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Early childhood caries (ECC) and neglect in child care: analysis of an Italian sample

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Abstract

Aim. Dental caries was identified as the single most common chronic childhood disease; its prevention should be a priority for dentists. With the aim of describing the correlation between early childhood caries (ECC) and the phenomenon of child neglect, a questionnaire which recorded socio-economic and dental service use data was provided to a randomly chosen sample of parents at three pediatric health service centers in Bari (Italy).

Materials and Methods. In order to evaluate the association among risk factors and ECC, contingency tables were created and the value of the Odds Ratio (OR) was calculated, indicating the confidence intervals and chi square values. A student's t-test for independent samples was performed to evaluate the differences between the averages. A value of p≤0.5 was considered to be significant for all tests used.

Results. Of the 63 children examined, 61.9% (n=39; 95%CL=49.9-73.9) presented with ECC, of which 47.6% (n=30; 95%CL=34.9-60.6) were classified as Wyne's Type I; 12.7% (n=8; 95%CL=5.6-23.5) were classified as Type II; and 1.6% (n=1; 95%CL=0-8.5) as Type III. Interestingly, the frequency of Types II and III were shown to be higher in low-income families (chi-square=8.50; p=0.03).

Conclusion. Dentists should recognize children's susceptibility to ECC and their exposure to risk factors for neglect, thus facilitating a primary prevention visit. ***Clin Ter 2013; 164(5):e365-371.*** **doi: 10.7417/CT.2013.1614**

Key words: *forensic science, early childhood caries, child neglect, pediatric dentistry, dental caries*

Introduction

Dental caries is an infectious, contagious and multifactorial disease that was recently identified as the single most common chronic childhood disease (1). Its control and prevention should be a priority for dentists, as it may lead to malocclusion, and other problems related to mastication, phonetics and esthetics (2, 3). Dental caries may also be a risk factor for diminished self-esteem and a gradual reduction of the child's rate of weight gain; such conditions can be remedied after appropriate intervention, however (4). The presence of persistently untreated dental caries is becoming more widely recognized as part of the phenomenon of child neglect (5, 6), or more specifically, dental neglect because "dental caries, periodontal diseases, and other oral conditions, if left untreated, can lead to pain, infection, and loss of function", resulting in a lower quality of life for the child (7-9). Moreover, the effects of Early Childhood Caries (ECC) can be long-term, increasing the risk of dental problems later on in life, and interfering with basic social functioning, as well as optimal growth and development.

Definition of Dental Neglect, risk and protective factors

The American Academy of Pediatric Dentistry (AAPD) (9) defines dental neglect as "the willful failure of parent or guardian to seek and follow through with treatment necessary to ensure a level of oral health that is essential for adequate function and freedom from pain and infection".

Unrecognized dental problems and abnormalities in dietary habits, which may lead to early eating disorders, can all be indications of neglect and may contribute to growth retardation (10-12). In fact, neglected children often present with reduced height and weight, and lower intelligence. Gowen (13) noticed that adequacy of child care predicted children's IQ scores and their ability to play with age appropriate toys.

Dental neglect, which is the failure to seek or obtain appropriate dental care, is often the result of a variety of correlated risk factors such as a child's disability, family isolation, parental ignorance or depression, domestic violence, lack of finances, and the lack of perceived value of oral health. Protective factors against neglect include parental recognition of a problem that prompts them to seek help, supportive grandparents, and accessible mental health care. Once the parents have been appropriately informed by a health care professional about the child's condition, the specific treatment needed, and the mechanisms of accessing the required treatment, they are expected to follow though. Should they fail to do so, the case must be reported to child protective services, as the parents would be considered negligent (14, 15).

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Some researches have reported a relationship between abuse and oral care among samples of children who were maltreated. Some studies (12, 13) have highlighted that income and family structure are related to maltreatment risk and, in particular, that family income seems to influence a child's access to quality medical and dental care.

Olivan examined a sample of Spanish children who were abused, and/or the victims of neglect and reported that over 50% of the sample presented with untreated dental problems (specifically caries). In this study, circumstances such as being socially disadvantaged, low-income, having caregivers who pay little attention to nutrition and hygiene, family isolation, parents' lack of health-promoting behaviors, and poor awareness of the importance of oral hygiene were all identified as risk factors for neglect.

Inadequate or indifferent care experienced by children is processed into thoughts of being unworthy of love and seeing other people as rejecting them (16). Adults who were maltreated as children have a higher incidence of suicidal thoughts and episodes of self-injurious behaviors (17), eating disorders (18), and drug or alcohol addiction (19). Furthermore, people coming from such backgrounds are at higher risk for juvenile delinquency and criminal behavior (20). In addition, a correlation has been shown between physical and emotional neglect, and an elevated risk for behavioral disorders, depression, and anxiety (21).

Professionals concerned about children's health and safety have an important role to play in addressing this problem (14, 15, 22); many physicians see their main responsibilities as the identification of and reporting of child abuse, although they could also play a role in prevention, treatment, and advocacy (23).

Definition of Early Childhood Caries (ECC) and etiology

The AAPD considers ECC to be the presence of any decayed deciduous tooth surface (cavitated or non-cavitated), missing teeth (due to caries), or filled ones in children younger than six years. Based on this definition, severe ECC (S-ECC) is represented by the presence of at least one of the following criteria: a) any sign of caries on a smooth tooth surface in children younger than 3 years of age; b) any smooth surface of anterior and posterior deciduous teeth that are decayed, missing (due to caries), or filled, in children between 3 and 5 years old; c) decayed, missing, and filled teeth index value (DMFT) equal to or greater than 4 at the age of 3 years, 5 at the age of 4 years, and 6 at the age of 5 years (24).

The biological mechanisms of dental caries are well known. The etiological factors, each of which must be simultaneously present to initiate and progress the disease, are: fermentable carbohydrates (substrate); cariogenic microorganisms; and a susceptible host (tooth surface) (8).

Dental caries starts with a primary streptococcal infection (S. mutans), followed by the accumulation of streptococci and lactobacilli in the biofilm (dental plaque) at pathogenic concentrations secondary to the frequent and prolonged exposure to a cariogenic diet. The fermentation of sugars by streptococci and the production of acids (which lower pH) then cause enamel demineralization that results in cavitation of dental structures (8, 25-36). Caries develops from decalcification of maxillary deciduous incisors immediately after their eruption and, if left unchecked, soon affects deciduous molars and canines. While the maxillary deciduous incisors are the most severely affected by ECC, mandibular incisors are kept clean by the tongue and moistened by the saliva from submandibular and sublingual glands (2, 37).

Cariogenic bacteria

The main cariogenic bacteria are S. mutans, S. sobrinus, and Lactobacilli (38, 44). Under normal conditions, after initial demineralization, the minerals in the oral cavity are redeposited onto the tooth surface once the neutral pH is restored (approximately 20 minutes after the introduction of carbohydrates). This process is dynamic, and as long as the minerals are replaced, the tooth surface is remineralized and remains intact. These microorganisms (Streptococci and Lactobacilli) colonize on tooth surfaces and produce acids faster than the biofilm's buffering capacity: a prolonged period of low pH (i.e., a value of less than 5.5) leads to demineralization and cavitation of the tooth surface (2, 38) Due to the fact that the major reservoir of S. mutans is the oral cavity, the infection of the child depends on the infection level of the parent or guardian (38).

Cariogenic diet

Sucrose is the most important cariogenic carbohydrate since it is the only one that, being metabolized by S. mutans GTF enzyme, produces dextrans which promote bacterial adhesion to tooth surfaces (39); the frequency of sucrose intake is more important than the total amount consumed, as frequent consumption provides a continuous substrate that influences the initiation and progression of the caries (40, 41). Other types of carbohydrates involved in cariogenesis are glucose and fructose, found in honey, fruit, and highly refined flour (38, 39).

Susceptible host

General host risk factors that influence the progression of caries may include: premature birth or low-birth weight; pre- and postnatal infection/illness; in addition to nutritional deficiency and environmental pollutants, including maternal smoking (42, 43).

The most important local risk factor is connected to saliva, since it is the host's main system of defense against caries by acting to remove food and bacteria. It also provides buffering against the acids produced. Saliva is a calcium and phosphate reservoir necessary for enamel remineralization. It contains specific and non-specific antibacterial substances (lysozyme, lactoferrin, peroxidase enzymes, histidine-rich proteins, mucins, glycoproteins, fibronectin, β2-macroglobulin, s-IgA) (44).

Salivary gland hypofunction, oral breathing, labial incompetence and other situations that decrease salivary flow, its immunological constituents, and its buffering capacity, all increase tooth susceptibility to caries (38, 44). Other important local host risk factors are: morphology of the tooth (size, surface, depth of fossae and fissures), enamel hypoplasia; immature post-eruptive enamel (2, 25, 35, 45, 46); and oral hygiene habits. In order to maintain the

concentration of fluorine in the saliva for a longer period of time, daily tooth brushing with fluoridated toothpaste together with brushing the teeth before going to sleep are important measures for the control of caries, since fluorine replaces calcium on demineralized dental surfaces, thereby increasing enamel resistance. Furthermore, flourine interferes with microbial metabolism that results in a bacteriostatic effect (41).

Associated risk factors

There are mainly two other risk factors associated with ECC: behavioral and psychosocial etiologic factors. Behavioral factors have great importance with regard to dietary practices: the utilization of baby bottles beyond 12 months predisposes a child to ECC because the bottle's nipple blocks access of saliva to the upper incisors, whereas the lower incisors are close to the main salivary glands and are protected from liquid contents by the bottle nipple and the tongue. The use of baby bottles at night is associated with prolonged exposure of the oral cavity to fermentable carbohydrates. Moreover, it has been demonstrated that children with ECC sleep less at night and receive more bottle-feedings as a way to manage their sleep problems (8, 38).

The second risk factor is socioeconomic status. ECC is more frequent in: children living in socio-economically disadvantaged conditions (1, 2, 29-31, 47-52); children who come from low-income families and ethnic/racial minority groups (1, 3, 52); those who are born to single mothers (55); and those whose caregiver's level of education is low (8, 29, 31. 33, 47, 48, 52, 53). In these populations there is a tendency toward: prenatal and perinatal malnutrition, which results in enamel hypoplasia; generally insufficient oral hygiene; a likely inadequate intake of fluorine (3, 54); and a greater preference for carbohydrate-rich foods (51, 56). Malnutrition, such as iron deficiency anemia, may even lead to reduced salivary secretion, thereby lowering buffering capacity (2, 29, 47, 50, 57, 58).

Finlayson reported that broader psychosocial factors might negatively influence health-promoting behaviors; chronic stress and depression are included among the risk factors that have been found to adversely affect parents' ability to engage in preventive health practices (1).

The aim of our work is to describe the correlation between ECC and the phenomenon of child neglect by analyzing its causes, consequences, and manifestations in order to inform and sensitize oral health physicians to the problem of dental neglect and to help prevent this type of child maltreatment.

Materials and Methods

The sample studied consisted of 63 parents and guardians from three pediatric health service centers in Bari (Italy). After a brief explanation of the study, informed consent was requested and obtained from the participants who were subsequently given an anonymous questionnaire to complete. Each parent/guardian had 20 minutes in which to fill out the form.

The questionnaire gathered information on socio-economic status, general demographics, and the frequency of their children's' odontologic visits, general health, diet, and oral hygiene habits (Table 1).

Table 1. Questionnaire delivered to parents/guardians.

1. Sex
2. Age
3. Living Parents?
4. Mother's age
5. Father's age
6. Divorced parents?
7. Guardian
8. Joint custody?
9. Mother's job
10. Father's job
11. Family illness
12. Which?
13. Person in charge of preparing meals
14. Lunch time
15. Dinner time
16. Frequent use of:
    a. Baby bottle with tisane
    b. Pacifier with sugar
    c. Pacifier with honey
    d. Baby bottle with fruit juice
    e. Baby bottle with biscuits
    f. Other
17. How long is baby bottle kept in mouth?
    a. Less than an hour
    b. More than an hour
    c. All night
18. Between main meals the child takes:
    a. Snacks
    b. Sweets/lollipops
    c. Chocolate
19. How many times a day does child brush teeth?
    a. One
    b.Two
    c.Three
20. Has the child been ever examined by a dentist?
21. With which frequency?

Each questionnaire was completed at an odontologic visit for each child. Wyne Early Childhood Caries nomenclature ECC (59) was used in the descriptions of each child's dental state (Table 2).

The data from the completed questionnaires, along with the results from the odontologic visits were entered into a database using *File Maker Pro* software, and analyzed using SPSS software®.

Quantitative variables were expressed as averages using standard deviation and range. The qualitative variables were expressed as proportions using 95% confidence intervals. In order to evaluate the association between specific risk factors and the onset of ECC, contingency tables were created and the value of the Odds Ratio (OR) was calculated, indicating the confidence intervals and chi square values. A Student's t-test for independent samples was performed to evaluate the differences between the averages.

A value of $p \leq 0.5$ was considered to be significant for all tests used.

Results

The sample analyzed consisted of 37 (58.6%; 95% CL=45.6-71) males, and 26 (41.4%; 95%CL=29-54.4)

Table 2. Wyne nomenclature for ECC.

Type I (mild to moderate)
Isolated carious lesion(s) involving molars and/or incisors. Usually found in children who are 2 to 5 years old.

Type II (moderate to severe) ECC
Labiolingual carious lesions affecting maxillary incisors, with or without molar caries depending on the age of the child and stage of the disease, and unaffected mandibular incisors. This type of ECC could be found soon after the first teeth erupt. Unless controlled, it may proceed to become Type III ECC.

Type III (severe) ECC
Carious lesions affecting almost all the teeth including the lower incisors. This condition is usually found between age 3 and 5 years. The condition is rampant and involves tooth surfaces which are usually unaffected by caries.

females. The average age of the subjects sampled was 4.8 years (SD=1.1; range 2-7) with no statistically significant differences between male (mean=4.83; SD=1.11) and female (mean=4.80; SD=1.13; t=0.1; p>0.05) subjects.

Of all the children examined, 61.9% (n=39; 95%CL=49.9-73.9) presented with ECC: 47.6% (n=30; 95%CL=34.9-60.6) of whom had Type I; 2.7% (n=8; 95%CL=5.6-23.5) Type II; and 1.6% (n=1; 95%CL=0-8.5) Type III.

36.5% (n=23; 95%CL=24.6-48.4) of the respondents reported that their child frequently used a baby bottle or a pacifier; this figure did not differ with those who presented with ECC (n=14/39; 35.9%; 95%CL=20.8-50.9) and those who were not affected (n=9/24; 37.5%; 95%CL=18.1-56.9; chi-square=0.02; p>0.05).

The number of subjects with Type I ECC was 39.1% (n=9/23; 95%CL=19.2-59.1) for those who used a bottle; and 52.5% (n=21/40; 95%CL=37-67.9) for those who did not (chi-square=1.04; p>0.05). The percentage of subjects with Type II ECC was 21.7% (n=5/23; 95%CL=4.9-38.7) for those who used a bottle; and 7.5% (n=3/40; 95%CL=-07-15.7) for those who did not (chi-square=2.67; p>0.05). And finally, Type III ECC was present in only one subject who did not use a bottle.

50.8% (n=32; 95%CL=37.9-63.6) of the subjects studied presented with scant accumulation of plaque; 34.9% (n=22; 95%CL=23.3-48) had a moderate accumulation; and 14.3% (n=9; 95%CL=6.7-25.4) had a heavy accumulation.

With regard to oral hygiene habits, 6.3% (n=4; 95%CL=1.8-15.5) of the children had never used a toothbrush; 39.7% (n=25; 95%CL=27.6-52.8) reported that they had brushed once a day; 38.1% (n=24; 95%CL=26.1-51.2) twice a day; and 15.9% (n=10; 95%CL=7.9-27.3) three times a day. No statistically significant differences were seen in the distribution of types of ECC in subjects with differing oral hygiene habits (chi-square=8.34; p>0.05).

33.4% (n=21; 95%CL=21.7-44.9) of those interviewed reported that at least one family member had a chronic illness: In this group, 57.1% (n=12/21; 95%CL=35.9-78.3) were free of caries. The presence of a chronic illness in the family was found to be a protective factor against caries (OR= 0.28; 95%CL=0.08-0.98; chi-square=5.15; p=0.02).

The final factor analyzed was socio-economic status, which first looked at the employment status of the parents, followed by the category of employment (income average) and the type of ECC (Table 3).

The occurrence of Type II and III ECC was higher in children who came from low-income families (chi-square=8.50; p=0.03).

Discussion

A strong correlation between the frequent use of bottles/pacifiers and the presence of ECC was found in our sample. This result was only seen in cases of Type II ECC. One significant datum is the relationship between the presence of a chronic illness in the family and the absence of ECC. This result may fundamentally explain the theory that those who are geographically close to health services have a greater probability of benefitting from them, whereas those who are farther away have less access to care (and in the case of this study, a higher incidence of ECC).

According to theoretical models of health inequality, those who have little access to healthcare and prevention are at risk of further reduction in access to this care over time. Loss of health also depends on social causes in that social position influences the condition of the sick, even as far as determining the outcome of an illness. In order to create an overall improvement in the quality of life, truly efficient treatment and prevention programs must be accessible to those who are able to derive better health from them. It is

Table 3. Distribution of ECC type by level of income.

ECC	Low Income		Medium/High Income	
	n	Confidence Limits (95%CL)*	n	Confidence Limits (95%CL)
0 (n.=24)	12	50 % (30-70)	12	50 % (30-70)
1 (n=30)	13	44.1 % (27.4-60.8)	17	55.9 % (39.2-72.6)
2 (n=9)	8	88.9 % (68.4-109-4)	1	1.1 % (-9.4-31.6)
3 (n=3)	3	100 %	0	-

n: Number of subjects in whom caries were found (Type I, II, and III)
* Percentage of subjects in whom ECC was not found in the low-income group. Extreme values

also just as important to consider a dimension of health that is not merely determined by factors of a biological nature (60-62): prevention could be also achieved by offering such services as psychological screening to detect psychosocial disorders, preventive check-ups, and by maintaining a connection to families, where observation of parent-child relationships may take place (14).

Another important datum is that of the correlation between socio-economic status and ECC. Parents play a key role in their child's development of healthy oral hygiene habits: if the parents have healthy habits, then the children are more likely to have them. It has been shown that the higher the socio-economic level of the family, the better the oral hygiene habits are.

This study has revealed a higher incidence of ECC in children who come from lower social echelons. It is the authors' opinion that this correlation may be explained by the fact that people in lower socio-economic spheres have less access to odontologic care. Those belonging to these classes tend to postpone the age at which a child begins odontologic treatment, thereby delaying the adoption of good eating and hygienic habits. Therefore, it is important to highlight two aspects related to ECC. Diet and hygiene habits play an important role in the development of caries on deciduous teeth, and parents with low levels of education may require special attention because their children are at higher risk for caries (63). Because ECC reduces children's quality of life and is strongly correlated to child neglect, its control and prevention should be a priority for dental practitioners. Professionals concerned about children's health should recognize children's susceptibility to ECC and their exposure to risk factors for neglect. In this way, a child may be directed to primary preventive care visits.

In summary, dental neglect, and the phenomenon of child maltreatment in general, have both short and long-term oral and general health consequences, as well as psychological and social effects (64).

In conclusion, health care specialists must be knowledgeable of local laws and regulations and should be educated about programs aimed at preventing child maltreatment (14). Dental practitioners have the four ''R''s of responsibility in preventing and reporting child neglect: these include recognizing maltreatment risk factors and manifestations, recording data, reporting abuse to local authorities, and appropriate patient referral (65). Dental physicians, in contemporary society, can act as proponents for governmental policies and programs that support children and families, in a modern vision of enhanced child health (64-66).

The educational function of this study is important also from the point of view that it may help in the prevention of neglect in the field of odontology, given that this type of neglect is often due to the fact that some parents are unaware of the fundamental role that correct oral hygiene plays. This observation is confirmed in our preliminary study in which we have verified that, in the majority of cases regarding dental problems, low socio-economic status is an important contributing factor.

Even though the sample in this study is limited, its contribution is that it aims to sensitize dentists to the problem of neglect, and recognizing neglect may only come about if there is a deep awareness of the phenomenon of child maltreatment.

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