Outcome of an oral health outreach programme for preschool children in a low socioeconomic multicultural area

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Background. Despite a significant reduction in the prevalence of dental caries, childhood tooth decay is still a public health problem in both developed and developing countries.

Objective. The aim of this study was to evaluate the caries preventive effect of an oral health programme for preschool children living in a low socioeconomic multicultural area in the city of Malmö, Sweden.

Methods. Eight hundred and four 2-year-old children were enrolled and recalled every third month between ages 2 and 3 and semi-annually between ages 3 and 5 years. From an outreach facility, parents were instructed on oral health with a focus on toothbrushing and diet, and provided fluoride

Introduction

Despite a remarkable reduction in the prevalence of dental caries, childhood tooth decay is still a public health problem in developed and developing countries¹. Oral health problems persist, particularly among poor and disadvantaged groups within the communities $^{2-4}$, and similar disparities were also found in immigrant children living in Sweden^{5–7}. Because childhood caries is a preventable disease, strategies based on restricting sugar and using fluoride in various preparations may help reduce this gap⁸. Other studies have pinpointed the effectiveness of early intervention with outreach activities from local health authorities⁹. In Europe and Asia, positive results have come from implementing supervised toothbrushing programmes in kindergartens and tablets free of charge. Participants completed a clinical examination and a structured interview at age of 5 years, at which point 651 children (81%) remained in the programme. The results of the intervention group were compared with a non-intervention reference group consisting of 201 5-year-old children from the same district.

Results. In the intervention group, 96% attended four or more of their scheduled appointments, and mean caries prevalence was significantly lower than in the reference group (5.4 deft vs. 6.9 deft; P < 0.001). The prevented defs fraction was 27%. Parents' daily assistance with toothbrushing and administering fluoride tablets was significantly better in the intervention group than in the reference group (P < 0.05). **Conclusion.** This study demonstrated that the early start of oral health programme had a significant beneficial effect on caries prevalence after 3 years.

providing free fluoridated toothpaste to highrisk children from underprivileged and multicultural groups^{10–15}. Furthermore, a comprehensive staged dental health programme and professional fluoride varnish applications proved the possibility of a reduction in early childhood caries in vulnerable groups^{16,17}. We have previously described a high-caries situation within an immigrant area in Malmö, Sweden⁷, where a community-based oral health programme was launched centred on diet, toothbrushing, and fluoride tablets, and directed toward 2-yearolds and their parents. The 1-year findings have been reported earlier¹⁸, and the present paper displays the results after 3 years of intervention, when the children were 5 years old.

Materials and methods

Study design

This study evaluated an oral health outreach programme involving preschool children in the suburban area of Rosengård in Malmö,

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Sweden. A 3-year longitudinal study was planned in which all children of a defined cohort were invited to participate (intervention group). A cohort of 3-year-old children from the same district served as a non-intervention reference group. The Ethics Committee at Lund University approved the study plan. Verbal and written information was given, and parental consent was obtained before the children were enrolled in the programme.

Study groups

All 880 2-year-old children registered in the study area, born between July 1998 and June 2000 (24 months), were invited to participate; 804 children (407 boys, 397 girls) accepted the invitation and entered the oral health education programme after a baseline oral inspection. Most of the children were immigrants, and 94% spoke languages other than Swedish at home. At age 5 years, 651 children (81%) remained in the programme and underwent a final examination and interview. Most of the participants who left the programme prematurely did so because of relocating. The historical non-intervention reference group consisted of all 238 children born between July and December 1997 (6 months) who were registered in the study area. They were first examined at age 3; at 5 years of age, 201 children (90%) were available for a final examination and an interview. The study groups are further described in Table 1.

Dental examination and interview

One of the authors (I.W.) performed the oral examinations in a dental office. Presence of

visible plaque was assessed according to the visible plaque index¹⁹ on the labial surfaces of the upper incisors, and gingival condition was scored as bleeding or non-bleeding after brushing. Before the dental examination, the teeth were carefully dried before being assessed under optimal lighting with the aid of a blunt explorer. Posterior bitewing radiographs were exposed on individual indications, 71% in the intervention group and 75% in the reference group. Caries was classified as manifest (cavitated) or initial (non-cavitated), decayed, extracted, or filled teeth or surfaces (deft or defs) according to Wendt *et al.*²⁰. The interview was in the form of a structured questionnaire, which included questions concerning ethnic background, medical history, diet, and oral hygiene habits. A booklet with illustrative photographs accompanied the questionnaire to facilitate understanding. Professional translators were made available, but only required, or demanded by parents, in a few cases.

Prior to the 3-year follow-up, the examiner was calibrated with a co-author (U.S.) and 39 children were examined by both investigators to check the interexaminer reproducibility. After 2 months, the same children were reevaluated for an intraexaminer calculation.

Intervention and reference programme

The intervention programme involved participants four times between ages 2 and 3 and twice between ages 3 and 5. The children and accompanying parent were invited for individualized information to an outreach facility located in the local shopping area, but not in direct connection with the local public dental

Table 1. Description of the study groups at the age of 5 years.

	Intervention group (%)	Reference group (%)		
Variable	<i>n</i> = 651	<i>n</i> = 201		
Dropout rate (3–5 years of age)	12	10		
Sex distribution, boys/girls	51/49	50/50		
Immigrant origin	94	93		
Arabic speaking	52	54		
Mother's education (< 9 years in school)	30	34		
Disabled	1	1		
Chronically diseased with medication	8	7		



 ∇ = oral health education programme at the outreach facility

 $\mathbf{\nabla}$ = regular oral health care at the Public dental service

Fig. 1. Outline of study. Intervention group = solid line; reference group = dotted line.

service (PDS). Two specially trained dental assistants aided throughout the study. Figure 1 outlines the programme. At each visit, parents were provided with dietary advices and toothbrushing instructions. The focus was to promote parent-performed brushing twice daily with fluoridated toothpaste containing 1000-1100 p.p.m. NaF. Fluoride tablets and toothbrushes were provided free of charge, and toothpaste was discounted. Parents were instructed to give the 2-year-olds one fluoride tablet (0.25 mg NaF) after evening brushing, and the 3- to 5-year-olds two tablets (one in the morning and another in the evening). The fluoride content in the piped water supply was low (≈ 0.2 p.p.m). The intervention protocol involved participants in the same way at age 3, 4, and 5 years in the dental office. The intervention programme supplemented the standard prevention care given to the reference group by the PDS. Children from both groups were offered dental health information from a local child health centre at around 1.5 years of age.

In addition, all children received preventive measures and restorative treatment based on their individual needs in connection with regular visits to the PDS at 3, 4, and 5 years of age.

Statistical methods

All data were transferred from special examination sheets to the SPSS software program (14.0, Chicago, IL, USA) with the aid of optical reading. Comparisons of caries prevalence between the groups were made using Student's *t*-test. The prevented fraction (PF) was calculated as the difference in mean caries prevalence between the intervention and the reference groups expressed as a percentage of the prevalence in the reference group. In all other comparisons, the Mantel–Haenszel chi-squared test was applied. Differences at the 5% level of probability were considered statistically significant.

Results

Of the participants who remained in the programme after 3 years, 96% attended four or more sessions and 60% attended all scheduled sessions at the outreach facility. Most families (91%) attended the dental examination and interviews at the PDS clinic. Table 2 displays mean caries prevalence in the study groups at age 5. The intervention group developed significantly fewer caries lesions (P < 0.001), and the PF was 22% on tooth level and 27% on surface level. Absolute risk reduction (ARR) for being caries free (defs = 0; non-cavitated enamel lesions = 0) was 8.4% and for having cavitated lesions, 22%. The number needed to treat (1/ARR) was 4.5. Figure 2 displays the distribution of caries in the intervention and

Table 2. Caries prevalence (cavitated and non-cavitated lesions; mean ± standard deviation) at the age of 5 years.

	Intervention group	Reference group		
Index	<i>n</i> = 651	<i>n</i> = 201	Р	
deft	5.4 ± 4.3	6.9 ± 4.3	< 0.001	
defs	8.2 ± 8.1	11.2 ± 9.7	< 0.001	
Caries free (defs = 0)	14.4%	6.0%	< 0.001	
Cavitated lesions	44.7%	66.7%	< 0.001	



Fig. 2. Percentage distribution of non-cavitated, cavitated, extracted, or filled teeth (deft) at 5 years of age.

Table 3. Caries prevalence (cavitated and non-cavitated lesions; mean \pm standard deviation) in the intervention group at 5 years of age in relation to the frequency of attendance at the outreach facility during the course of the project (r = -0.43; P < 0.01).

Number of visits	n	deft	defs
≤3	21	7.3 ± 4.9	12.0 ± 10.2
4–5	236	6.5 ± 4.4	10.0 ± 9.2
6	394	4.8 ± 4.1	7.0 ± 7.4

reference groups. Sixty-two children from the reference group turned out to be siblings to children in the intervention group. Excluding these children, the difference in caries prevalence between the groups was even more noticeable (8.2 vs. 12.0 defs; PF = 32%). The intervention group demonstrated an inverse relationship between number of visits to the outreach facility and caries prevalence. The more frequent visits to the outreach facility, the fewer caries were scored at age 5 (Table 3). Mean caries prevalence in children who attended less than three or three sessions was significantly higher (P < 0.05) than in those who attended six sessions.

Table 4 contains selected interview data. Both groups reported identical information regarding snacking and consuming sweetened beverages at night, whereas significantly different results (P < 0.05) were noted concerning parental help with brushing and fluoride tablet usage. The use of fluoride toothpaste was close to 100% in both groups. Differences in visible plaque and bleeding after brushing were non-significant. In the intervention group, 63% of the children displayed visible plaque and 51% bled after brushing. Corresponding values in the reference group were 58% and 47%.

The interexaminer agreement was 93% and the corresponding intraexaminer value was 87%.

Discussion

Early childhood caries is still a global health problem, especially among immigrant children or those from low-income, urban areas⁹. Several recent global studies underline the fact that these children continue to develop caries, despite greater awareness of the problem^{7,21–24}. Besides socioeconomic factors, parental behaviour and attitudes affect early caries development^{22,25}. The present study groups were dominated by immigrants, and at least one-third of the mothers were uneducated or unemployed, both proven risk factors for caries^{26,27}. This highlights the need to establish effective oral health programmes for children in immigrant and low socioeconomic areas to promote oral health in early childhood^{8,9}.

The present project was based on the common risk factor approach, teaching parents healthy habits and concentrating resources where they were needed most. Because many of the families failed to attend their local child health centre or PDS clinic, the strategy was

Table 4.	Selected	data	from	the	interviews	after	3	years	of	intervention.
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	Intervention group (%)	Reference group (%)	
Variable	n = 651	n = 201	Р
Frequent small eating	18.6	21.4	NS
Sweet drinks at night	2.8	6.5	NS
No parent brushing help	8.4	14.4	< 0.05
No F tablets	11.2	64.7	< 0.001

NS, not statistically significant.

to establish an outreach facility for early intervention. The idea was to provide an easily accessible point of contact, as proven successful in several previous studies^{16,28–30}. Attendance and compliance with the intervention programme exceeded expectations, showing the importance to motivate and explain the reasons for intervention. This field study had a nonrandomized design, which limits the level of evidence and requires close scrutiny of the results. We felt morally obligated to implement the full programme for all 2- to 5-year-old children in the area because of the severe caries situation. The historical reference group, which was enrolled in the basic preventive programme, was socio-demographically and dentally comparable to the intervention group. Because one-third of the reference group had siblings in the intervention group, a 'spill-over' effect may have created a comparison bias, which was partly verified by the enhanced difference in caries prevalence when the siblings were excluded. Although this spillover effect may mask programme results, the intervention programme was clearly beneficial for society.

The main finding was that the intervention group developed significantly fewer caries lesions than those from the reference group after 3 years. The PF was almost 30%, and similar results have been reported from other interventions in corresponding field studies^{11,23,24,31}. Providing the children with fluoride supplements and fluoridated toothpaste was probably the key factor in caries reduction, reinforcing previous suggestions⁸. Judging from the visible plaque scores, efforts to improve oral hygiene were ineffective. Cultural beliefs and a trust in Western medicine may explain the strict compliance observed in fluoride tablet usage^{23,32}. When comparing the present results after 3 years with the previously reported 1-year results¹⁸, it was observed that the main improvement was gained during the first year of intervention and that the caries incidence was more or less similar in both study groups between 3 and 5 years of age (data not shown). From the encouraging initial findings¹⁸, one would expect that the difference between the intervention group and the reference group would have continued to

increase over the years. We can only speculate why this did not occur, but a possible reason was that the programme was less intensive during the second and the third year. Another possible explanation was that the healthy message was more difficult for the parents to maintain with increasing age. It should also be kept in mind that although the attendance and compliance with the intervention protocol generally were good, there were children who did not take part in the whole programme and these children also displayed higher caries prevalence (Table 3). Thus, a higher attendance would likely have improved the caries-reducing effect of the programme. In any case, our present results strongly emphasize the importance of early intervention, which has been stressed in other trials^{21,28}. Studies show that high-risk children who attend preventive visits at an early age require less restorative and emergency care^{9,33}. In our study, 4% of the 3-year-olds already had experienced fillings and extractions, and earlier intervention may have helped to prevent this, especially in the light of the demonstrated effects on caries severity. We observed that regular visits to the outreach facility made the children more willing to cooperate when restorative treatment was required. The intervention group thus seemed to display less dental anxiety than the reference group, saving time and resources. Further studies of preventive tools suitable for caries prevention in underprivileged and multicultural groups are, however, needed. The results from this study are encouraging, but the results also indicate that the risk factors must be further reduced in order to bring down the caries prevalence in this multicultural group, and an earlier start to the extended programme has thus been permanently implemented in the Rosengård area.

In conclusion, a comprehensive oral health programme starting at age 2 years significantly reduced caries prevalence after 3 years in 5year-old children living in a low socioeconomic, multicultural suburban district of Malmö, Sweden. The high level of participation and strict compliance with fluoride supplements seemed to greatly influence the outcome. The programme is currently subjected to a health economic evaluation.

What this paper adds

- Early start of oral health outreach programmes has beneficial effects on caries prevalence in preschool children living in a low socioeconomic, multicultural area.
- The high degree of participation and the good compliance with the fluoride supplements seem to be key factors for the outcome.

Why this paper is important to paediatric dentists

- Children from immigrant and/or underprivileged urban areas continue to have increased caries experience in spite of the awareness of the problem.
- Early start of oral health programmes are needed to prevent early childhood caries in vulnerable groups.

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