Send Orders of Reprints at reprints@benthamscience.net

104 *The Open Dentistry Journal,* 2014, *8,* 104-108

aOpen Access

Influence of an Intervention to Prevent Early Childhood Caries Initiated before Birth on Children's Use of Dental Services up to 7 Years of Age

Kamila Plutzer[1,*] and Marc J.N.C. Keirse[2]

[1]*Australian Research Centre for Population Oral Health, School of Dentistry, The University of Adelaide, Adelaide, South Australia, Australia*

[2]*Department of Obstetrics, Gynaecology and Reproductive Medicine, Flinders University, Adelaide, South Australia, Australia*

Abstract: *Background*: In a previously reported randomised controlled trial, advising first time mothers on the prevention of early childhood caries from before their child was born, decreased the prevalence of early childhood caries at 20 months of age 5-fold.

Objective: We examined the effect of the intervention on the frequency and nature of dental visits up to 7 years of age.

Methods: Of 649 expectant mothers who participated in the trial, 277 completed a "Child Oral Health Survey" 7 years later. Their answers were compared with those of a comparison group of 277 mothers selected at random among those living in the same area with a first child born in the same year enrolled with the South Australian School Dental Services (SA SDS).

Results: Only 1.5% of children had a dental visit before 12 months of age and only 4% before 2 years of age unless a dental problem had arisen. The age at the first visit did not differ among groups, but the reasons for the visit did as did the number of visits and the need for treatment under sedation or anaesthesia. In the trial group, 34% of first visits were for pain, 29% for injury, and 29% for concern with appearance. In the comparison group, pain was the main concern in 49%, injury in 9.5%, and appearance in 25% (p=0.019). Over time, children in the trial had an average of 2.2 visits compared with 3.1 in the comparison group. In the intervention group of the trial, no child had required treatment under sedation or general anaesthesia compared with 2.9% in the control group, and 6.5% in the comparison group. Only 15% of mothers reported that they had received any information on caries prevention from health care professionals other than dental care practitioners.

Conclusion: Providing first-time mothers with guidance on the prevention of childhood caries decreased the use of dental services to deal with problems in preschool children.

Keywords: Dental care, early childhood caries, health promotion, preschool children, randomised controlled trial.

INTRODUCTION

In the late 1980s, there was much speculation about the future of dentistry in the 21st century [1]. Barmes [2], among others, believed that the success of preventive action would make childhood caries an unusual condition. Much of that optimism was derived from a steady decline in caries in primary teeth seen over the years. In Australia, that decline continued into the 1990s, but started to level off in the mid-1990s. Since then, caries in both primary and permanent teeth of children has steadily increased [3], as it has elsewhere [4].

To counteract the onset of oral disease, the American Academy of Pediatric Dentistry puts emphasis on early professional involvement with oral examination, risk assessment and the provision of anticipatory guidance to parents [5]. It recommends that infants should be scheduled for an initial oral health evaluation within 6 months of the eruption of the first primary tooth, but not later than at 12 months of age. The Canadian Dental Association recommends the same with the purpose of having a child visit a dentist before there is a problem with teeth [6]. The Australian Dental Association also recommends a first visit at 12 months of age or shortly after eruption of the first teeth [7]. At this first visit, the dentist can evaluate the health of teeth, their alignment, and give instruction to parents on the use of fluoride, brushing and general oral health. That visit should help to establish a life-long habit of preventive oral health care.

While authoritative international bodies have formulated guidelines for the timing of a child's first dental visit, implementing them has been a different matter. In the United States, only 2% of children have seen a dentist by their first birthday [8]. In a nationwide Australian survey, conducted in

*Address correspondence to this author at the Australian Research Centre for Population Oral Health, School of Dentistry, The University of Adelaide, SA 5005, Australia; Tel: +61 8 8313 3292; Fax: +61 8 8313 4858; E-mail: kamila.plutzer@adelaide.edu.au

1874-2106/14

Table 1. Children's age (in valid percentages) at the time of their first dental visit.

Age in Years	Trial Participants		Comparison Group	Total*
	Intervention	Control		
	(n = 137)	(n = 126)	(n = 271)	(n = 534)
< 1	1.5	1.6	1.5	1.5
< 2	5.8	4.8	7.7	6.6
< 3	16.1	15.1	17.7	16.7
< 4	49.6	50.0	43.5	46.6
< 5	76.6	72.2	79.3	77.0
< 6	84.7	85.7	96.3	90.8

*Age at first visit was not reported for 20 children (3.4%).

1995, only 12% of children had ever visited a dental professional before 3 years of age and only 43% before 5 years of age [9].

Recognition of the importance of early intervention has spurned a search for alternative ways of reaching children and their families to prevent early childhood caries. These have included home visiting programmes [10], telephone contacts with mothers [11], motivational interviewing [12], Medicaid-sponsored programmes in the United States [13], sending mothers oral health information adapted to the age of their child [14], and involving well-baby clinics and other non-dental primary health care providers in the oral health of children [15, 16].

In 2002-2005, we conducted a randomised controlled trial inviting pregnant women to participate in a programme of anticipatory guidance to prevent early childhood caries in their child [14]. The educational intervention significantly reduced the incidence of early childhood caries by 20 months of age, from 9.6% in the control group to 1.7% in the intervention group (P <0.001). In a follow-up of this trial, we examined the dental visiting pattern of these children from birth up to 6-7 years of age and compared the data with those in a population-based cohort of school children with similar characteristics.

METHODS

One in five women expecting their first child and receiving antenatal care in public hospitals across Adelaide in 2002 were invited to participate in the "Cavity Free Children" randomised controlled trail. 82% (n = 649) agreed. Details of the trial have been published previously [14, 17]. Briefly, mothers in the intervention group received three rounds of oral health promotion material: the first at their enrollment in the study and the other two by mail when their child was 6 and 12 months old. At 20 months of age, children from both groups were examined by a dentist for the presence of any sign of early childhood caries [14].

All mothers enrolled in the trial were invited to participate in a *Child Oral Health Survey* after their child had reached 6 years of age, the age by which children must be enrolled in school. 43%, equally distributed between the intervention group (n = 141) and the control group (n = 136) participated. A comparison group of 277 children with similar demographic characteristics, born as a first child in 2002 and living in the same postal districts as the children in the trial was randomly selected from children enrolled with the South Australian School Dental Services (SA SDS). The trial participants and the comparison group were similar in terms of mothers' education, occupational status, household income, private dental insurance, and number of siblings born after 2002 [18].

Mothers completed the survey in the privacy of their home. It contained sections on dental problems and use of dental services, oral hygiene, general health, social support, and demographic characteristics.

Ethical approval for the study was obtained from the ethics committee at the 5 hospitals where women were originally recruited, from the Human Research Ethics Committee at the University of Adelaide, and from the Board of SA SDS. All participants signed separate informed consents for participation in the survey and to access data held by SA SDS.

The chi-square test was used for statistical analysis.

RESULTS

Only 1.5% of children had a dental visit before their first birthday with no differences between the two trial groups and the comparison group (Table **1**). Less than half had seen a dentist before the age of 4 and nearly a quarter had not seen a dentist before the age of 5, again with no differences among groups (Table **1**). However, 14 mothers in the trial (5.0%) and 6 in the comparison group (2.3%) did not report the age of their child at its first dental visit.

The majority of children (69.4%) had their first dental visit at the School Dental Services; 18.8% of mothers took their child to their own private dentist and 9.9% to another private dentist (Table **2**). 63% of mothers were very satisfied with the dental care obtained at that first visit, with only 1.8% dis-satisfied and 1.0% very dis-satisfied.

Of 493 mothers (89.9%), who reported the reason for the first visit to a dentist, 111 (22.5%) reported that this had

Table 2. Type of care provider at a child's first dental visit.*

Dental Care Provider	Trial Participants		Comparison Group	Total*
	Intervention	Control		
	(n = 117)	(n = 112)	(n = 267)	(n = 496)
Mother's dentist	25.6	19.6	15.4	18.8
Other private dentist	12.0	11.6	8.2	9.9
School dental service	60.7	67.9	73.8	69.4
Other practitioner	1.7	0.9	2.6	2.0

Percentages are based on valid numbers as shown (missing data: $n = 58$).

Table 3. Percentage of children having a known number of dental visits up to 7 years of age.*

Number of Visits	Trial Participants		Comparison Group	Total*
	Intervention	Control		
	(n = 117)	(n = 113)	(n = 274)	(n = 504)
1 – 2	72.6	63.7	50.4	58.5
3 – 4	23.9	25.7	32.1	28.8
≥ 5	3.4	10.6	17.5	12.7

* Percentages are based on valid numbers shown (91% of participants).
Statistical differences: intervention versus control: $P > 0.05$; trial group versus comparison group: $P < 0.001$.

been to deal with one or more problems, such as appearance, pain, or injury, rather than for a check-up. However, for children under 2 years of age, this was 42.9% indicating that only 4% of children had a dental check-up before the age of 2 unless there was a problem. Of the 485 mothers whose child had seen a dentist before the age of 6, all but two reported the reason for the first visit compared with only 10 of 49 (20.4%) after 6 years of age.

While there was no difference in the frequency of a problem prompting the first consultation among groups, the nature of the problem differed. Injuries accounted for 7.6% of first visits in the trial group (21 of 277) and for 3.9% (8 of 277) in the comparison group ($P < 0.03$). In the trial group, pain accounted for 9.0% of first visits (intervention: 7.8%; control: 10.3%). In the comparison group, it accounted for 14.8% of first visits ($P < 0.05$). This is consistent with 12.7% of mothers in the intervention group, 21.2% in the control group and 28.2% in the comparison group reporting that their child had suffered severe toothache ($P < 0.002$).

91% of mothers (n = 504) reported the number of dental visits with large differences between the groups (Table **3**). 17% of mothers in the trial, exactly the same in the intervention and the control group, did not recollect the number of visits, compared with only 1.1% in the SA SDS comparison group. The average number of visits for those who reported them was 2.1 in the intervention and 2.4 in the control group of the trial, compared with 3.1 in the SA SDS group. The percentage of children who had 5 visits or more to a dentist by 7 years of age was 3.4% in the intervention group of the trial, 11.9% in its control group, and 21.2% in the comparison group (Table **3**; $P < 0.001$).

Mothers were also asked to recall a situation when their child needed dental care but could not get it. Only 47 mothers (8.5%) recalled such a situation giving a variety of reasons, such as unable to make an appointment (34.0%), unsure where to go (21.3%), unable to get time off from work (14.9%), too far to travel (8.5%), the dental problem occurred after hours (8.5%), or the child refused to go (2.1%).

85% of mothers reported receiving information about the prevention of early childhood caries from dental staff at that first dental visit. One in five would have preferred to receive more information on caries prevention than they did and only 2.2% felt that they had received too much (Table **4**). Mothers' opinion as to whether they had received enough information did not differ significantly between the two trial groups, but it did between the trial participants and the comparison group ($P < 0.02$).

Overall, 50.5% of mothers reported that they had received information related to a healthy diet, 72.8% about tooth brushing, 20.1% about the use of fluoride, and 5.5% about injury prevention. 20% of mothers received explanations about the development of dental diseases from dental health care professionals and 17% received information about the use of dental services.

Only 83 mothers (15%) reported that they had received any advice on dental health from other health care professionals. The majority of them (55.4%) had received advice

Table 4. Mothers' opinion on the information received to prevent early childhood caries at their child's first dental visit.*

Information Received	Trial Participants		Comparison Group	Total*
	Intervention	Control		
	(n = 140)	(n = 136)	(n = 275)	(n = 551)
Too little	12.9	20.6	26.5	21.6
Enough	82.9	77.0	72.0	76.2
Too much	4.3	1.5	1.5	2.2

* Percentages are based on the valid numbers shown (missing data: $n = 3$).
Statistical differences: intervention versus control: $P > 0.1$; trial group versus comparison group: $P < 0.02$.

or information from Child and Youth Health Services. Few of the 83 had received any advice from medical practitioners (13.3%), hospital health promotion units (12.0%), dieticians (4.8%), or pharmacists (1.2%).

22 mothers (4.0%) reported that their child had received dental treatment under sedation or general anaesthesia. 18 were in the comparison group (6.5%) and 4 in the control group of the trial (2.9%). None were in the intervention group of the trial (trial versus comparison: $P < 0.005$).

DISCUSSION

Dental caries remains one of the most prevalent diseases in children. It is the most common pediatric disease in the United States [19]. In England, it is the 4th most common reason for a child's admission to hospital [20]. In Australia, dental caries is the main reason for hospitalization of 1-4 year old children [21]. Early childhood caries adversely affects all aspects of a child's quality of life, including its learning ability [22-24]. Not to be ignored either is the effect on its parents' quality of life [24], the financial burden of dealing with it [25], and the fact that caries in the primary dentition is a major risk factor for caries in the permanent dentition with life-long consequences [26].

While the disease is known to be largely preventable, there is no silver bullet to do so, as it results from an interaction among several biological, behavioral and social factors not all of which are easily remedied. However, there is reasonable evidence that providing mothers, as the gatekeepers to the health of their children [27, 28], with adequate information on caries prevention can go a long way [10, 14, 29]. However, few mothers seem to receive enough information in a timely fashion.

Despite the fact that mothers and children generally have several contacts with health care professionals before a child reaches school age, only 15% of mothers reported that they had received any advice on oral health and caries prevention from practitioners other than dental practitioners before their child reached school age. In our population-based cohort more than 1 in 4 also reported that they had received too little information from the dental practitioner at their first visit. Even in the intervention arm of our trial, 13% of mothers felt that they would have preferred to receive more information in addition to the three rounds of information offered at enrollment and when their child was 6 and 12 months old.

There are a number of limitations to our study, though. Only 43% of women enrolled during their first pregnancy participated again 7 years later. Many could not be contacted as they had moved address, which is common enough given the residential mobility of young families, but for most we do not know what happened in the meantime. However, our comparison group, recruited from the School Dental Services, may partially compensate for this loss in generalisability. Recall bias is another limitation that needs to be considered as mothers may not recollect everything that happened to their first-born child in its first 6-7 years. This is evident from the fact that 3.4% of mothers did not recall their child's age at its dental first visit and 9%, especially those not enrolled with the School Dental Service, did not recall the total number of dental visits. However, recall bias is unlikely to apply to major events, such as hospitalization and treatment under sedation or general anaesthesia, which were markedly different among groups. Although the Child Oral Health Survey was anonymous and mothers completed the questionnaire in the privacy of their home, we cannot exclude the possibility of a social desirability bias either, especially from our trial participants who had been sensitized to the importance of preventing early childhood caries. Nonetheless, cross-checking among questions indicates that this is not likely to be a significant bias.

It would seem that the main challenge to combat childhood caries is to gain the attention of mothers and children before problems arise. Other studies have shown that this may apply especially to the first-born child in a family, who is likely to receive dental care at a later age than its siblings [16]. Despite universal recommendations from dental associations, dentists still see few children in time to recommend preventive actions. It was disappointing to realize that mothers in our trial were not more likely to take their child to a dentist at an earlier age than other mothers were. On the other hand, they may have obtained some reassurance at the 20 months dental check-up that was offered free of charge to all trial participants [14].

Obviously, pediatricians and primary care providers especially can play an important role in the prevention of early childhood caries. Unfortunately, if our study is anything to go by, too few of them seem to do so.

CONCLUSION

The intervention strategy not only improved the oral health of children as shown previously. It also decreased the use of dental services to address problems in preschool children. The study further revealed that mothers of young children receive very little oral health preventive information from non-dental health care providers. All health care practitioners need to realize that oral health is a key element of the health of young children.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

ACKNOWLEDGEMENTS

We are indebted to the Evaluation and Research Unit and the staff of the South Australian School Dental Services (SA SDS) for their assistance and to emeritus professor AJ Spencer for ongoing support. We also thank the mothers who participated in the study and the obstetricians and midwives who facilitated recruitment in the trial.

REFERENCES

[1] Expert Committee on Educational Imperatives for Oral Health Personnel: Change of Decay. WHO Technical Report Series 794. WHO, Geneva 1990.

[2] Barmes DE. International perspectives for the first quarter of the twenty-first century. Swed Dent J 1989; 13: 1-6.

[3] Spencer AJ. Putting the population back into oral health; decoupling oral health improvement from clinical dental practice. Commun Dent Oral Epidemiol 2012; 40 (Suppl 2): 5-11.

[4] Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries: a pending public health crisis. Am J Dent 2009; 22: 3-8.

[5] American Academy of Paediatric Dentistry. Guidelines on infant oral health care. Pediatr Dent 2010; 32: 114-8.

[6] Canadian Dental Association. Available from: http://www.cdaadc.ca/en/oral_health/cfyt/dental_care_children/first-visit.asp. [Accessed: January 2014].

[7] Australian Dental Association. Available from: http:// www.ada.org.au. [Accessed: January 2014].

[8] Tang SS. Profile of pediatric visits. Ekk Grove Village, iii: American Academy of Pediatrics: 2010. Available from: http://www.aap.org/en-us/professional-resources/practice-support/-financing-and-payment/Billing-and-Payment/Docucments/Profile_-Pediatric-Visits [Accessed: January 2014].

[9] Slack-Smith LM. Dental visits by Australian preschool children. J Paediatr Child Health 2003; 39: 442-5.

[10] Kowash MB, Pinfield A, Smith J, Curzon MEJ. Effectiveness on oral health of a long-term health education programme for mothers with young children. Br Dent J 2000; 188: 201-5.

[11] Plonka KA, Pukallus ML, Barnett A, Holcombe TF, Walsh LJ, Seow WK. A controlled, longitudinal study of home visits compared to telephone contacts to prevent early childhood caries. Int J Paediatr Dent 2013; 23: 23-31.

[12] Harrison R, Benton T, Everson-Stewart S, Weinstein P. Effect of motivational interviewing on rates of early childhood caries: a randomized trial. Pediatr Dent 2007; 29: 16-22.

[13] Chi DL, Momany ET, Jones MP, *et al.* Relationship between medical well-baby clinics and first dental examinations for young children in Medicaid. Am J Public Health 2013; 103: 347-54.

[14] Plutzer K, Spencer AJ. Efficacy of a oral health promotion intervention in the prevention of early childhood caries. Commun Dent Oral Epidemiol 2008; 36: 335-46.

[15] Edelstein B. Dental visits for Medicaid children: analysis and policy recommendations. Children's Dental Health Project. Washington DC 2012. Available from: http://www.cdhp.org/resource/dental_visits_medicaid_children_analysis_ and_ policy_ recommendations [Accessed: January 2014].

[16] Leroy R, Bogaerts K, Hoppenbrouwers K, Martens LC, Declerck D. Dental attendance in preschool children – a prospective study. Int J Paediatr Dent 2013; 23: 84-93.

[17] Plutzer K, Keirse MJNC. Incidence and prevention of early childhood caries in one- and two-parent families. Child Care Health Dev 2011; 37: 5-10.

[18] Plutzer K, Spencer AJ, Keirse MJNC. Reassessment at 6-7 years of age of a randomized controlled trial initiated before birth to prevent early childhood caries. Commun Dent Oral Epidemiol 2012; 40: 116-24.

[19] Tinanoff N, Reisine S. Update on early childhood caries since the Surgeon General's Report. Acad Pediatr 2009; 9: 396-403.

[20] Fayle S. Improving oral health care for children – a great opportunity. Br Dent J 2013; 214: 547-9.

[21] Australian Institute of Health and Welfare. Australian Hospital Statistics 2009-10. Health services series no. 40. Cat. no. HSE 107. AIHW, Canberra: Australia 2011.

[22] Abanto J, Carvalho TS, Mendes FM, Wanderley MT, Bönecker M, Raggio DP. Impact of oral diseases and disorders on oral health-related quality of life of preschool children. Commun Dent Oral Epidemiol 2011; 39: 105-14.

[23] Jackson SL, Vann WF, Kotch JB, Pahel BT, Lee JY. Impact of poor oral health on children's school attendance and performance. Am J Public Health 2011; 101: 1900-6.

[24] Martins-Júnior PA, Vieira-Andrade RG, Corrêa-Faria P, Oliveira-Ferreira F, Marques LS, Ramos-Jorge ML. Impact of early childhood caries on the oral health-related quality of life of preschool children and their parents. Caries Res 2013; 47: 211-8.

[25] Casamassimo PS, Thikkurissy S, Edelstein BL, Maiorini E. Beyond the DMFT: the human and economic cost of early childhood caries. J Am Dent Assoc 2009; 140: 650-7.

[26] Peretz B, Ram D, Azo E, Efrat Y. Preschool caries as an indicator of future caries: a longitudinal study. Pediatr Dent 2003; 25: 114-8.

[27] Finlayson TL, Siefert K, Ismail AI, Sohn W. Maternal self-efficacy and 1-5 year old children's brushing habits. Commun Dent Oral Epidemiol 2007; 35: 272-81.

[28] Saied-Moallemi Z, Virtanen JI, Ghofranipou F, Murtomaa H. Influence of mothers' oral health knowledge and attitudes on their children's dental health. Eur Arch Paediatr Dent 2008; 9: 79-83.

[29] Twetman S. Prevention of early childhood caries (ECC): review of literature published 1998-2007. Eur Arch Paediatr Dent 2008; 9: 12-8.

Received: January 03, 2014 Revised: May 01, 2014 Accepted: May 13, 2014