

- 1) How to perform a screening examination and what to look for (as to normal or atypical anatomy and disease or health)
- 2) How to perform risk assessments and the knowledge that physicians will need to know concerning oral health and disease processes and oral development.
- 3) How to educate parents about dental disease and how their health and behaviors may affect their children.
- 4) How to apply Fluoride varnish (with appropriate training on fluoride toxicity, dosing, and appropriate levels of exposure)
- 5) How to integrate an appropriate referral mechanism that refers patients to dentists/a dental home/safety net providers.

While UFCD's and the DOH's projects are separate, much of the research and design will be shared and will overlap.

Moreover, some DOH CHDs (Palm Beach and Jackson counties), have implemented oral health screening initiatives in their WIC programs. Dentists or dental hygienists screen infants and toddlers (and expectant parents) for oral disease.

Similarly, Alachua County Organization for Rural Needs (ACORN) Dental has a dental outreach program that services seven rural counties: Alachua, Bradford, Columbia, Hamilton, Lafayette, Suwannee and Union. "Tooth Fairies" go to the elementary schools and Head Start centers to provide educational presentations to three to six year olds.

Also, the Seminole Tribe of Florida instituted a surveillance program to determine the prevalence of ECC and from data gleaned from this survey initiated a policy of a mandatory dental examination for those age one and older as a contingency of enrollment in preschool – those under age one are required to have a dental exam within 30 days after their first birthday.

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