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Prolonged effect of a mother–child caries preventive program on dental caries in the permanent 1st molars in 9 to 10-year-old children

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Abstract

Objective. To evaluate the prevalence of caries in the permanent 1st molars of a group of 9 to 10-year-old children, and to determine the long-term effect of a mother–child preventive dental program (PDP) that started when the women were pregnant and continued until the children were 6 years of age. ***Material and methods.*** The permanent 1st molars of 37 children in the PDP group were evaluated for caries, both clinically and radiographically, and compared with those of a control group of 42 children who had not participated in the PDP. ***Results.*** Of children in the PDP group, 70% were caries-free compared to 33% in the control group ($p < 0.001$). Of permanent 1st molars in the PDP group, 87% were caries-free compared to 61% in the control group ($p < 0.001$). The mean DFS of the PDP children 10 years of age was 0.51 ± 0.93 versus 1.57 ± 1.38 for the control children ($p = 0.002$). ***Conclusions.*** Examination of children 4 years after discontinuation of a caries preventive program reflected a long-term reduction in the DFS score of permanent 1st molars.

Key Words: *Caries prevention, long-term effect, permanent 1st molars*

Introduction

Despite the considerable decrease in the prevalence of dental caries among children during recent decades, a significant proportion of children are still affected by the disease [1]. Since dental caries is well recognized as a dietary carbohydrate-modified bacterial infectious disease [2], caries prevention in young children has been dependent on mothers being educated on dental health and nutrition. This has included preventing the transfer of cariogenic micro-organisms from mother to infant using interventions such as fluoride, early screening of children, and good oral hygiene practices [3]. In recent studies, prevention programs conducted during pregnancy have evaluated whether this might lead to a more positive attitude to dental care and at the same time improve the oral health of children [4–6].

A longitudinal preventive dental program (PDP) started in pregnant mothers and continued until their children were 6 years of age has shown that when basic caries prevention is supplemented with education and preventive treatment every 6 months, 31% more children were caries-free in the PDP group at 6 years compared to the figure for children in the control group [6,7]. Of great interest from a clinical point of view is how stable caries reduction is after the mother–child caries program is discontinued and whether there is any long-term preventive effect on permanent molars erupting around the time the PDP is terminated at 6 years of age.

The aim of the present investigation was to follow-up on our earlier clinical studies [6,7] as a means of determining whether the PDP also had a prolonged preventive effect on the permanent 1st molars during the age period 6 to 10 years after the program stopped.

Material and methods

The Medical Center at the Almirante Nef Naval Hospital in Viña del Mar, Chile, offers pregnant

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women and their children a free motivational and educational PDP for oral health. This mother–child caries preventive program, which is voluntary, starts when the women are in their 4th month of pregnancy and is provided until their children are 6 years of age, i.e. when they have one or more erupted permanent molar. Beyond this period, the children are treated at the Navy Dental Clinic, receiving equivalent dental care to children attending the public dental service in the Viña del Mar Health Service. Part of a longitudinal study of children since birth, it was designed as a cohort study with age-matched controls and approved by the clinical ethics committee of the Almirante Nef Naval Hospital.

Subjects

All 37 PDP children (19 M, 18 F; mean age 9.6 years, SD 0.7) examined at 6 years of age [6] were invited to the present follow-up study. The children (until they were 6 years of age) and their mothers had been on a three-part preventive program: examination, education, and treatment. In the examination part, dental disease, oral hygiene, and dietary habits were recorded for both mothers and children. The educational part is aimed at the pregnant mothers, who are instructed about the aims of the program and encouraged to participate actively for the benefit of their children's dental health. The mothers are taught proper oral hygiene and dietary habits applicable to them and to their children. Emphasis is on teaching mothers to avoid or minimize the possibility of infecting their children with their own mutans streptococci, i.e. avoiding any salivary contact with them. The treatment part for the mothers included removal of dental calculus using an ultrasonic device (Titan® Plus Sonic Scaler; StarDental, USA) and professional tooth-cleaning with fluoride prophylactic pastes, antimicrobial mouth-rinsing once a day at home (Listerfluor; Warner Lambert S.A. or Plax, Colgate-Palmolive, Chile), and use of a fluoride dentifrice with triclosan at least twice daily (Colgate Total; Colgate-Palmolive, Chile; 1450 ppm fluoride) [6,7]. After the birth of the child, the antimicrobial rinse was prescribed only if the mother continued having high caries activity. Every 6 months the mothers received further education related to plaque control and dietary counselling, and the oral hygiene and dietary habits in the children were examined. Mothers and children in need of dental extractions or restoration were referred to the Naval Dental Clinic in the area. In the Navy, the criterion to be met before a tooth can be filled is a cavitated dentinal carious lesion, whereas initial non-cavitated enamel lesions are treated with remineralizing fluoride agents. The mean dft of the children at the end of the PDP was 0.2 (SD 0.6). After discontinuation of the PDP, the children followed the conventional annual prophylactic and restorative dental treatment program carried out at the Naval Dental Clinic.

A control group of 42 children (22 M, 20 F) of similar age (mean 9.8 years, SD 0.3), and who agreed to be examined, were selected by applying a table of random numbers from a file of 162 dental records at the Naval Dental Clinic. The inclusion criteria were that neither the children nor their mothers had been involved in any specific dental preventive program other than the conventional treatment program given at the Navy Dental Clinic. Their mean (SD) dft at 6 years of age was 2.2 (2.2), which was similar to the dft value (2.0) of the Valparaiso region in the National Dental Survey in 1999. They had been living in the same area over the entire period and had the same middle socio-economic status as the mother–child pairs of the PDP group.

The drinking water contained 52.6 μmol l^{-1} (1.0 ppm) fluoride from 1985, when fluoridation of the drinking water was started in the area of Valparaiso, but after 1996 the concentration was reduced to 31.6 μmol l^{-1} (0.6 ppm) fluoride.

Examination

The clinical examination was carried out as previously described [6]. Briefly, dental caries was recorded and evaluated clinically and radiographically in accordance with the World Health Organisation (WHO) criteria [8]. In order to avoid bias among the examiners, two posterior bitewing radiographs were taken at the radiographic examination. Caries prevalence was evaluated without access to the previous dental records. Clinical recordings of dental decay at the enamel and dentinal lesion level were made by three examiners who had been calibrated prior to the study until a 95% concordance level ($\kappa = 0.83$) had been achieved. One of the examiners (A.W.) was also involved in the previous examinations of the PDP children. In the present study, only caries level in decayed and filled 1st permanent molars (DFS) in the children was used in the analyses.

Statistical analysis

The child was taken as the unit of analysis. Differences in group means were tested using the t-test and differences in proportions evaluated using the chi-squared test. The level of significance was set at $p < 0.05$.

Results

At 10 years of age, 70% of the children in the PDP group were void of initial and cavitated carious lesions in the permanent 1st molars compared with 33% in the control group ($p < 0.001$; Table I).

Table I. Number of DFS in the permanent 1st molars of children in the control and PDP groups at 4 years post-preventive dental program (PDP)

Group	No. of children	No. of children with DFS		
		0	1–2	3–4
Control	42	14 (33%)	16 (38%)	12 (29%)
PDP	37	26 (70%)*	8 (21%)	3 (8%)

*Significantly different from the control group; $p < 0.001$.

Twelve of the children in the control group (29%) and 3 in the PDP group (8%) had ≥ 3 DFS.

The children in the PDP group had 87% caries-free molars compared with 61% in the control group. The means (SD) of DF (decayed and filled) surfaces were 1.57 (1.38) in the control group and 0.51 (0.93) in the PDP group. The difference of 1.06 DFS was mainly due to a significantly higher prevalence of filled tooth surfaces in the control group when statistically examined with the child as the unit (1.33 vs 0.19; $p < 0.001$).

Discussion

The present study was undertaken to find out whether the differences in caries prevalence in the primary dentition of 6-year-old children could be maintained after discontinuation of a mother–child caries preventive program. Our results demonstrated that 4 years after termination of the program, when the children in the PDP group had reached 10 years of age, dental caries in the permanent 1st molars was significantly lower than was found in a control group. This observation was supported by the fact that 70% of the children at 10 years were caries-free compared with 33% of the control group. However, because the groups were small, the results should be interpreted with caution.

The PDP started when the mothers were pregnant and was carried out at regular intervals in every mother–child pair until the children were 6 years of age. When the PDP terminated at 6 years of age, the children in the PDP group had significantly fewer decayed and filled primary teeth than the control children who had not received the preventive program from birth [6]. After termination of the PDP at 6 years of age, the 1st permanent molars erupted and these teeth were thus not directly affected by the preventive program. However, the molars were probably colonized by a microflora which was affected beneficially by the preventive program dealing with oral hygiene, dietary advice, and avoidance of sources of infection. Despite the absence of the PDP treatment during the 4-year post-treatment period, there seems to have been a beneficial effect on newly erupted teeth, because the incidence of new caries lesions in the permanent 1st molars in the test group was significantly lower than in the control group. This is also in accordance with many studies showing a positive correlation between caries experience in primary and permanent teeth [9–13].

Although the preventive program provided education related to oral hygiene and dietary habits, we did not measure continuation of these habits from the childhood years. However, it is conceivable that the children in the PDP group between 6 and 10 years of age had continued to follow the advice of the program, as there are reports indicating that early family-related childhood background factors of dental health seem to be stable from infancy to 10 years of age in spite of the teeth changing from primary to permanent [14,15].

Between 6 and 10 years of age, all the children in the two groups had lived in the same area and attended the same Navy Dental Clinic where normal caries prevention had been carried out. The higher caries risk in the control group affected the molar teeth significantly more during the maturation period than was the case in the low-risk PDP group. Moreover, the children in the control group had 6 times more filled molars at 10 years of age than the children in the PDP group, which implies that they required more treatment and that their manifest lesions had been taken care of. As the children with caries in their primary teeth had developed more caries at 10 years, it is reasonable to assume that the level of caries at 6 years would be a good predictor of treatment need in the late primary dentition and 1st permanent molars. This view is in line with studies showing that 6-year-old children with caries require significantly more treatment in their primary dentition between 7 and 12 years of age than children who are caries-free at 6 years [16].

Earlier studies have shown that the caries risk for permanent 1st molars is highest 1 to 4 years after emergence and decreases thereafter [17,18]. However, recent survival data indicate that no caries peak is observed in children with good oral hygiene and no visible caries of the adjacent primary molars, but instead that the risk of caries in the 1st molars increases slightly over time [12]. Most reports on discontinuation of fluoride describe a slow and gradual loss of preventive effect over the years [19,20]. In the present study, some of the permanent molars (13%) in the PDP group became carious after cessation of the preventive program, thus underlining the fact that permanent molars are still susceptible to new caries lesions after the maturation period and further progression of existing lesions and need continued caries prevention.

Studies have shown that caries preventive programs starting in mothers during pregnancy have resulted in reduced colonization of mutans streptococci and in lower caries incidence in their children [4,5]. They have also demonstrated that permanent 1st molar teeth which erupted after a 2-year preventive xylitol program ended demonstrate

long-term caries risk reductions for up to 5 years [21]. Chlorhexidine gel treatment in 4 to 7-year-old preschool children has resulted in significantly lower caries compared to a control group at a 9-year follow-up, when the children were 16 years old [22]. Also, a 3-year antimicrobial preventive program using a chlorhexidine gel given at intervals to 13 to 14-year-old children with a high caries risk demonstrated that 2 years after discontinuation of the preventive measures the caries reduction achieved by the program was maintained [23]. In the present study, the children, from birth, together with their mothers, were put on a preventive program aimed at good dental health. It is possible that the program led to the establishment of a relatively stable low-cariogenic microflora which, along with the other beneficial factors behind good dental health, continued to persist and coexist from infancy to prepuberty. This, too, underlines how important dietary and dental health habits are during the childhood years if optimal dental health is to be expected at 10 years of age after the permanent molars have erupted.

In conclusion, the results of this study support and emphasize the importance of preventive intervention in mothers from the time of pregnancy in protecting their children from long-lasting caries.

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References

[1] Marthaler TM. Changes in dental caries 1953–2003. Caries Res 2004;38:173–81.
[2] van Houte J. Role of micro-organisms in caries etiology. J Dent Res 1994;73:672–81.
[3] Ismail AI. Prevention of early childhood caries. Community Dent Oral Epidemiol 1998;26 Suppl 1:49–61.
[4] Brambilla E, Felloni A, Gagliani M, Malerba A, Garcia-Godoy F, Strohmenger L. Caries prevention during pregnancy: results of a 30-month study. J Am Dent Assoc 1998; 129:871–7.
[5] Günay H, Dmoch-Bockhorn K, Günay Y, Geurtsen W. Effect on caries experience of a long-term preventive program for mothers and children starting during pregnancy. Clin Oral Investig 1998;2:137–42.
[6] Gomez SS, Weber AA, Emilson CG. A prospective study of a caries prevention program in pregnant women and their children five and six years of age. ASDC J Dent Child 2001; 68:191–5.
[7] Gomez SS, Weber AA. Effectiveness of a caries preventive program in pregnant women and new mothers on their offspring. Int J Paediatr Dent 2001;11:117–22.
[8] WHO. Oral Health Surveys: Basic Methods, 3rd edn. Geneva: World Health Organisation; 1987.
[9] Raadal M, Espelid I. Caries prevalence in primary teeth as a predictor of early fissure caries in permanent first molars. Community Dent Oral Epidemiol 1992;20:30–4.
[10] Mejàre I, Stenlund H, Julihn A, Larsson I, Permert L. Influence of approximal caries in primary molars on caries rate for the mesial surface of the first permanent molar in Swedish children from 6 to 12 years of age. Caries Res 2001; 35:178–85.
[11] Li Y, Wang W. Predicting caries in permanent teeth from caries in primary teeth: an eight-year cohort study. J Dent Res 2002;81:561–6.
[12] Leroy R, Bogaerts K, Lesaffre E, Declerck D. Effect of caries experience in primary molars on cavity formation in the adjacent permanent first molar. Caries Res 2005;39:342–9.
[13] Skeie MS, Raadal M, Strand GV, Espelid I. The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age – a longitudinal study. Int J Paediatr Dent 2006;16:152–60.
[14] Mattila ML, Rautava P, Paunio P, Ojanlatva A, Hyssälä L, Helenius H, et al. Caries experience and caries increments at 10 years of age. Caries Res 2001;35:435–41.
[15] Mattila ML, Rautava P, Aromaa M, Ojanlatva A, Paunio P, Hyssälä L, et al. Behavioural and demographic factors during early childhood and poor dental health at 10 years of age. Caries Res 2005;39:85–91.
[16] Alm A, Wendt LK, Koch G. Dental treatment of the primary dentition in 7–12 year-old Swedish children in relation to caries experience at 6 years of age. Swed Dent J 2004;28:61–6.
[17] Carlos JP, Gittelsohn AM. Longitudinal studies of the natural history of caries. II. A life-table study of caries incidence in the permanent teeth. Arch Oral Biol 1965;10: 739–51.
[18] Carvalho JC, Ekstrand KR, Thylstrup A. Dental plaque and caries on occlusal surfaces of first permanent molars in relation to stage of eruption. J Dent Res 1989;68:773–9.
[19] Haugejorden O, Lervik T, Birkeland JM, Jorkjend L. An 11-year follow-up study of dental caries after discontinuation of school-based fluoride programs. Acta Odontol Scand 1990; 48:257–63.
[20] Bravo M, Montero J, Bravo JJ, Baca P, Llodra JC. Sealant and fluoride varnish in caries: a randomized trial. J Dent Res 2005;84:1138–43.
[21] Isogangas P, Mäkinen KK, Tiekso J, Alanen P. Long-term effect of xylitol chewing gum in the prevention of dental caries: a follow-up 5 years after termination of a prevention program. Caries Res 1993;27:495–8.
[22] Gisselsson H, Emilson CG, Birkhed D, Björn AL. Approximal caries increment in two cohorts of schoolchildren after discontinuation of a professional flossing program with chlorhexidine gel. Caries Res 2005;39:350–6.
[23] Zickert I, Emilson CG, Krasse B. Microbial conditions and caries increment 2 years after discontinuation of controlled antimicrobial measures in Swedish teenagers. Community Dent Oral Epidemiol 1987;15:241–4.