Dental hygiene work in a clinical trial

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Abstract: Dental hygiene activities were developed as part of a randomized clinical trial designed to assess the safety of low-level mercury exposure from dental amalgam restorations. Along with dental-hygiene clinical work, a community programme was implemented after investigators noticed the poor oral hygiene habits of participants, and the need for urgent action to minimize oral health problems in the study population. *Objectives:* Clinical and community activity goal was to promote oral health and prevent new disease. Community activities involved participants and their fellow students and were aimed at providing education on oral health in a school environment. *Methods:* Dental hygienists developed clinical work with prophylaxis, sealants application and topical fluoride and implemented the community programme with in-class sessions on oral health themes. Twice a month fluoride mouthrinses and bi-annual tooth brushing instructional activity took place. Participation at dental-hygiene activities, sealed teeth with no need of restoration and dental-plaque-index were measures used to evaluate success of the programme for the participants. *Results:* Improvement in dental hygiene is shown by the decrease in dental plaque index scores ($P < 0.0001$); also sealants integrity is achieved in 86.3% of teeth. 888 (13.7%) teeth with sealants had to be restored or were lost. Children participated actively on dental hygiene activities. Teachers became aware of the problem and included oral-health in school curricula. *Conclusion:* Dental hygiene activities have shown to be helpful to promote dental hygiene, promote oral health and to provide school-age children with education on habits that will be important for their future good health.

Key words: dental hygiene; health promotion; school children

Introduction

A clinical and a community school-based dental hygiene programme was developed to promote oral health in children participating in a randomized clinical trial, designed to assess the safety of low-level mercury exposure from dental amalgam restorations.

The 'Study of the Health Effects of Dental Amalgams in Children' started in 1997 as a cooperative agreement among the University of Washington (Seattle), the University of Lisbon and the National Institute of Dental and Craniofacial Research (Grant 1U01DE11894). Detailed discussion of the study design and results for primary outcomes (neurobehavioral assessments of memory, attention/concentration, and motor/visual-motor domains, as well as nerve conduction velocities) have been previously published (1, 2).

Dental hygiene clinical activities started in 1997, along with dental treatments, and lasted until 2005. The school-based dental hygiene programme took place from 1998 until 2005 and was introduced after the clinical trial investigators noted the poor oral hygiene habits of the majority of study participants and the need for urgent action to improve their oral health.

The scope of dental hygiene involves these two different fields of work, clinical and community, yet with the same goal: promote oral health and prevent diseases.

The clinical dental hygienist interacts directly with the individual. In Portugal, dental hygienists are clinically competent to provide dental hygiene care and to manage dental hygiene needs of patients of all ages and to work with members of the health team, promoting oral health and educating for correct health behaviours helping the individual to achieve a better oral health and motivate to acquire enduring habits of oral hygiene.

The community dental hygienist work involves the entire population to which the programme is developed. The goals are essentially the same as the clinical dental hygienists, but activities are developed for groups of individuals. Activities include the participation in health education programmes, motivation of the population to the prevention of oral diseases and participation in the planning, implementation and evaluation of public health programmes.

The programmes developed by dental hygienists, mainly in the scope of primary prevention, can help the community to benefit from a better state of oral health and prevent oral diseases, which are progressive and cumulative health problem that can benefit from these kinds of programmes.

The prevalence of dental caries in school-age populations is a well-documented problem. An assessment of Portuguese school children's oral health status, aged 6 and 12 years old, was performed in 1999, and showed a prevalence rate of dental caries of 46.9% in 6-year olds, and 52.9% in 12-year olds, with a DMFT of 2.1 and DMFT of 1.5. This same study showed that 90% of children, at age 12, had poor dental hygiene (3).

The caries process is well described, comprising a dynamic disease process that can be interrupted through multiple interventional elements, by reducing the pathological processes or enhancing protective factors (4).

These protective factors can be enhanced through activities developed by dental hygienists either in the clinical setting, with one patient at a time, or in community-based programmes. A clinical activity that has demonstrated effectiveness in preventing caries of occlusal surfaces of posterior teeth in children and adolescents are the pit and fissure sealants (5).

Community dental hygiene activities aiming to promote and educate for oral health are also a major part of caries prevention. Regular in-class educational activities, tooth-brushing instruction and bi-monthly fluoride mouthrinses are effective ways to promote oral health (6). With these clinical and community measures, the amount of primary dental caries can be reduced (7).

Taking in consideration the fact that dental hygiene activities can promote a better oral health, an evaluation of the activities and clinical parameters of the study participants was performed. The objective of this study was to evaluate the outcomes of clinical and community dental hygiene activities on the dentition status and motivation towards oral health of children in the Study of the Health Effects of Dental Amalgams in Children, 7 years after implementation of the programme.

Material and methods

Clinical Dental Hygiene activities for the 'Study of the Health Effects of Dental Amalgams in Children' were begun in January 1997. In September 1998 and after investigators noted the poor oral hygiene status and habits of study participants, a school-based dental hygiene programme was implemented in the seven Casa Pia Schools from which participants were recruited.

The study population consisted of 647 students at the Casa Pia school system in Lisbon, Portugal, who were 8–10 years old as of 1 January 1997. These participants had diverse backgrounds for ethnic culture and habits, high oral disease rates, and did not seek dental care in spite of having some access to dental care facilities within the school system. This situation has changed during the study period as participants had free

access to dental treatment at the Lisbon Dental School Study Clinic and also promoted dental care among their peer students. As approved by the IRB's at the University of Washington and the University of Lisbon, written informed consent was obtained from parents or guardians, along with signed assent of the children. From these 647 participants, 507 met the inclusion criteria for the study, as described in previous publications (1).

For this dental caries high-risk population, activities of dental hygiene had a primary goal of caries reduction. To achieve this goal a clinical dental hygienist provided to every participant, at least once a year, a dental hygiene appointment including dental screening, prophylaxis, pit and fissure sealants application (when possible and every occlusal surface was sealed) and topical fluoride. A plaque index score was obtained using plaque disclosing solution and recording the presence of plaque with the Plaque Control Record by O'Leary, Drake and Naylor (1972).

The community dental hygienists developed an oral health promotion and educational programme not only for the study participants, but also involving their non-study peers, as activities took place in the classrooms.

The school-based dental hygiene programme consisted of in-class sessions on oral health themes presented to the students with the support of audiovisual media, covering issues, such as dental plaque, dietary habits, dental caries, periodontal disease, the role of fluoride in caries prevention, tooth brushing and flossing instruction.

Bi-monthly fluoride mouth rinses and bi-annual tooth brushing instructional activity took place in the classroom. These themes were updated and adapted to the age of the participants to accompany their physiological and mental growth.

The main focus of the programme was on the prevention of dental caries and worked intimately with the clinical activities of motivation (plaque disclosure, tooth brushing and flossing techniques demonstration) and pit and fissure sealant placement.

School-based activities reached not only the study participants but also teachers and educators participated in the educational sessions for the students.

Large educational sessions occurred in every school aiming at motivating teachers and educators to promote oral health in the classroom and at home. Teachers were asked to talk about dental hygiene in the class and to include the theme in the class curricula, which was done mainly during natural sciences classes, whenever it fitted the lesson theme.

With the support of each school, in the first 3 years of the programme, a full-day all-school event for dental hygiene awareness with dental hygiene knowledge quizzes and prizes for students was established.

An evaluation of these dental hygiene activities is essential to understand the success of the programme and to help in the planning of future activities. For this purpose, analyses of oral plaque scores, pit and fissure sealants integrity, and participant motivation to stay in the programme were performed. Statistical analysis included analysis of dental plaque index scores, at baseline and at the last year, for statistical significance of the difference with *t*-test. Number of pit and fissure sealants placed and their integrity are also presented.

Results

Study population at baseline was of 507 individuals ages ranging from 8 to 10 years old, as of 1 January 1997, from which 279 were males and 228 females. At baseline 60.7% of participants were at elementary school (grades 1–4), other participants were fifth (34%) and sixth (5.3%) grade students. Children enter first grade with 5 or 6 years of age (depending on birthdates), the ones who fail to pass are retained in the grade until success. These individuals were randomized into study groups. There was a high caries experience at baseline, presented in Table 1, by surface-caries.

In spite of having access to dental care at school most of the children did not access it because of lack of interest and possibly dental fear. There was a general unmotivated attitude towards dental hygiene and dental care and that reflects in the oral health status of the children. Study population, (n = 507,

Table 1. **Caries experience, in surfaces, at baseline for randomized participants**

	Amalgam group (n = 253)		Composite group (n = 254)	
	Mean	SD	Mean	SD
Caries				
Age 8	17.3	11.0	20.3	12.1
Age 9	17.6	9.1	16.3	10.2
Age 10	14.4	8.3	14.8	9.7
Age 11	14.4	8.3	13.3	8.3
Overall	15.6	9.0	15.9	10.2
Primary teeth caries				
Age 8	12.7	9.7	15.1	9.8
Age 9	11.9	7.7	10.8	8.0
Age 10	7.9	7.1	7.2	7.8
Age 11	7.1	6.8	4.7	6.5
Overall	9.4	7.9	9.1	8.7
Permanent teeth caries				
Age 8	4.5	2.9	5.2	3.2
Age 9	5.7	3.3	5.5	3.6
Age 10	6.5	4.6	7.6	4.9
Age 11	7.4	5.3	8.6	6.0
Overall	6.2	4.3	6.8	4.7

ages 8–10), mean DMFS at baseline was of 4, 3 and at 12 years old the mean DMFS was of 5, 6.

At the end of the sixth year of study 450 individuals were still participating. By the eighth year (after a re-consent process for 2 year's extension) a total of 353 participants continued in the study, from the 400 that re-consented participation.

Clinical dental hygiene activities took place during the entire study period with a total of 4073 dental hygiene appointments. Topical fluoride applications and prophylaxis were performed in every appointment.

A total of 6489 pit and fissure sealants (Ultraseal XT plus; Ultradent, South Jordan, UT, USA) were applied in permanent premolars and molars. Whenever necessary, sealants were applied in anterior teeth with enlarged cingula (14 teeth). Distribution of pit and fissure sealants is presented in Table 2.

As expected the majority of sealants were placed in the early study years, not only because participants had never received prior dental care, but also due to their age and teeth eruption patterns. In the first 4 years of the study 90.6% of the eventual total number of sealants were placed. Maxillary and mandibular premolars represent 64.3% of total sealants.

Of the 6489 sealants placed, 888 (13.7%) were lost or replaced by restorations (17 sealants were lost due to tooth extraction for orthodontic procedures, and 871 were lost due to restorative treatment). These 888 pit and fissure sealants had an average time of presence in the mouth of 44 months with the maximum of 93 months. The reasons for replacement by restorations are presented in Table 3, which shows the surface(s) where dental caries was diagnosed, and which led to the sealant's removal.

Most of the decay occurred only in one surface (82.7%). The distal surface was the most common to have dental caries; it represents 46.7% of decayed surfaces. Occlusal surfaces by themselves accounted for 14% of sealant replacements and only these can be considered as a sealant failure in terms of the goal to prevent occlusal caries.

Inter-proximal surfaces accounted for 82.4% of decay that led to sealants replacement. Maxillary and mandibular premolars represent 70% of lost sealants.

Table 3. **Distribution of decayed surfaces in previously sealed teeth**

Surface	Total number
Mesial	168
Distal	403
Occlusal	122
Buccal	27
Mesial and occlusal	12
Distal and occlusal	19
Mesial and distal	116
Buccal and occlusal	4

Table 2. **Distribution of pit and fissure sealant placement by study year**

	Total sealants	Premolars		Molars		Anterior teeth
		Maxillary	Mandibula	Maxillary	Mandibula	
Year 1	2284	809	811	361	297	6
Year 2	1299	460	496	196	142	5
Year 3	1241	420	370	234	216	1
Year 4	1059	309	312	235	203	0
Year 5	350	71	65	106	108	0
Year 6	189	18	28	78	64	1
Year 7	60	3	4	28	24	1
Year 8	7	0	0	3	4	0
Total	6489	2090	2086	1241	1058	14

A Plaque Control Record was obtained in every dental hygiene appointment, and in the first study year an average of 98.2% surfaces with plaque presence was noted. Increasingly lower scores during the study period was noted, showing a reduction to an average of 72.9% of surfaces with plaque in study year 8. Statistically significant differences were found for participants with baseline scores and seventh year scores with $P < 0.0001$, when a *t*-test was used to examine if the plaque-index scores decreased.

Community dental hygiene activities were developed in the classes, and involved as many as 63 classes and over 1300 students in the entire school system at the same time over the year. Bi-monthly fluoride mouth rinses and bi-annual tooth brushing instructional activity took place for every class in the programme. Once a year, an all-school activity was organized with games and quizzes to test student's knowledge on dental hygiene issues.

During the study period, students within the school system, not only study participants, had twice a month education sessions on dental plaque, dietary habits, dental caries, periodontal disease, role of fluoride in caries prevention, tooth brushing and flossing instruction.

On average, 14 educational sessions took place per classroom annually along with the bi-monthly fluoride mouthrinses. There were no cases in which either the teachers or the students as a class refused to participate in the oral hygiene community programme. As a result of the programme, leaflets and other didactic material, such as calendars, pens, shirts, all with messages related to dental health were produced at the participating schools.

Discussion

Although there was a statistically significant decline in dental plaque index, plaque still remained in a very high

percentage (72.9%) of surfaces, this means that in spite of all efforts children still have a poor dental hygiene. The high percentage of dental plaque can be explained by the fact that participants did not brush correctly and, when they did brush, probably for a short period of time. It is described in the literature that most of people brush for short periods of time, such as 37 s, for brushing (8). Moreover, the cooping with floss was very difficult to achieve. This can be another reason to the high values of dental plaque, literature mentions that only 10% of the general population flosses regularly (9). The programme did not reach the expected goals and future programme implementation should be done following different guidelines.

No community programme can be successful if the target population does not recognize it as important. This is what happened with the present dental hygiene activity, children involved in it did not feel the need for a better dental hygiene.

As a suggestion for future work an initial questionnaire should be made to the population to identify their perceived needs and start by addressing them, including more dental hygiene activities along with the attendance to the primary requests made by the children.

The new caries incidence pattern reduction achieved can be attributed to the pit and fissure sealants and also to the fluoride exposure from clinical appointments and bi-monthly mouthrinses along with tooth brushing with fluoridated toothpaste.

In spite of the discussion over the cost effectiveness of sealants placement on premolar, investigators decided to seal premolar as this was a high-risk group, this was also considered by Bhuridej (10) who mentions that sealing all at-risk teeth for a group of children that is more susceptible to develop caries would be the most cost-effective method to prevent future restoration treatments. Presence of sealant until failure was of 44 months in average exceeding the findings by Simeck *et al.* (11) of 26 months in a 4-year follow-up study. This same author noticed that sealant failures were much higher among subjects with high risk for caries. The same study found a retention rate of 87.8% after an average of 35 months follow-up. In our study, the retention rate was of 86.3% after an average of 75 months follow-up after sealant placement. The retention rate is also higher than the values mentioned by Kitchens (6) of 82% retention after 5 year of placement.

Participation in community activities was high. Teachers and students engaged in the activities and the acceptance was very high.

Conclusion

Dental hygiene activities can be helpful to prevent new disease, promote oral health and to provide school-age children with education on habits that will be important for their future good health.

The possibility to develop at the same time a clinical and a community dental hygiene programme is not very common and can amplify the results of each activity *per se*.

The participants in the 'Study of the Health Effects of Dental Amalgams in Children' were involved in dental hygiene programmes for 7 years; their peers at the school received education on dental health and were also involved in community health promotion activities for a long time period too. It was a great opportunity to reach thousands of children at the same time.

If nothing else was achieved, the work done with children in their early stage of life for such a long period of time has, for sure, created in them a special awareness of oral health issues.

The involvement of teachers, educators and school directors has led to the introduction of oral health themes in the class curricula, and the creation of extra-class activities. This kind of action assures the continuation of oral health issues in the curriculum for present and future students.

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