

## CHAPTER II

### Essay:

### **Dental Caries Prevention for Preschool Children**

#### **Introduction**

Dental caries is a multifactorial etiologic disease (Kidd and Joyston-Bechal, 1987). It is a preventable disease. Many developed countries are successfully reducing the prevalence of caries in their children, but in developing countries, the prevalence of this disease is clearly on the rise (Murray, Rugg-Gunn, and Jenkins, 1991). For example, in the UK between 1973 and 1983, caries found in five-year-old children fell by 50 percent (Murray et al., 1991). Caries among US children aged five to nine decreased from an average of 6.3 surfaces in 1971-74 to 3.9 surfaces in 1986-87 (Brown, et al., 1995), and in 1986-87, the caries prevalence of children at age five was 42 (Edelstein and Douglass, 1995).

In comparison contrast, the Beijing Survey showed that the incidence of caries in children age five was 5.0 teeth or 10.8 surfaces (Douglass et al., 1995). There are methods in current use in many countries that are effective in preventing or controlling dental caries, even though they cannot provide complete prevention (Bowen, 1995).

The critical point is to use the existing knowledge and critically apply it appropriately for situations in developing countries. Since dental caries not only impact to individual person but also impact to national cost. Therefore, the government should propose the effective prevention to encourage the residents to take care of themselves. This essay also reviews current knowledge of the causes and effects leading to dental caries risk and discusses the effectiveness of some preventive programs.

### **What is Dental Caries?**

Among oral diseases, dental caries and periodontal disease are highly prevalent problems (WHO, 1992). Dental caries can result in tooth loss at a young age, but periodontal disease is a slow progression from childhood to tooth loss at adulthood and old age (WHO, 1992). Dental caries is a disease of the mineralized tissue of the teeth, namely enamel, dentine and cementum, caused by the action of microorganisms on fermentable carbohydrates (Kidd and Joyston-Bechal, 1987). This definition derived from the concept of chemico-parasitic or acidogenic theory that was advanced by Miller (McDonald and Avery, 1994). Dental caries is characterized by a decalcification of inorganic portion and followed by a disintegration of the organic substance of the tooth. Because the outer surface of enamel is far more resistant to demineralization by acid than the deeper portion of enamel is, the lesion occurs in the subsurface and continues to enlarge, with the eventual collapse of the thin surface layer becoming a cavity. At the stage of demineralization on the incipient subsurface enamel, the lesion can be arrested or reversed by the process of remineralization (McDonald and Avery, 1994).

## **Dental caries indicators**

The common dental health status measurement is the DMF index (WHO, 1989). This value is the sum of the number of decayed, missing and filled teeth or surfaces. The DMF value has been widely used for assessing the oral health status of populations for public health planning and policy-making purposes (Jakobsen and Hunt, 1990). The DMF is a measure of cumulative caries attacks that shows the occurrence of caries including past and present caries. The modified index for primary dentition is dmf, which uses the same criteria as DMF and df in which the d includes teeth needing filling or extraction. The common reports of epidemiological data use the mean decayed-missing-filled teeth (dmft) or the mean decayed-missing-filled surface (dmfs) and caries prevalence rate (DHD, 1994; KK.PHO, 1996).

## **Patterns of caries in primary dentition**

The exposure to caries risk starts at the age when teeth erupt. The age at which primary teeth erupt is between six and 33 months. The age range of the first and last tooth eruption is six to ten months and 25 to 33 months. The pattern of eruption is in sequence from central incisor, lateral incisor, first molar, cuspid, and second molar (McDonald and Avery, 1994). The data obtained by a survey of 2,700 low socio-economic status families in Bangkok showed that the first tooth that caries attacks was the maxillary central incisor at the age of 7-12 months (Raveewan and Yuttana Panya-ngam, 1992).

Dental caries measured by dmf is a cumulative status. The score of dmf in children will increase by age. Dental caries once penetrate to inner surface of a tooth, the tooth will irreversible to be a sound tooth. Epidemiological data of Thai children studied in Chiang Mai found that caries prevalence of one- and two-year-old children were 14.3 percent and 40.5 percent respectively. The average number of decayed teeth per person was 1.09 and 2.01 respectively (Thanuchporn Booncharoen and Kanlaya Aroonkaew, 1992). At the ages of three and five years, 61.7 percent and 85.1 percent of Thai children had dental caries respectively and the dmft was 3.4 and 5.7 respectively (DHD, 1994).

The level of susceptibility to caries in children can be characterized as caries-free, pit and fissure caries, and proximal molar caries pattern (Greenwell et al., 1990, quoted in McDonald & Avery, 1994). Other dental caries characterized are Rampant Dental Caries (McDonald, Avery, & Stookey, 1994) and Nursing Caries (Milnes, 1996), or Baby Bottle Tooth Decay (Bruerd and Jones, 1996). The caries pattern in Khon Kaen children was pit and fissure caries at age three and advanced to proximal molar caries pattern at age five.

So dental caries prevention should start early as the first teeth erupt at age six months. The information of caries pattern is useful for select the appropriate prevention which in Khon Kaen case, should prevent pit and fissure caries.

### **Why is dental caries in preschool children a public health problem?**

The prevalence of dental caries in preschool children was high and had increasing trend. In Khon Kaen Province, caries prevalence seems higher than the national average. The data obtained from the Khon Kaen oral health survey in 1987, 1991, and 1996 showed an increasing trend of dental caries in five- and six-year-old children which was 72.5, 83.9, and 88.7 percent respectively (KK.PHO, 1996). While caries prevalence in six-year-old children obtained from DHD's survey in 1984, 1989, and 1994 was 71.6, 82.8, and 85.1 respectively (DHD, 1994).

The consequences of dental caries not only have personal impacts but also social impacts. In comparison to the sickness impact profile, the major categories of dental caries impacts are physical, psycho-social, and social roles (Bergner and Babbitt, 1981, quoted in Locker, 1989, quoted in Griffiths and Boyle, 1993). Teeth problems have an effect on nutritional intake. Restrictions on the diet is caused by hypersensitivity of the teeth to hot and cold foods. Many children suffer dental pain and discomfort and few of them have access to dental treatment. The later stages of caries see infection of the pulp, which is usually treated by extraction. The appearance of the teeth and mouth are important for individual self-esteem. General dissatisfaction with one's appearance can restrict one from normal social activities. Children are apt to be absent from school due to dental diseases and their parents losing days of work and must pay for related expenses such as treatment and transportation. Overall personal and social costs affect the nation's economy (Griffiths and Boyle, 1993).

Because most preschool children were attacked by dental caries and its consequence affected the nation's economy, so the dental caries in preschool children should concern as a public health problem.

### **Factors influencing dental caries**

Dental caries is considered a multifactorial disease. The main etiology of dental caries are microorganisms, carbohydrate substrate and tooth susceptibility. Dental caries in children is influenced from childcare practice by mothers or parents such as dietary habits, oral hygiene habits (Chaiyut Siriviboonkiti et al., 1994).

Due to the growth of industrialization, the lifestyle of the population has begun to undergo change. The growth rate of the GDP in 1993 for Thailand was 8.2 percent and increased slightly to 8.7 percent in 1994 (National Statistical Office [NSO], 1996). Behavior with high risks toward health has increased, such as diets high in fat elevating the chances for heart disease and increased sugar intake, which can lead to dental caries. Laborers are leaving the agricultural sector to work in industry, causing migration from rural to urban areas. More women are working outside the home. Children and the elderly are taken care of less by their families. These changes in lifestyle introduce children to high risks leading to dental caries.

However, dental caries is a multifactorial disease. Only one high-risk factor may not lead to dental caries. To understand the influence factors and how much it significance to dental caries that useful for preventive strategies selection.

## **Influencing factors**

### **1. Microbiological factors**

*Lactobacilli* and *Streptococcus mutans* are recognized as important factors in caries development. *S. mutans* have been associated mainly with the initial development of caries and *lactobacilli* with the progression of carious lesions (Bowden et al., 1983). *S. mutans* is not present in the oral cavity of infants at birth and can be detected only after the primary teeth begin to erupt (McDonald and Avery, 1994). *S. mutans* is transmitted orally from mother to infant (Davey and Rogers, quoted in McDonald and Avery, 1994). Brown, Junner and Liew have demonstrated a relationship between the number of *S. mutans* present in mothers and infants (Quoted in McDonald and Avery, 1994). Child dental caries is also related to the mother's dental experience (Thanuchporn Booncharoen and Kanlaya Aroonkaew, 1992). A multivariate study involving six factors (*S. mutans*, *lactobacilli*, pH, salivary flow rate, buffer capacity and initial caries) indicated that *S. mutans* were the second best factor related to caries incidence over a two-year period after previous caries experience (Klock & Krasse, 1979). So *S. mutans* is a significant predictor of dental caries.

### **2. Diet**

Despite its important role in the etiology of caries, diet did not associate strongly with caries (Kristoffersson et al., 1986). This is because the complexity of the diet is difficult to express in a simple and valid index. The association between

total sugar consumption and caries was low. The amount of sugar consumption is associated with caries only when oral hygiene was simultaneously poor (Kleemola-Kujala and Rasanen, 1982; Harel-Raviv et al., 1996). However, there was a high correlation between the sugar consumed between meals and dental caries. Snacks and drinks between meals are a regular part of eating patterns among young children. Frequency of diet is related to caries incidence (Pisanu Uttamavetin et al., 1992). Sucrose is the most cariogenic of all sugars and may play a more dominant role in the development of smooth surface caries than pit and fissure caries (Newbrun, 1982). A study in Lopburi, Thailand showed that the practice of eating dessert and fruit after meals is a significant factor with impacts to low dental caries (Chaiyut Siriviboonkiti et al., 1994).

The attention on caries prevention should be paid to non-fermentable carbohydrate consumption and frequency of meals and snacks per day (Harel-Raviv et al., 1996).

### **3. Hygiene**

Oral hygiene measured by several indexes has a low correlation to caries experience. This indicator was determined most often by gingival status and plaque index (Demers et al., 1990). Daily tooth brushing had significant positive effects on the level of oral hygiene and dental status (Schou and Uitenbroek, 1995). Tooth brushing reduces the number of oral microorganisms and substrate, particularly if the teeth are brushed after each meal. Removal of these materials will often result in a reduction of smooth surface lesion. Furthermore, the main effect of fluoride-



containing dentifrice by chemical reaction will increase the remineralization process on decalcified lesions during brushing and will result in cariostatic activity (Tinanoff, 1990). Daily brushing habit control by the mother effected to low dental caries of baby (Chaiyut Siriviboonkiti et al., 1994; Thanuchporn Booncharoen and Kanlaya Aroonkaew, 1992). The age at which cleansing commences is correlated to the number of decayed, filled, and missing teeth (Thanuchporn Booncharoen and Kanlaya Aroonkaew, 1992). But the study at Nakhon Sawan showed that there are no statistic significant differences between the number of decayed, missing, and filled teeth by the frequency of babies' oral cleansing and the age at which brushing is started (Pornthip Phupattanakul et al., 1995).

Therefore, daily brushing with mother's control is necessary to prevent dental caries of children. The Cleansing should commence early before caries attack. Fluoride-containing dentrifrice should promote to be used for caries prevention.

#### **4. Socioeconomic status**

The socioeconomic status (SES) of the family affects parent's behavior about child oral care and child oral health. The directly affects its attitude toward the values of dental health (Mathewson and Primosch, 1995). The family with low-income levels or below-average education has tendencies to seek dental treatment when symptoms occur (Mathewson and Primosch, 1995). Families with high income and education levels attend more to preventive programs (Mathewson and Primosch, 1995). Children from low socioeconomic status (SES) groups (categorized by

household income or parental education) had higher mean dmfs and DMFS values than children from high SES groups (Slade et al., 1996). The commonly used index is the occupation of the father or the head of the family (Demers et al., 1990; Schou and Uitenbroek, 1995). Children whose mothers are civil servants had lower occurrences of dental caries than children whose mother do not work or are laborers (Chaiyut Siriviboonkiti et al., 1994). The level of education of the father (Rossow et al., 1986, quoted in Demers et al., 1990) and of the mother (Chaiyut Siriviboonkiti et al., 1994; Pornthip Phupattanakul et al., 1994) were also associated with caries. Age of parents is associated with children's eating habits. Young parents influence an increase in between-meal eating (Dielman et al., 1982).

The social lifestyle also influences dental health status. A Thai national survey found that children age three in rural Thailand had higher caries prevalence than those in urban areas (DHD, 1994). This result may reflex that people in rural areas did not have more knowledge to prevent from the high-risk habit which due to social transition.

## **5. Anatomical characteristic of teeth**

Pits and fissure areas are susceptible to caries especially during the first two years of tooth eruption, which is the period of complete enamel calcification. During the first two years after eruption, the teeth required complete enamel calcification (McDonald and Avery, 1994).

## **Control of dental caries**

Dental caries is a preventable disease. Theoretically on the basis of etiology of disease, the three ways of preventing caries are 1) elimination of the fermentable carbohydrate substrate 2) increasing the resistance of the host or reduce risk area 3) elimination of bacterial plaque (Kidd and Joyston-Bechal, 1987). Each of these measures requires the patient's cooperation. Four main preventive strategies have been developed over the years, namely, fluorides, fissure sealing, dietary choice, and plaque control. Fluorides are having a major impact on smooth-surface caries; hence, strategies combining fluorides and fissure sealing are very effective. Changing dietary practices seems to be having little impact. Plaque control, as practiced routinely by the majority of people, is not sufficient to result in caries reduction (O'Mullane-D, 1995). Fluoride has pre-eruptive effects and post-eruptive effects on caries prevention. There are several models of action. First, fluoride ions act on enamel to form fluoroapatite, which is more resistant to acid dissolution. Second, fluoride ions act on cariogenic bacteria by inhibiting sugar fermentation, inhibiting plaque colonization, and by a direct antibacterial effect. The pre-eruptive stage during the terminal stages of crown formation and during the crown maturation, fluorides is incorporated into the enamel surface. At the post-eruptive stage, fluoride acts as a cariostatic agent (Mathewson and Primosch, 1995). A longitudinal study of children age seven to 18 showed a significant reducing effect of pre-eruptive fluoride in the number of dentinal lesions in a fluoridated area, provided that fluoride was also consumed post-eruptively for a considerable period of time. About 66 percent of the greatest reduction in pit and fissure caries came from pre-eruptive fluoride, while in

smooth surface, this effect was reduced to 25 percent. In approximate surfaces, the reduction was due half to pre- and half to post-eruptive fluoride. Post-eruptive fluoride became more important with decreasing the severity of caries attack (Groeneveld et al., 1990).

### **Public prevention program**

Among community prevention programs throughout the world, water fluoridation is the most cost-effectiveness for caries reduction (Murray et al., 1991). Twenty-four studies out of the 66 studies of water fluoridation throughout the world showed that for deciduous teeth, the model percentage caries reduction was 40-49 percent, and for permanent teeth, the model percentage caries reduction was 50-59 percent (33 out of the 86 studies) (Murray et al.). This acts as a guide indicating the efficiency of fluoride programs. Public water fluoridation holds first rank according to estimated cost-effectiveness (Newbrun and Burt, 1978, quoted in Murray et al, 1991; Heifetz and Burt, 1978, quoted in Murray et al, 1991). Clinical application of fluoride is second, fluoride tablet distribution is third, and tooth brushing with fluoride toothpaste is fifth. Although the value of water fluoridation as a way of preventing caries was recognized, water fluoridation was not always possible. It is not accessible by people in rural areas, which don't have a piped water supply. However, there are effects on the skeleton for lifelong consumption and Thai people may be susceptible to fluorosis (Sansanee Ruchchakul, 1997). The alternative program is fluoride tablets or drops distribution. A study in British Columbia and Canada, determined the prevalence of dental caries in children ages 6-14. The study showed that children who

had taken fluoride supplements for four years or more had 0.67 fewer decayed and filled tooth surfaces (26 percent reduction) compared to children with no exposure to fluoridated water or supplements. Reductions by surface type showed savings on both smooth and pit and fissured surfaces (Clark et al., 1995). Guidelines for fluoride supplements by the Dental Health Division, Thailand's Ministry of Health, suggest that fluoride supplements should be distributed to children age six months to 16 years by controlled dosage as in the American Dental Association's regimen.

### **Dental health status and existing intervention in Khon Kaen Province**

Khon Kaen is a province in the northeastern region of Thailand. It has one dental school, one dental nursing school, and many medical centers that provide dental treatment services, including private dental clinics and private hospitals. More than 60 percent of dental service centers are located in town, Muang District. The others are distributed with one or two stations per district. The dental health data in Khon Kaen Province obtained from the Khon Kaen survey conducted in 1996 showed that 88.7 percent of the five- and six-year-old group had dental caries experience and the average number of decayed, filled and missing teeth per person was 5.3. This shows higher prevalence than the national rate.

Khon Kaen Provincial Health Office started the caries prevention program for children under five years old in 1991. This program offers fluoride drops for children and oral health care instruction to parents at the pediatrics clinic by health officers. Children with parents came regularly to receive vaccinations at age two, four, six,

nine, and 18 months at the Well Baby Clinic. Expanding distribution of fluoride drops by health volunteers who visited their homes three times a year for measuring weight and height.

The oral health status of children aged five-six seemed to be stable when comparing the average number of decayed, filled and missing teeth per person between the 1996 and 1991 surveys. But caries prevalence in the 1996 Khon Kaen survey was higher.

The caries prevalence in primary teeth of Khon Kaen children aged five was high in occlusal surface of first molar which erupts at age 16 (14-18) months (KK.PHO., 1996).

### **Effectiveness of public prevention programs**

Thailand started the preschool children's dental health promotion program in 1992. A dental health education strategy was used to solve the dental caries problem. The purpose was to teach and encourage mothers to take responsibility for their children's oral health. A nationwide preschool children's dental health promotion program evaluation on one and a half- to two-year-old children (1994) found that 60.5 percent of the parents had received dental health education in the antenatal clinic. Health officers gave out first toothbrushes to 41.9 percent of children. It was found that 61.6 percent of the children had been bottle-fed; 29 percent of children slept while sucking; and 37.2 percent of children ate sweets and candy every day. The data

showed a statistically significant number of mothers who received toothbrushes from health personnel were interested and brushed their children's teeth more than mothers who did not receive the toothbrushes (Penthip Chitchumnong et al., 1995).

Many provinces conduct fluoride supplementary activities. It was reported that the percentages of parents' compliance was very low (Rayong Provincial Health Office, 1997). About 50 percent of children who had ever used fluoride drops still take them every day. Penthip Chitchumnong et al. (1995) recommended that improvements should be made in the distribution of fluoride drops and parents should be motivated to comply. Because of the low level of efficiency, this activity should be halted (Penthip Chitchumnong et al., 1995).

A community-oriented program to prevent Baby Bottle Tooth decay was implemented in 12 American Indian/Alaska Native (AI/AN) communities in 1986. The prevention program was multi-disciplinary and multi-strategic. The two major components were: (a) one-to-one counseling with the caretakers of infants and (b) community-wide intervention that included a media campaign, participation in health fairs, and computerized mailings to the caregivers of one-year-olds. In the five sites that continued both one-to-one counseling and community prevention activities over the eight-year period from 1986 to 1994, the prevalence of BBTD of three- to five-year-old children was decreased by 38 percent ( $P < .001$ ). For the seven sites that discontinued community-based prevention activities, the decrease from 1986 to 1989 was statistically significant ( $P < .001$ ); however, the increase from 1989 to 1994 was not statistically significant. The primary reason given for discontinuing the

community-based prevention activities was staff turnover. The one-to-one counseling intervention continued by interval recommended by national Women, Infant, and Child guidelines. At the successful sites, staff reported involvement in a wide variety of community-based educational activities, including computerized mailings to caretakers of infants, smile contests, health fair booths, TV and radio public service announcements, posters, newspaper articles, and parenting workshops (Bruerd and Jones, 1996).

## **Conclusion**

The prevention of caries in children therefore requires parental motivation. Even though the effectiveness of fluoride tablets or drops have appeared in literature (WHO, 1994), the effectiveness is less in non-compliance fluoride use. Considering caries as a multifactorial disease, risk behavior plays a major role in prevention. Multi-strategic community-based prevention programs are required to improve the effectiveness of caries prevention. However, the previous intervention should be evaluated before developing to any new program. So government should criticize and propose an effective prevention for people to take care themselves.



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