Prevalence of Early Childhood Caries in a Population of Children with History of Maltreatment

Nancy Valencia-Rojas, DDS, MSc; Herenia P. Lawrence, DDS, MSc, PhD; Deborah Goodman, MSW, RSW, PhD

Abstract

Objective: *The purpose of this study was to investigate the prevalence of early childhood caries (ECC) in a population of maltreated children in Toronto, Ontario, Canada.* ***Methods:*** *The sample consisted of preschool-aged children (2 to 6 years) admitted to the care of the Children's Aid Society of Toronto (CAST) between 1991 and 2004. Data were collected by reviewing the dental and social workers' records of CAST. ECC was determined using the decayed, missing, and filled deciduous teeth (dmft) index. The type and severity of maltreatment were obtained from the Eligibility Spectrum.* ***Results:*** *The study included 66 children: 37 (56 percent) boys and 29 (44 percent) girls, with an average age of 4.1 years [standard deviation (SD) = 1.2]. Four (6 percent) children had evidence of dental injury, and none had teeth filled or extracted as a result of decay. ECC was observed in 58 percent of the abused children. Of these, the mean decayed teeth ("dt") value was 5.63 (SD = 4.17,* n = *38) and 3.24 (SD = 4.21) for the whole sample (*n = *66). The proportion of children with untreated caries was 57 percent among "neglected" children (*n = *53) and 62 percent in physically/sexually abused cases (*n = *13). Logistic regression revealed that children in permanent CAST care and those in its care more than once were significantly less likely to have experienced caries.* ***Conclusions:*** *Abused and neglected young children had higher levels of tooth decay than the general population of 5-year-olds in Toronto (30 percent prevalence, mean dt = 0.42, SD = 1.20,* n = *3185). However, this study did not find any difference in ECC prevalence between children with different types of maltreatment. The study did find that CAST services had a protective effect on children's oral health, which supports the recommendation that child protection services should investigate possible dental neglect in physical/sexual abuse and neglect cases.*

Key Words: dental caries, primary dentition, ECC, prevalence, child maltreatment, child abuse and neglect

Introduction

Child maltreatment and early childhood caries (ECC) are major public health problems affecting young children in all cultural, ethnic, and socioeconomic groups, with medical, moral, cultural, and psychological implications (1). In Canada, child maltreatment is defined as "the mistreatment of a child or a disregard for the developmental needs of a child by a parent, guardian or caregiver resulting in injury, emotional/psychological harm or the potential for such harm" (2). Similar to ECC, child maltreatment is the result of a combination of multiple socioeconomic factors associated with poverty (1), dysfunctional families, and parenting behavior (3).

Despite the fact that these two health issues are different, they share some important common features such as high prevalence, risk factors, and long-term consequences. Child maltreatment affects more than 225,000 children a year across Canada (4). Correspondingly, the prevalence of dental caries among 5-year-old children in urban areas is estimated to be 30 percent (5). Second, although child maltreatment is present in all segments of society, young children at a high risk of dental disease and child maltreatment have common risk factors, especially those related to low socioeconomic status (SES) (6,7), social deprivation (8), single-parent households (9,10), family isolation and disintegration (11,12), low parental level of education (13,14), substance abuse (3,14), and unemployment (7). Third, both ECC and child maltreatment can affect children permanently, and the devastating effects of abuse in children go beyond physical injuries. Children who experience maltreatment are at a very high risk of developing psychological, behavioral, emotional, and social problems not only in childhood and adolescence, but also into adulthood (15). Likewise, untreated dental caries in young children can not only destroy their teeth but also affect their general health and have detrimental consequences on the children's well-being and quality of life (16). Moreover, the close relationship between these two public health issues seems evident when it is repeatedly suggested that severe cases of dental caries such as "nursing caries" could

Send correspondence and reprint requests to Dr. Herenia P. Lawrence, Community Dentistry Discipline, Department of Biological and Diagnostic Sciences, Faculty of Dentistry, University of Toronto, 124 Edward Street, Room 515D, Toronto, Ontario, Canada M5G 1G6. Tel.: (416) 979-4908 ext. 4492; Fax: (416) 979-4936; e-mail: herenia.lawrence@utoronto.ca. Nancy Valencia-Rojas and Herenia P. Lawrence are with the Discipline of Community Dentistry, Department of Biological and Diagnostic Sciences, Faculty of Dentistry, University of Toronto. Deborah Goodman is with the Children's Aid Society of Toronto and the Faculty of Social Work, University of Toronto. This research was completed while Dr Valencia-Rojas was a Master's student in Dental Public Health at the University of Toronto. **Source of support:** Research Fund from the Faculty of Dentistry at the University of Toronto. This paper was presented at the 2006 Annual General Meeting and Scientific Conference of the Canadian Association of Public Health Dentistry, held in St. John's, Newfoundland, August 25-26, 2006. Manuscript received: 12/3/06; accepted for publication: 9/8/07.

DOI: 10.1111/j.1752-7325.2007.00077.x

be seen as a sign of child maltreatment, particularly dental neglect (17).

Nevertheless, very little is known about the prevalence of dental caries in young abused/neglected children. The present study sought to a) determine the prevalence of ECC in an identified population of abused and neglected children, b) investigate whether or not the prevalence of caries in a population of maltreated children is the same as that in the general population in the same geographic location, and c) examine the extent to which untreated decay rates are associated with varying types of child maltreatment. We hypothesized that maltreated young children not only experience higher rates of dental caries than nonabused children but also that the type of maltreatment is associated with untreated dental caries (an indicator of access to dental care). Children suffering neglect are potentially less likely to visit the dentist and therefore are more likely to have untreated dental caries.

Methods

This was a retrospective prevalence study of the oral health status of young children admitted for care to the Children's Aid Society of Toronto (CAST), Ontario, Canada. Medical and dental examinations, followed by any required treatment, are provided for all children admitted to CAST. The children selected for this study were identified by reviewing the records of CAST dental services. The target population was the roster of all eligible children who were admitted to the care of CAST and who were referred for dental evaluation from 1991 to 2004. The study protocol was reviewed and approved by the Research Ethics Review Committees of the University of Toronto and CAST. Selection of children was based on the following criteria: a) cases were referred to a specific private pediatric dental practice in the city of Toronto, close to CAST, and b) at the time of the first dental examination, children were in the primary dentition stage of tooth development. The specific dental office was selected because a large number of CAST children are referred there; this practice has worked in partnership with CAST for many years and has extensive experience treating this vulnerable pediatric population. Three pediatric dentistry specialists work in this dental practice.

Data on the oral health status from the first referral visit were collected by the principal investigator through retrospective dental chart reviews of primary dentition odontogram (tooth/mouth diagram) and dental history. The page giving the patient name, address, and other personal information was removed to keep the investigator blind to the identification of the child. Abstracted data such as untreated decayed (d), missing (m), and filled (f) teeth (t) were recorded, and indices were calculated.

For the purpose of this study, the outcome was determined by means of the following indicators: a) ECC case, if the dmft was greater or equal to 1; b) severe ECC (S-ECC) case, defined as a child with a total dmft of 4 or more; c) evidence of dental trauma, as noted by the dentist in the child's dental chart based on tooth discoloration and mobility; and d) the mean dmft value and its components (dt, mt, ft).

Data on maltreatment were also collected from protective social services (CAST). These included the type of abuse, severity of the abuse, number of times in CAST care, number of siblings in CAST care, period of time under CAST care, and guardianship status – all collected from CAST internal records, which were retrieved by CAST personnel not directly involved in the study. Data were entered in an Excel spreadsheet and provided to the primary investigator with coded identifiers to allow for merging with the oral health status data. Specifically, the type and the severity of the abuse were obtained from the Eligibility Spectrum, which is an objective and updated tool used by social workers in Ontario to make consistent and accurate decisions about eligibility for service and provide reasons for admission at the time of referral (18). Guardianship status refers to the legal guardian of the child. In extremely severe cases, when it is necessary to remove the child from the home, the child may be made a Crown ward by the court. Crown wards are recognized as permanent wards of the province until the age of 18, or until they are adopted. While children are Crown wards, the Children's Aid Society (CAS) assumes the rights and responsibilities of the parent. A second classification is the Society ward. Society wards are not permanent Crown wards, and CAS and the parent share the legal guardianship of the maltreated child, usually for periods less than 2 years. A third classification, "temporary care," applies to cases of child maltreatment in which both CAS and the parent have legal status over the child, but the child is likely to be in CAS custody only on a short-term basis. Two other classifications, "apprehension" and "noncourt order," are also of short-term duration, typically lasting, on average, 5 days, with CAS and the parent sharing legal status.

Descriptive statistics were used to summarize the data and inspect the shape of the variables' distributions. Bivariate statistical analyses of associations between the oral health status variables (dichotomized) and various CAST categorical and demographic indicators were done by means of Pearson's Chi-square test and Fisher's exact test. Bivariate (unadjusted) odds ratios (OR) and 95 percent confidence intervals were employed to determine the strength of the relationship between CAST indicator variables and ECC and S-ECC. For caries experience, as measured by the dmft/s indices and their components (discrete variables), the *t*-test and the Mann–Whitney *U*-test were used, depending on the shape of the data distribution. Logistic regression modeling was used to evaluate the joint effect of CAST indicators and the child's demographic factors on the risk of ECC and S-ECC. Statistical tests were two-tailed and interpreted at the 5 percent significance level.

Table 1
Characteristics of the Study Population

Variable	% ($n = 66$)
Age (years)	
2	16.7
3	28.8
4	30.3
5	18.2
6	6.1
Age (years) (regrouped)	
2-3	45.5
4-6	54.5
Sex	
Male	56.1
Female	43.9
Type of abuse	
Physical/sexual	19.7
Harm by omission	22.7
Emotional harm	4.5
Abandonment/separation	1.5
Caregiver capacity	51.5
Type of abuse (regrouped)	
Physical/sexual	19.7
Neglect	80.3
Severity of the abuse	
Minimally/not severe	3.0
Extremely/moderately	97.0
Number of times in CAST care	
Only once	66.7
More than once	33.3
Siblings in CAST care	
No siblings	75.8
Siblings	24.2
Period in CAST care	
Less than 1 year	65.2
More than 1 year	34.8
Guardianship status*	
Crown ward	15.2
Society ward	33.3
Temporary care	1.5
Apprehension	36.4
Noncourt order	13.6

* Guardianship status (see text for definition).
CAST, Children's Aid Society of Toronto.

Information about the mean dmft values from 5-year-olds from the general population in the city of Toronto, published in 2001, were used for comparison (5). These data were collected as part of the Ministry of Health and Long-Term Care of Ontario's dental screening mandated Dental Indices Survey (DIS) on schoolchildren aged 5, 7, 9, and 13. According to the DIS guidelines, all age-eligible children are to be screened each year to determine the risk level of individual schools and the dental public health needs of each for the following school year. DMFT/deft index data are collected by health units' calibrated dental public health hygienists and recorders, using sterilized, blunt dental explorers and mouth mirrors, with a standard light source. To compare the mean dmft of the study population with that of the general population of Toronto, a pooled estimate of the variance was computed and a two-independent-samples *t*-test was calculated.

Results

The initial target population size was 83 children, but 12 were excluded because these children had been defined as "requesting assistance" of protective social services, which means that no abuse had been inflicted, and another five were excluded because their dental records could not be accessed. All final 66 cases studied had no evidence of previous dental treatment; only untreated decay at the time of the first dental examination was observed. In other words, none had filled or missing teeth caused by caries. The proportion of boys and girls was nearly equal (Table 1), with an average age of 4.1 years [standard deviation (SD) = 1.16]. Approximately one in five children (13/66) experienced physical/sexual abuse, and 80 percent (53/66) experienced neglect. Severity of the abuse and neglect was classified as extreme/moderate in all but two cases. Crown wards comprised 15 percent (10/66) of the whole sample. Other demographic information on the children and the service characteristics (CAST indicators) are summarized in Table 1.

ECC ($dt \geq 1$) were observed in 57.6 percent of the abused children (Table 2), as compared with 30 percent among 3,185 5-year-old schoolchildren in the city of Toronto (5). The prevalence of S-ECC ($dt \geq 4$) was 31.8 percent. The proportion of children with untreated caries was 61.5 percent (8/13) among those who had been physically/sexually abused, and 56.6 percent (30/53) among "neglected" children ($\chi^2 = 0.104$, $P = 0.75$). Likewise, the proportion of children with S-ECC tended to be higher (46.2 percent) in physically/sexually abused children than in neglected children (28.3 percent) (Fisher's exact test, $P = 0.319$). The age distribution was similar, i.e., 61.5 percent (8/13) cases of physical/sexual abuse and 52.8 percent (28/53) cases of neglect occurred among 4- to 6-year-old children ($\chi^2 = 0.319$, $P = 0.57$). Only four children had clinical evidence of dental injury, recorded in the dental

Table 2
Bivariate Analyses of the Relationship between Oral Health Status and Child Maltreatment Outcomes in Preschool Children in CAST Care

Oral health status indicators	Total	Child maltreatment outcomes		
		Physical/sexual	Neglect	*P*-value
Number of participants	66	13	53	
n (%) with ECC (dt ≥ 1)	38 (57.6)*	8 (61.5)	30 (56.6)	0.75‡
n (%) with S-ECC†	21 (31.8)	6 (46.2)	15 (28.3)	0.32¶
n (%) with dental trauma	4 (6.1)	2 (15.4)	2 (3.8)	0.17¶
Mean dt (SE)	3.24 (0.52)	3.54 (1.00)	3.17 (0.60)	0.52§
For those with caries				
Number of participants	38	8	30	
Mean dt (SE)	5.63 (0.68)	5.75 (1.00)	5.60 (0.82)	0.47§

* As compared with an ECC prevalence of 30% among 3,185 5-year-old schoolchildren in the City of Toronto (5).
† S-ECC, severe early childhood caries (dt ≥ 4).
‡ Chi-square test.
¶ Fisher's exact test.
§ Mann–Whitney *U*-test.
CAST, Children's Aid Society of Toronto; ECC, early childhood caries; SE, standard error; dt, decayed teeth.

Table 3
Prevalence of ECC and S-ECC by Age, Sex, and Type of Abuse

	n	ECC *n* (%)	S-ECC *n* (%)	dt Mean ± SE
Age (years)				
2-3	30	15 (50.0)	8 (26.7)	2.60 ± 0.73
4-6	36	23 (63.9)	13 (36.1)	3.78 ± 0.73*
Male				
2-3 years	18	9 (50.0)	5 (27.8)	2.50 ± 1.01
4-6 years	19	13 (68.4)	6 (31.6)	3.68 ± 0.92
Female				
2-3 years	12	6 (50.0)	3 (25.0)	2.75 ± 1.09
4-6 years	17	10 (58.8)	7 (41.2)	3.88 ± 1.17
Type of abuse				
Physical/sexual	13	8 (61.5)	6 (46.2)	3.54 ± 1.00
Neglect	53	30 (56.6)	15 (28.3)	3.17 ± 0.60
Physical/sexual				
Male	8	5 (62.5)	4 (50.0)	3.75 ± 1.40
Female	5	3 (60.0)	2 (40.0)	3.20 ± 1.53
Neglect				
Male	29	17 (58.6)	7 (24.1)	2.93 ± 0.79
Female	24	13 (54.2)	8 (33.3)	3.46 ± 0.94

* As compared with the mean dt of 0.42 (SD = 1.20, SE = 0.021) among 3,185 5-year-old schoolchildren in the City of Toronto (5). The mean deft for 5-year-olds in Toronto equaled to 1.21 (SD = 2.47) and dt/dmft ratio = 0.347 or 34.7% (5).
ECC, early childhood caries; S-ECC, severe early childhood caries; SE, standard error; SD, standard deviation; dt, decayed teeth; dmft, decayed, missing, and filled deciduous teeth.

chart as tooth discoloration (2/13 were physically/sexually abused and 2/53 were neglected). The mean dt value was 3.24 [standard error (SE) = 0.52, SD = 4.21] for the whole sample, while the mean dt value in physically/sexually abused children (3.54, SE = 1.00, SD = 3.62) and neglected children (3.17, SE = 0.60, SD = 4.38) did not differ significantly. Among those with dental decay, the overall mean dt value was 5.63 (SE = 0.68, SD = 4.17), 5.75 (SE = 1.00, SD = 2.82) among children who had been physically/sexually abused, and 5.60 (SE = 0.82, SD = 4.50) for those who had been neglected.

Generally, there was a tendency for more boys to be affected by ECC than girls, but the mean dt value was slightly higher for females of all ages (Table 3). In the 4-to-6 age group, a higher proportion of females was affected by S-ECC. However, neither the rates of ECC/S-ECC nor the dt mean values were significantly different between the sexes. Caries prevalence was high, with 50 percent (15/30) children under 4 years of age and 64 percent (23/36) of those 4 to 6 years being affected; however, this difference between age groups was not statistically significant ($\chi^2 = 1.29$, $P = 0.26$). As anticipated, the prevalence of S-ECC was also higher among older children (36.1 percent) than younger ones (26.7 percent), but the difference was not statistically significant ($\chi^2 = 0.673$, $P = 0.41$). In terms of the mean dt difference between populations (study population versus general population), 4- to 6-year-old abused/neglected children scored nine times higher than the general population of 5-year-old schoolchildren residing in the City of Toronto ($n = 3{,}185$; mean dt = 0.42, SD = 1.20, SE = 0.021; *t*-test, $P < 0.001$). The total dmft index score for 5-year-olds in Toronto was 1.21 (SD = 2.47), with a dt/dmft ratio of 0.347, or 34.7 percent (5).

Children who were admitted to CAST more than once and with the guardianship status of Crown ward were significantly less likely to have ECC (Table 4). Similarly, abused/neglected children who had been under CAST care more than once were 87 percent less likely to have S-ECC than those who had been admitted only once, with no difference in the age distribution of these children (data not shown).

Guardianship status of the child was the only variable that remained statistically significant in the model predicting the risk for ECC, adjusting for age, sex, presence of siblings at CAST, type of abuse, and number of times under CAST care (Table 5). In

Table 4
OR (95% CI) for the Odds of ECC and S-ECC by CAST Indicators

CAST indicator	Category	*n*	*n* (%)	OR (95% CI)	*P*-value
ECC					
Number of times in care	Only once	44	29 (65.9)	Ref	0.05*
	>Once	22	9 (40.9)	0.36 (0.13,1.03)	
Guardianship status	Temporary	56	36 (64.3)	Ref	0.01†
	Crown wards	10	2 (20.0)	0.14 (0.03,0.72)	
Period in CAST care	<1 year	43	29 (67.4)	Ref	0.03*
	>1 year	23	9 (39.1)	0.31 (0.11,0.89)	
S-ECC					
Number of times in care	Only once	44	19 (43.2)	Ref	0.01*
	>Once	22	2 (9.1)	0.13 (0.03,0.63)	
Guardianship status	Temporary	56	20 (35.7)	Ref	0.15†
	Crown wards	10	1 (10.0)	0.20 (0.02,1.70)	
Period in CAST care	<1 year	43	15 (34.9)	Ref	0.47*
	>1 year	23	6 (26.1)	0.66 (0.21,2.02)	

* Pearson's Chi-square test.
† Fisher's exact test.
CAST, Children's Aid Society of Toronto; ECC, early childhood caries; S-ECC, severe early childhood caries; OR, odds ratio; CI, confidence interval.

other words, those children with permanent legal status had 86 percent decreased risk of ECC than those with temporary status (adjusted OR = 0.14). Conversely, for S-ECC, the significant predictor was "number of times in CAST care," which conferred an 84 percent decrease in the odds for S-ECC for those children who had been in CAST care more than once (adjusted OR = 0.16) (Table 6).

Discussion

This is the first Canadian study that estimated ECC prevalence in a preschool population of confirmed cases of child maltreatment. Our case definition of ECC was adapted from the National Institute of Dental and Craniofacial Research (NIDCR) (19). The children included in our project demonstrated a staggering degree of dental disease. The results of this study indicate that the prevalence of ECC (decayed only) is high among abused/neglected children (58 percent) in Toronto. By contrast, the prevalence of ECC in the general child population of similar age within the same urban area was 30 percent (5), which clearly shows a disproportionate level of decay in the study population. This is despite the methodological differences between the data abstracted from the clinical records of pediatric dentists and those recorded by calibrated dental hygienists without the use of X-rays. Nevertheless, this finding confirms our first hypothesis that abused young children would demonstrate high levels of dental caries.

As obvious untreated caries and cases of rampant caries have been mentioned as possible indicators of dental neglect (20), we assumed that children who have endured overall neglect could present with high levels of tooth decay. Surprisingly, our results showed that a higher proportion of physically/sexually abused children experienced both ECC and S-ECC more than neglected children, although this difference was not statistically significant. This finding, however, refutes our second hypothesis that neglected children have higher rates of untreated decay than physically/sexually abused ones. The reasons for this finding remain, at present, unclear.

When analyzing the severity of decay, which was determined by the mean dt in each subgroup classified by type of maltreatment, we found that both groups presented similar rates of decayed teeth, with a mean of 3.24. This score is almost eight times higher than that observed in 5-year-old children within the general population of Toronto, where the reported mean dt was 0.42 (5).

Boys and girls were distributed evenly in terms of risk for ECC within our study groups. The present study did not find a statistically significant sex difference by type of child maltreatment and presence of ECC. However, our data reflect a slight tendency of male victims to predominate: 62.5 percent of physically/abused children and 58.6 percent of neglected children who have experienced ECC were boys.

Only four children (6 percent) displayed some evidence of intraoral trauma, a level not dissimilar from that reported by Becker et al. (21). In their study, intraoral lesions represented 6 percent of overall injuries in cases of physical abuse. Our study found only one record indicating a child had a history of facial trauma (bruises on the chin), as reported by a physician.

The bivariate analyses of the association between ECC and CAST indicators showed that children who had been admitted to CAST more than once and who had the permanent legal guardianship status of Crown ward were significantly less likely to have ECC. Moreover, the prevalence of S-ECC was significantly lower among children who had been under the protection of CAST for a period longer than 1 year. Taken together, these findings indicate that CAST services have a protective effect on children's oral health.

Only four previous studies have examined the relationship between dental decay and child maltreatment among children aged 2 to 12, and the results from these studies are conflicting. Three were conducted among abused/neglected children from military families in the United States (22-24). Two of them demonstrated that abused/neglected children have 5.2 to 8 times increased likelihood of having untreated decayed teeth than nonabused children (23,24). Nevertheless, the third study (22) found no significant differences in deft/DMFT from the American national average. Results of the American studies done

Table 5
Logistic Regression Model for the Odds of Early Childhood Caries in Abused/Neglected Young Children

Variable	Adjusted odds ratio	95% confidence interval	Wald *P*-value
Age (2-3 years = 0; 4-6 years = 1)	1.52	0.51, 4.58	0.45
Sex (male = 0; female = 1)	0.54	0.17, 1.70	0.29
Siblings in CAST care (no sibling = 0; with sibling = 1)	0.74	0.21, 2.69	0.65
Type of abuse (physical/sexual = 0; neglect = 1)	1.09	0.27, 4.39	0.90
Number of times in CAST care (only once = 0; more than once = 1)	0.42	0.13, 1.39	0.16
Guardianship status (temporary = 0; permanent/Crown ward = 1)	**0.14**	**0.02, 0.83**	**0.03**

CAST, Children's Aid Society of Toronto.

Table 6
Logistic Regression Model for the Odds of Severe Early Childhood Caries in Abused/Neglected Young Children

Variable	Adjusted odds ratio	95% confidence interval	Wald *P*-value
Age (2-3 years = 0; 4-6 years = 1)	1.18	0.36, 3.82	0.79
Sex (male = 0; female = 1)	0.84	0.26, 2.73	0.77
Siblings in CAST care (no sibling = 0; with sibling = 1)	0.81	0.21, 3.08	0.75
Type of abuse (physical/sexual = 0, neglect = 1)	0.61	0.16, 2.37	0.48
Period of time under CAST care (less than 1 year = 0; more than 1 year = 1)	1.29	0.32, 5.21	0.73
Guardianship status (temporary = 0; permanent/Crown ward = 1)	0.22	0.02, 2.70	0.24
Number of times in CAST care (only once = 0; more than once = 1)	**0.16**	**0.03, 0.83**	**0.03**

CAST, Children's Aid Society of Toronto.

on military populations may not be generalizable, especially because military personnel and their families have access to free dental care and other social benefits that are not available to the civilian population. On the other hand, a fourth study conducted (25) in Spain found a prevalence of caries of 50.4 percent in abused children up to 12 years of age and concluded that these children are more likely to have untreated decayed teeth than nonabused children. In the present study, the ECC problem was even more severe, as we found a mean dt of 3.24, which was higher than the dt of 1.29 observed in the Spanish study.

However, our study has limitations that must be acknowledged. First, we reviewed only charts of patients admitted to CAST; therefore, causal relationships cannot be determined through a retrospective analysis. Second, the relatively small number of cases made definitive comparisons between the prevalence of ECC and potential risk indicators difficult as a result of poor statistical power. Third, this sample may not be representative of all children who have been exposed to abuse and any attempt to extrapolate the results to the entire child maltreated population must be done with considerable care. Fourth, because this study is based on secondary data, it provides an incomplete picture of the sociodemographic environment relevant to the etiology of maltreatment and ECC. The data-retrieval process did not include sociodemographic indicators, especially those related to SES. Therefore, correlations between these variables and the outcome could not be calculated, making it impossible to compare this sample with other samples for important sociodemographic variables that may influence the outcome measure.

Future studies may wish to explore the SES of the family, immigrant status, and ethnicity in an attempt to better understand the relationship between ECC and child maltreatment. Low SES and ethnicity is associated with certain behaviors and attitudes toward oral health and oral health care. Families whose children may typically develop caries are those from impoverished families where relationships are complicated, and where immature parents are ill equipped to bring up their children (26,27). Such immaturity is manifested by allowing the child to watch TV for hours, frequent feeding of sugary foods and snacks, and also using sweets to comfort the child during temper tantrums or sleeping difficulties (28). Correspondingly, in dysfunctional families where episodes of abuse exist, parents may also have negative attitudes toward health care, which significantly impact the provision of dental treatment (29). Lack of parental motivation and interest in oral health can lead to development of dental caries in children, which, if left untreated, can be perceived as dental neglect.

Because of the inaccessibility of socioeconomic data, we could not assess the effect of SES on the relationship between child maltreatment and ECC. Similarly, we could not determine whether the presence of untreated caries was linked to neglect. While most neglect, including dental neglect, can be attributed to societal problems such as poverty, we should not automatically assume that the poor are neglecting their children. To rule out the suspicion of dental neglect, the need for dental treatment must first be explained clearly to the caregiver. Then, existing financial obstacles must be eliminated or resolved. If after that still no treatment is provided, evidence of dental neglect is established (30).

In summary, the results indicate that dental caries is highly prevalent among abused/neglected young children. Despite the limitation of prevalence studies to demonstrate causal relationships, this study shows that children who have been abused are more likely to have untreated caries than those in the general population. However, this study did not find differences in ECC/S-ECC prevalence between types of maltreatment. It did find that social services improved children's oral health, as CAST covers dental treatment and preventive services to all children under their care. Barriers to access to dental care for very young children are likely a significant problem. This study suggests that 2- to 6-year-old physically abused/neglected children in Canada have high levels of need for dental treatment and oral health promotion services. Indeed, more than half of the children had dental decay with no evidence of treatment, suggesting that they may not have previously visited a dentist until they were admitted to CAST. Our results enable us to advocate for a better knowledge of dental care and its impact on the general well-being of children on the part of social welfare workers. Furthermore, these findings have significant implications for the child protection services to ensure that they investigate possible dental neglect in young children in sexual/physical abuse cases, as well as in neglect cases. This study is a first step toward understanding the relationship between child maltreatment and ECC.

Acknowledgments

Special thanks go to the staff of CAST and to the three pediatric dentists who provide dental care for the CAST population. The authors would also like to thank the Faculty of Dentistry at the University of Toronto for supporting the study through its research fund. Thanks also to the reviewers who provided insightful comments and suggestions on an earlier draft of this manuscript.

References

1. Vadiakas G, Roberts MW, Dilley DCH. Child abuse and neglect: ethical and legal issues for dentistry. J Mass Dent Soc. 1991;40:13-5.
2. National Clearinghouse on Family Violence. Child abuse and neglect overview paper. Ottawa: Health Canada, Public Health Agency of Canada, Family Violence Prevention Unit; 1990 [updated 1997 Feb; cited 2006 Nov 22]. Available from: http://www.phac-aspc.gc.ca / ncfv - cnivf / familyviolence / html / nfntsnegl_e.html
3. Jessee SA. The neglect of our youth: a dental perspective. ASDC J Dent Child. 1993;60:361-4.
4. Trocmé NM, Tourigny M, MacLaurin B, Fallon B. Major findings from the Canadian incidence study of reported child abuse and neglect. Child Abuse Negl. 2003;27:1427-39.
5. Leake JL, Goettler F, Stahl-Quinlan B, Stewart H. Report of the sample survey of the oral health of Toronto children aged 5, 7, and 13. Toronto: Faculty of Dentistry, University of Toronto and Toronto Public Health; 2001.
6. Dilley GJ, Dilley DH, Machen JB. Prolonged nursing habit: a profile of patients and their families. ASDC J Dent Child. 1980;47:102-8.
7. Berger LM. Income, family characteristics, and physical violence toward children. Child Abuse Negl. 2005;29:107-33.
8. Petti S, Cairella G, Tarsitani G. Rampant early childhood dental decay: an example from Italy. J Public Health Dent. 2000;60:159-66.
9. Wu SS, Ma CX, Carter RL, Ariet M, Feaver EA, Resnick MB, Roth J. Risk factors for infant maltreatment: a population-based study. Child Abuse Negl. 2004;28:1253-64.
10. Hallett KB, O'Rourke PK. Early childhood caries and infant feeding practice. Community Dent Health. 2002;19:237-42.
11. Dong M, Anda RF, Felitti VJ, Dube SR, Williamson DF, Thompson TJ, Loo CM, Giles WH. The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. Child Abuse Negl. 2004;28:771-84.
12. Willems S, Vanobbergen J, Martens L, De Maeseneer J. The independent impact of household- and neighborhood-based social determinants on early childhood caries: a cross-sectional study of inner-city children. Fam Community Health. 2005;28:168-75.
13. Peres MA, Latorre MRDO, Sheiham A, Peres KGA, Barros FC, Hernandez PG, Maas AMW, Romano AR, Victora CG. Social and biological early life influences on severity of dental caries in children aged 6 years. Community Dent Oral Epidemiol. 2005;33:53-63.
14. Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. Child Abuse Negl. 1998;22:1065-78.
15. Latimer J. The consequences of child maltreatment: a reference guide for health practitioners. Ottawa: Health Canada, Public Health Agency of Canada, National Clearinghouse on Family Violence, Family Violence Prevention Unit; 1998 [cited 2006 Nov 22]. Available from: http://www.phac-aspc.gc.ca/ncfv-cnivf/familyviolence/html/nfntsconsequencevio_e.html/
16. Acs G, Shulman R, Ng MW, Chussid S. The effect of dental rehabilitation on the body weight of children with early childhood caries. Pediatr Dent. 1999;21:109-13.
17. Jessee SA. Orofacial manifestations of child abuse and neglect. Am Fam Physician. 1995;52:1829-34.
18. Ontario Association of Children's Aid Societies. Ontario child welfare eligibility spectrum, 2000 [updated 2007 Dec 17; cited 2007 Dec 17]. Available from: http://www.oacas.org/pubs/oacas/eligibility/index.htm
19. Drury TF, Horowitz AM, Ismail AI, Maertens MP, Rozier RG, Selwitz RH. Diagnosing and reporting early childhood caries for research purposes. A report of a workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration. J Public Health Dent. 1999;59:192-7.
20. da Fonseca MA, Feigal RJ, ten Bensel RW. Dental aspects of 1248 cases of child maltreatment on file at a major county hospital. Pediatr Dent. 1992;14:152-7.
21. Becker DB, Needleman HL, Kotelchuck M. Child abuse and dentistry: orofacial trauma and its recognition by dentists. J Am Dent Assoc. 1978;97:24-8.
22. Badger GR. Caries incidence in child abuse and neglect. Pediatr Dent. 1986;8(Spec No 1):101-2.

23. Greene PE, Chisick MC, Aaron GR. A comparison of oral health status and need for dental care between abused/neglected children and nonabused/nonneglected children. Pediatr Dent. 1994; 16:41-5.
24. Greene P, Chisick MC. Child abuse/neglect and the oral health of children's primary dentition. Mil Med. 1995;160: 290-3.
25. Olivan G. Untreated dental caries is common among 6 to 12-year-old physically abused/neglected children in Spain. Eur J Public Health. 2003;13:91-2.
26. Psoter WJ, Pendrys DG, Morse DE, Zhang H, Mayne ST. Associations of ethnicity/race and socioeconomic status with early childhood caries patterns. J Public Health Dent. 2006;66:23-9.
27. Mattila ML, Rautava P, Sillanpää M, Paunio P. Caries in five-year-old children and associations with family-related factors. J Dent Res. 2000;79:875-81.
28. Ayhan H. Influencing factors of nursing caries. J Clin Pediatr Dent. 1996;20:313-6.
29. Adair PM, Pine CM, Burnside G, Nicoll AD, Gillett A, Anwar S, Broukal Z, Chestnutt IG, Declerck D, Ping FX, Ferro R, Freeman R, Grant-Mills D, Gugushe T, Hunsrisakhun J, Irigoyen-Camacho M, Lo EC, Moola MH, Naidoo S, Nyandindi U, Poulsen VJ, Ramos-Gomez F, Razanamihaja N, Shahid S, Skeie MS, Skur OP, Splieth C, Soo TC, Whelton H, Young DW. Familial and cultural perceptions and beliefs of oral hygiene and dietary practices among ethnically and socioeconomically diverse groups. Community Dent Health. 2004;21(Suppl 1):102-11.
30. Loochtan RM, Bross DC, Domoto PK. Dental neglect in children: definition, legal aspects, and challenges. Pediatr Dent. 1986;8(Spec No 1):113-6.