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Peer teaching pilot programme for caries prevention in underprivileged and migrant populations

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Background. Focused caries prevention programmes for migrant children often fail because there is an important barrier of linguistic and cultural diversity.

Aim. The aim of this study was to evaluate whether a tailored peer teaching approach can improve oral health behaviours of underprivileged and/or multinational migrant first graders.

Design. Two fourth grade classes (30 children, mean age 9.6) and two first grade classes (38 children, mean age 6.6) with high migrant background participated. The fourth graders took part in a preparatory course of oral health and developed a concept for tutoring first graders in oral health concepts as well as the Fones toothbrushing method. Later then, the fourth graders instructed the first graders during two lessons. Toothbrushing of each first grader was filmed before and 7 days after instruction. Toothbrushing time, method, and systematic were evaluated.

Results. After instruction, circular toothbrushing movements and systematic toothbrushing were observed significantly more often ($P = 0.0001$); toothbrushing time did not change.

Conclusions. This pilot study shows that tutoring by older peers of similar origin resulted in significant changes towards better oral health in underprivileged and/or multinational migrant first graders. Authentic role models could be provided, and communication and cultural barriers circumvented.

Introduction

During the last two decades, the oral health of Western population has improved in general. This improvement, however, seems to be less significant in primary teeth of children[1]. In socially deprived communities, particularly in those with high immigrant populations, the caries burden is high in Germany[2] and elsewhere[3,4], and the disparity that 25% of children in one country account for 75% of the caries lesions still seems to be true, especially concerning the primary dentition[3,4], and even reverse effects have been observed[5–7]. There is a strong association between socioeconomic status and health, including oral health[8,9], and many factors which have been found to be associated with caries prevalence like eating habits[10], absence of fluorine supplements[9], early age at which *Streptococcus mutans* is acquired[10] have at least some interdependency with the socioeconomic status. Therefore, preventive action is often targeted on socially deprived children[2,4,11–13]. Socially deprived, however, are particularly difficult to reach, because programme participation[11,13], and the use of dental services for asymptomatic care[14] occur less frequently. Therefore, developing community outreach facilities and free toothpaste provision can be a successful option[12,14]. Another way of getting through to these children is a school-based approach[1,4]. Oral health education in schools is mostly done by dental professionals (i.e. by paediatric dentists who engage themselves in the local area), dental hygienists[15] or by trained persons from other professions like teachers[1] or supervisors[4]. Even though these approaches have been reported to be successful[1,4,15], in multinational population

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interaction often fails, when the specific cultural barriers are not appreciated[14] and when there is no common language to communicate with the oral health educator[3,13]. This, however, is often the case in schools in socially deprived areas. In their early years of primary school, pupils very often cannot sufficiently interact in the target language. Nor is there one common foreign language, because frequently children are of more than ten different ethnic origins. So traditional, or even thorough preventive measures of highly engaged paediatric dentists, can fail[10], because the linguistic diversity is too important. Many studies, however, have demonstrated the importance of early preventive intervention[10,13,14], so concepts are needed to reach this population.

The aim of this study was to develop and evaluate a peer teaching approach in order to circumvent language and cultural barriers, and improve oral health in an underprivileged and/or migrant population. The hypothesis of this study is that fourth graders from the same primary school who can instruct first graders in their respective mother tongue can motivate first graders to improve their oral health behaviour.

Materials and methods

Thirty-two fourth graders and 42 first graders all attending a primary school in a deprived area of Cologne were invited to take part in this study. Children's and parents' consent was a prerequisite for participation. Finally, 30 fourth graders (93%) (mean age 9.6 ± 0,6) and 38 first graders (90%) (mean age 6.6 ± 0.6) entered in this study. Ethical approval and protocol authorization were given by the College's Institutional Review Board. The exclusion criteria were: presence of motor deficiencies (plaster, psychomotor diseases) and current correct practise of the Fones toothbrushing technique. More than 50% of the first and fourth graders had a migration background and came from at least seven different countries (see Table 1).

Table 1. Origin of children attending fourth class.

Origin	First graders	Fourth graders
German	14	13
Turkish	15	10
Italian	5	3
Indian	1	1
American	0	1
Albanian	1	0
Chinese	1	0
Polish	0	1
Portuguese	0	1
Russian	1	0
Total	38	30

Preparation of fourth graders

The fourth graders were taught basic topics of cariology (pathogenesis and prevention), as well as the Fones technique in theory and practice during 5 school hours in a project-like manner[16] which included experiments concerning the effect of acids on the enamel and calculations of the amount of sugar in different types of foods and drinks. The introduction of the Fones toothbrushing method was exercised using 24 denture models which came on loan from a vocational school. Instruction in toothbrushing was done by a trained teacher with groups of four using facilities in the changing room of the gymnasium. In the following week, the fourth graders brushed their teeth in class each day after breakfast. Toothbrushing was supervised by the teacher. Errors concerning toothbrushing were corrected mainly by classmates and, if necessary, by the teacher.

Motivation for brushing their teeth at home was ensured by animal posters (shark, lion, or beaver) on which blue stickers could be fixed for morning brushing and red ones for evening brushing. A fully completed poster could be exchanged after 1 week for a balloon, a funny sticker, or a poster.

Afterwards, the fourth graders planned during 4 hours how to teach Fones toothbrushing method to first graders. The 'think' (for oneself) 'pair' (with your partner) 'share' (with the class) technique was used to establish a first pilot manual and to identify potential problems and pitfalls. This pilot manual was improved upon in groups using the three-step simulation technique (simulation with videotaping, sequence evaluation, correction, resimulation). The following day, all modified pilot manuals were re-evaluated, a final instruction manual was established, and then exercised in groups of

Table 2. Allocation of first and fourth graders into groups.

Origin	First graders number of groups	First graders group size	Fourth graders number of groups	Fourth graders group size	Comments
First cohort					
German	4	2	4	2	With American pupil
	2	3	2	2	
Indian	1	1	1	1	
Albanian		1		0	1 Polish
Chinese	1	1	1	0	1 German with a Russian grandmother
Russian		1		0	1 top German pupil
Second cohort					
Turkish	5	3	5	2	
Italian	1	3	1	2	
	1	2	1	2	With Portuguese pupil
Total	15		15		

three. All fourth graders who were able to use this manual correctly were awarded the 'dental teacher sticker'. This sticker was not just an award for their efforts, but also the identification as a student teacher for the first graders.

Study protocol for the first graders

All first graders were interviewed, and their toothbrushing was observed twice: once before and then again 7 days after intervention. Both the interview and the toothbrushing were videotaped for subsequent analysis. All questioning was done by the same teacher. The teacher who did the interviews was known to the children from several previous visits.

Interview questions and questions after toothbrushing were drawn from an interview manual which had been elaborated before. All questions had been tested before with children of the same age to ensure comprehensibility.

Questions of the interview were about toothbrushing frequency and duration. The introductory question was always in an open manner; the subsequent ones were asked more specifically (i.e. the exact time of day when the toothbrushing was performed).

Additional questions were whether they had been taught a toothbrushing method, whether toothbrushing was supervised, whether they had ever been at a dentist's, whether there had been drilling, and whether they had ever experienced toothache. The closing question always enquired about what they thought of healthy teeth.

Tutor instruction

The instruction took 2 hours. For fire safety reasons, the maximum capacity of classrooms is limited to 38 pupils. For this reason, each class had to be divided into two cohorts so that 16 fourth graders worked with 18 first graders in the first cohort and 14 fourth graders with 20 first graders in their respective class room (see Table 2). Where possible, origins of first and fourth graders were matched. Apart from one matched group of two Indian pupils, groups of two or three were composed. So non-native fourth graders (one American in a group of German and one Portuguese in a group of Italian pupils) always had a peer who was a native speaker. For one group of first graders (one Albanian, one Chinese, and one Russian pupil), direct matching to fourth graders was not possible. However, partial matching (one German-speaking fourth grader had one Russian grandmother) could be reached. Moreover, this group was reinforced by the top German pupil of the class.

The first cohort started with the instruction; the second cohort played caries-related games, produced drawings, and solved worksheets. After 2 hours, the first and the second cohort swapped activities.

The instruction itself commenced with a story read out by the teacher. The story was about a little bear that has to brush its teeth, illustrated by video-projected pictures. Then,

the first graders were invited to discuss why dental hygiene is vital.

After this introduction, the fourth graders started to instruct the first graders with the aid of their instruction manual which had been elaborated before. The first phase was to explain in small teaching units how to brush teeth according to the Fones method using the denture models. Each step was demonstrated on the denture model by the fourth grader and then repeated by the first grader. Each step successfully accomplished by the first grader was ticked off on the checklist of the instruction manual. Then, the fourth graders actually demonstrated themselves how they brush their teeth with the Fones method, and the first graders were invited to follow this example. The toothbrushing was supervised by the fourth graders and corrected where necessary.

Each first grader who was able to brush his teeth correctly according to the Fones method was given a button and a motivation poster during a small ceremony.

Seven days after instruction, each first grader was interviewed again and the toothbrushing was observed.

Statistical analysis

Statistical analysis was performed with distribution free methods because parametric assumptions were not met. Nominal data of matched pairs were analysed using the McNemar's test. Differences regarding the tested variables between the two cohorts were calculated using Fisher's exact test.

Results

In first graders with a migrant background, 6 of 24 never had been shown how to brush their teeth. Twenty of 38 first graders stated that they had already experienced toothache. Nineteen of thirty-eight first graders stated in the interview that during a dental visit, they had undergone invasive treatment.

The following items were further analysed with regard to changes before and after the instruction: toothbrushing time, toothbrushing technique which was divided in circular brushing technique, and systematic cleaning of all dental surfaces.

Mean value of toothbrushing time before instruction was 87.1 s ± 63; the bottom value was 11 s and the maximum was 279 s. Mean value after instruction was 86.1 s ± 42, with a bottom value of 35 s and a maximum value of 196 s.

Before the instruction, 10 first graders employed a circular toothbrushing technique; after instruction, this figure trebled. Statistical analysis using McNemar's test showed a highly significant difference ($P = 0.0001$).

None of the first graders used a systematic toothbrushing (masticatory, outer and inner surface), an approach which is recommended by German dentist organizations for children from kindergarten age on[17]. After instruction, 26 first graders used this systematic approach when brushing their teeth. Statistical analysis using McNemar's test showed a highly significant difference ($P = 0.0001$).

Using Fisher's exact test, no significant difference (greatest difference $P = 0.086$) was found regarding the tested variables between the two cohorts.

Discussion

The interviews confirmed that this intervention took place in a population at risk. Half of the first graders reported previous invasive dental treatment indicating some form of dental decay. Moreover, almost one-third of the children with a migrant background stated that they had never been shown how to brush their teeth correctly. This apparent lack of parental models who brush their teeth and the subsequent lack of topical fluoride administration have been identified as one key factor of caries development[10]. Many paediatric dentists who engage themselves in local schools or provide group prophylactic sessions in their cabinet face these problems and might wonder how they can create efficient preventive learning opportunities. To our minds, our study proposes two peculiar answers to this problem.

First, the linguistic barrier could be circumvented by using multi-ethnic fourth graders as tutors. Linguistic analysis showed that in most approaches, at least one linguistic code switch

happened. Either the whole instruction was held in the appropriate foreign language, or, as in most cases, the instruction was a code-switching of German and the appropriate foreign language. Technical words were mostly explained in the appropriate foreign language.

Second, fourth graders were accepted as authentic role models which was strongly supported by video analysis of the instruction and the subsequent improvement of the fourth grader's own oral health behaviour. Older children serve most of the time as a model for younger children and, moreover, in this case the majority of models came from the same ethnicity. Role models, especially parental attitudes[18] and habits[10] were found to have a significant impact on the establishment of habits favourable to oral health.

Ethnic peculiarities which play an important role in children's risk profile[1,2,13] could be treated specifically by the fourth grade tutor who in the majority of cases was of the same ethnicity. Therefore, this approach was extremely tailored and could effectively deal with particular unfavourable representations about dental hygiene[18].

Last but not least, the final ceremony and the button and poster 'awards' were of vital importance. Video analysis revealed many utterances of pride in first graders after the award had been given. This seems to indicate that this instruction without language barriers, authentic role models, and the awards could provide a strong empowerment. Empowerment has been strongly associated with enhanced compliance in dental hygiene[19,20].

However, it was puzzling to see that in contrast to the brushing technique, toothbrushing time did not increase after the instruction. We believe that some external factors may have contributed to these findings. It may be that some children wanted to impress the examiner with their toothbrushing efforts while they were filmed. The high standard deviation and the high range from the shortest to the longest toothbrushing time (11–279 s) seem to confirm that this might have been a confounding factor. Moreover, the interviews indicated that the sense of time was merely developed in many first graders. When being asked about their toothbrushing time, many of them answered with unrealistic time spans of '3 hours' or '100 min'.

Further analysis revealed that this approach increased the oral health behaviour of fourth graders, as well. Significant improvements regarding the appropriate toothbrushing technique and toothbrushing time were detected and published elsewhere.

In this pilot study, we were not able to detect plaque levels by dental examination, and the follow-up of 7 days was short. This was because of important parental resistance. Parental consent could be reached only for this non-invasive procedure of limited duration. Unfortunately, there was also some resistance from local teaching staff, so the amount of time, which had been allocated to this study during school lessons, was limited as well. This was quite surprising because the intervention was designed in accordance with curricular guidelines, and so no education was lost. However, this shows that even if interventions follow the appropriate curricular guidelines, they should be scheduled with the respective teachers at the end of the preceding school year already so that they can adapt their educational planning accordingly.

Even though it seems reasonable[1,4,12] to limit oral health behaviour to toothbrushing with fluoride toothpaste in this study, we acknowledge that dental caries is a complex disease, and hard evidence concerning a caries-preventive effect exists for sufficiently high concentrations of fluoride only[1,4,10,12]. Therefore, the caries burden of these children cannot be diminished by this oral behaviour change alone.

Nonetheless, there is evidence that even short educational interventions like this study are effective in young children[15].

Further studies will be necessary to confirm these results of this pilot study. Therefore, the positive results, which this pilot study yielded, should be encouraging to reach consent for a more comprehensive study protocol in the future.

Conclusion

The results of this pilot study demonstrate that the tutoring concept of fourth graders instructing first graders from the same school was able to overcome language barriers and to provide highly targeted authentic role models in a multi-ethnical primary school with a high migrant background. This peer

teaching concept yielded highly significant increases concerning the appropriate tooth-brushing technique, and can be integrated according to curricular guidelines in schools.

What this paper adds

- Peer tutoring can successfully circumvent language and cultural barriers in first graders.
- Tailored empowerment of underprivileged and multinational migrant first graders can significantly increase oral health behaviour.
- Peer tutoring can be readily integrated in schools at little additional costs.
- Programmes must be scheduled long time in advance so that local teachers can adapt their educational planning accordingly.

Why this paper is important to paediatric dentists

- The important number of children from underprivileged and/or immigrant communities with high caries burden.
- Proposal of new adequate tools for paediatric dentists to reach this growing population.

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