ABSTRACT

Background: The limited availability of oral health care services and the lack of knowledge on oral health in the population have been documented as contributing factors for poor oral health among preschool children. Aims and Objectives: This study was designed to evaluate the effect of an oral health education intervention, in a Sri Lankan rural setting. The objective was to improve the oral health status among preschool children. Materials and Methods: Mothers and their preschool children who were permanent residents of the area were considered eligible. Two hundred and nineteen mother/child pairs were recruited using a convenience sampling technique. WHO criteria for detecting dental caries and treatment need were used along with modifications suggested by the National Institute for Dental Research. Loe’s plaque index was used on modified Ramfjord teeth to determine the oral hygiene status of preschool children. Mothers were educated on common oral health problems and causes among preschool children. Preventive strategies and available oral health care services were introduced. Their knowledge of healthy food habits, of oral hygiene practices and of opportunities for self-referrals to oral health care facilities was enhanced during the intervention. Pre- and Post-Intervention clinical assessments were performed on children. Data were collected at baseline and 6 months after the intervention.

Results: The prevalence of caries was reduced from a mean DMFT of 3.60 to 3.00 (P<0.005) six months after the intervention. The major change was a reduction in the number of non-cavitated lesions, where the mean was lowered to 1.83 from 2.11 (P<0.04). Preschool children not in need of treatment for dental caries increased to more than half (69%) of the sample after 6 months, compared to 54% initially (p=0.564). The need for preventive care decreased from 41% to 19% (p<0.005). The same observation was made for treatment need 5, where the reduction was from 14.6% to 5.9% (p=0.003). Prevalence of plaque was reduced from 86% to 81% post intervention. Conclusion: In conclusion, utilizing non-dental personnel to deliver appropriate education messages can improve the oral health of preschool children.

Keywords: Preschool children, Preschool Teachers, Mothers, Oral health

Introduction

Primary prevention of oral diseases should target populations as early as possible in their lifespan. There is substantial evidence that the earlier the intervention, the more effective are the prevention efforts [1,2]. Mothers play a key role in the development of the oral hygiene habits of their children so it is essential that parents be must be having dental awareness. For example, teaching pregnant or lactating mothers on the importance of oral hygiene for both herself and her baby during the antenatal period, through auxiliaries or oral health care personnel, can establish sound oral hygiene practices later in childhood and adolescence [1-4].

The risk factors for the poor oral health of a child include mother’s or the family’s misconceptions, the level of knowledge and attitudes towards oral health. [3]. Oral health promotion programs provided in the form of guidance and information can significantly reduce the incidence of Early Childhood Caries [4]. The oral health status of children, especially dental caries, is correlated with their parents’ dental and oral health-related behaviors [5]. This may be just one among many factors related to a child’s hygiene and dietary practices, others being the environment at school and, inter alia, the availability of oral health care services [1,3,5].

Record-based evidence from School Medical Inspections in Sri Lanka suggests that dental caries is the most common health problem among school children at present. According to National Oral Health Survey (NOHS) results in 2002/2003 [6] the prevalence of dental caries in deciduous teeth of 6-year-old children was 65.3% and the prevalence of active caries 63.5%. Only 1.8% of the 5-year-old children had been treated for caries teeth. The percentage of healthy periodontal tissue among 12-year-old children was reported as only 23%, with nearly 13% having bleeding gums on probing. The periodontal status of 5-year-old children was not assessed in that survey: Among the 5-year-old children studied, 83% had never visited a dental facility; only 7% had visited a School Dental Clinic [6].

There is no systematic way of referring children who are under the age of 5 years for oral health care services in Sri Lanka. As a result, these needs are largely neglected and there is a high burden of dental caries. Parents’ and caregivers’ perceptions about maintaining good oral health of children and the importance they place on the deciduous dentition largely determine the oral health status of children. As there are no ongoing community-based oral health care services at present to upgrade the oral health knowledge and practices of adults, it will invariably affect the oral health status of children, especially preschool and children under the age of 5 years [7].

Oral health knowledge and oral health care practices of mothers/caregivers of were found to be associated with the oral health status of preschool children by studies done in Sri Lanka [8,9]. In the urban setting the oral health knowledge of mothers is sound as their level of literacy is better and the availability and accessibility of oral health care services are substantial [10]. However, this cannot be said about the rural community [8,9]. Therefore this could be a contributing factor.

PREVALENCE OF PLAQUE WAS REDUCED FROM 86% TO 81% POST INTERVENTION. CONCLUSION: IN CONCLUSION, UTILIZING NON-DENTAL PERSONNEL TO DELIVER APPROPRIATE EDUCATION MESSAGES CAN IMPROVE THE ORAL HEALTH OF PRESCHOOL CHILDREN.
for the lower level of dental caries in the urban areas as compared to rural areas [8, 9].

There have been many successful interventions targeting improvement of the oral health of preschool children. There are encouraging data from China [11], Brazil [12], Indonesia [13] and Sweden [14] which might be used as examples for countries like Sri Lanka.

The aim of the present study was to test if we could improve the oral health of preschool children by educating mothers/caregivers.

Methods

Our study was conducted as a community-based Quasi-experimental study [15, 16]. It was designed to evaluate the effectiveness of a health education intervention implemented through trained mothers/caregivers of preschool children. Prior to the study, ethical clearance was obtained from the University of Colombo, Sri Lanka. Informed written consent was obtained from mothers for themselves and for their children to participate.

Data collection started in March 2010 and was completed in September 2010.

The study area was the Padukka Medical Officer of Health (MOH) area in the Western Province. This is 33 Km East of the commercial city of Colombo, and comes under the administration of a Village Council: it is considered to be rural: the population is approximately 8000.

Children who were permanent residents of the MOH area were considered eligible. A convenience sampling method was adopted and the principal investigator visited the eligible households until the required sample size of 233 was obtained. The sample size of mothers/caregivers of preschool children for the intended study was the minimum size of the sample to detect the effectiveness of the intervention with a predetermined level of precision and confidence. The following formula was used to calculate the sample size, where α is the level of significance used for detecting a difference of the type I error (0.05) and β is type II error 0.1 when power is set at 0.9.

\[ n = \frac{P1 (100-P1) + P2 (100-P2)}{(P2-P1)^2} \times f (\alpha \beta) \]

To minimize the clustering effect, the obtained value was multiplied by the design factor: This is considered as 1.5 in community-based research. The non-response rate was considered as 20% by reference to previous intervention studies performed at the community level.

A date and a time were given for each family for data collection. Most (219) mother-child pairs responded positively and stayed at home on the given date.

Prior to data collection, a female dental surgeon was trained by the PI for identifying dental caries and in recording visible plaque, according to the study protocol. The kappa statistic for dental caries was 84%, that for VPI 86%, with PI as the gold standard. Along with the dental surgeon, a school student who had passed the General Certificate in Education (Advanced Level) was trained as a recorder.

Each child’s oral health was measured using dental caries and oral hygiene as indices. Since, WHO criteria for deciding the treatment need for Dental Caries is nationally and internationally accepted and has been used in National Oral Health surveys in Sri Lanka, this was used here, also [17]. Dental caries was measured with the WHO standard criteria for detecting dental caries along with modifications suggested by the National Institute for Dental Research for detecting non-cavitated lesions [9, 18].

It was decided for the purpose of this study to use only the treatment need criteria for dental caries, as this is the most common oral health problem among preschool children, while the prevalence of gingivitis is relatively low among them [6]. The dental surgeon who acted as data collector was informed about the availability of treatment options that preschool children receive in the local setting, as suggested by WHO [1].

The most commonly used indices to measure oral hygiene status of preschool children are either the Visible Plaque Index (VPI) or the gingival bleeding index [12, 14, 18, 19, 20 and 21]. Partial-mouth recording is considered to be adequate for surveys in which a degree of underestimation is an acceptable trade-off for lower costs [22]. Research suggests that the Ramfjord index teeth [23] can be used more effectively with a different combination for the deciduous dentition, these being: maxillary right deciduous second molar; maxillary left deciduous central incisor; mandibular left deciduous canine; mandibular left deciduous second molar; mandibular right deciduous central incisor; and mandibular left deciduous second molar [22]. To arrive at a VPI, the mean scores for the index teeth were calculated for each individual. Use of a mean value is debatable, as the different index classes are not equidistant. However, the procedure was used during analysis, since the Ramfjord method [23] is based on the calculation of means and most epidemiologic studies present their data for the plaque as mean values.

The trained and calibrated dental surgeon conducted oral examinations in the homes of the children, with the trained recorder for data entry. To avoid intra-examiner bias, The Principal Investigator (PI) examined 5% of the sample of preschool children randomly and compared data with that of the examiner. An Education Intervention in the form of a written module targeting mothers/caregivers was used. This was planned and developed by the PI with a team of experts in the field of education and dental public health. The attitudes and skills the mother/caregiver should possess to promote the oral health of a preschool child were considered when developing the modules. They were pretested before implementation.

Training of mothers involved hands-on practical sessions with
the PI and a dental public health specialist. Their knowledge and skills were developed using day to day case scenarios and role plays. They were taught how to examine the oral cavity under normal daylight conditions to detect dental caries and visible plaque.

Six months after the intervention the same data collectors visited the same households and followed the same protocol for oral examination and recording. Prevalence of dental caries and dental plaque, DMFT indices, visible plaque scores, and treatment need for dental caries were analyzed at pre and post intervention using SPSS version 16.

**Results**

Nearly 60% of the families under study were nuclear families and the majority had two children. Almost all study subjects were Sinhalese. Only 5% of mothers/caregivers among the study group had University or other higher education qualifications. The majority (67%) of the families had a monthly income of approximately LKR 10,000 [24].

According to statistics available at the Zonal Education Department Colombo, the total number of preschool children in the study area at the time of data collection was 710, of which 403 were male and 307 female. The participation rate of preschool children in the study was more than 90% (Table 1).

Chi-square analysis was used to determine differences in the prevalence of dental caries and visible plaque at pre- and post-intervention stages (Tables 2 and 3). The most significant difference was observed with non-cavitated lesions (B1), where prevalence dropped from 41% to 19% (p=0.0001). The majority of children (48%) had VPI between 1.00 - 2.00 before the intervention, however, this changed to VPI <1.00 following the intervention. (Table 3).

Our results show that, six months after the intervention, dental caries experienced by preschool children were reduced from a mean DMFT of 3.60 to 3.00 (Table 4). The component which mainly contributed to this drop was the level of decayed teeth without cavitations (B1), where the mean decreased from a 2.11 to a 1.83. Although this difference was small, it was significant (p<0.005). The mean for filled teeth was 0.70 post intervention, not a marked increase from the 0.11 pre-intervention, but statistically significant. Individual components of DMF all showed significant differences (Table 4).

TN 0, improved from 31.5% to 54.3% at the post-intervention stage, though the difference was not significant (Table 5). The need for preventive care (TN P) was reduced (p<0.005) coinciding with the lowered mean of non-cavitated enamel lesions (Table 4). There were 110 preschool children who needed restorations on more than one surface (TN 2) at the beginning, the number decreasing to 65 following the intervention, this difference is significant (P<0.005). Further, a significant difference was observed between TN 5 (need for pulp care) at pre and post-intervention stages (P=0.003). This is explained by a number of teeth with pulp involvement having been extracted, the “m” component of DMF rising from 0.01 to 0.39. (Table 4). There are very limited facilities for pulp therapy in this area. A number of teeth have been restored, however, the “f” component rising from 0.11 to 0.70.

<table>
<thead>
<tr>
<th>Estimated sample size</th>
<th>Number participated</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>233</td>
<td>219</td>
</tr>
<tr>
<td>Males</td>
<td>117</td>
</tr>
<tr>
<td>Females</td>
<td>102</td>
</tr>
</tbody>
</table>

Table 1. Distribution of preschool children in the study

<table>
<thead>
<tr>
<th>Prevalence</th>
<th>Pre Intervention (219)</th>
<th>Post Intervention(219)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decayed teeth without cavitation (B1)</td>
<td>41.01% (90)</td>
<td>19.18% (42)</td>
<td>x²= 60.192, df=2, p=0.0001</td>
</tr>
<tr>
<td>Decayed teeth with cavitation (B1)</td>
<td>27.40% (60)</td>
<td>26.48% (58)</td>
<td>x²=137.178, df=2, =0.0001</td>
</tr>
<tr>
<td>Caries prevalence(B1+B2)</td>
<td>68.49% (150)</td>
<td>45.66% (100)</td>
<td>x²=11.29, df=2, p=0.008</td>
</tr>
<tr>
<td>Prevalence of Dental Plaque</td>
<td>86.30% (189)</td>
<td>80.82% (177)</td>
<td>x²=2.627, df=2, p=0.105</td>
</tr>
</tbody>
</table>

Table 2. Comparison of Dental caries experience before and after intervention

<table>
<thead>
<tr>
<th>VPI</th>
<th>Pre Intervention (N)</th>
<th>Post Intervention (N)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>13.7</td>
<td>42</td>
</tr>
<tr>
<td>0.1 – 0.9</td>
<td>45</td>
<td>20.5</td>
<td>97</td>
</tr>
<tr>
<td>1.00 – 2.00</td>
<td>105</td>
<td>47.9</td>
<td>75</td>
</tr>
<tr>
<td>&gt;2.00</td>
<td>39</td>
<td>17.8</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3. Comparison of visible plaque scores before and after intervention
Taken together these explain 0.67/1.53, i.e., 44% of the observed reduction in active carious lesions. The remaining over 50% of the reduction in cavitated carious lesions, and the reduction from 2.1 to 1.83 in mean scores for non-cavitated lesions, may be attributed to better oral health care within families, and this to our health promotion intervention.

**Discussion**

Our results show after six months from the intervention, the prevalence of caries diminished from 68% to 46%. The main contributor to this reduction was a decline in decayed teeth without cavitation which was reduced substantially from 41% to 19% as indicated in Table 2. According to Haynes (2013), education on practical oral hygiene measures does have the potential to stop the disease process and actively promote re-mineralization of tooth structure [25]. The possible reasons for the drop in caries prevalence include i) The serious emphasis given to preventive measures for dental caries; regular and correct brushing with fluoridated toothpaste; and the information of oral health care services provided during the training after the pre-intervention results had been observed [26, 27]. ii) The intervention being implemented during a school holiday period was likely to have had an impact since the children could more easily be taken to oral health care services. As a consequence the results are plausible. Nevertheless, there could be newly formed non-cavitated lesions which were not recorded separately.

Decayed teeth with cavitation (B2) declined, but not markedly, indicating that timely treatment was not carried out for most children with such lesions at baseline. Waiting lists and the need to undertake several visits for the completion of a course of care may have contributed to the few cavities treated. This is consistent with a study done in Kurunegala District, Sri Lanka, in the late 1990’s [28] which showed that many families regarded oral health care services such as fillings, scalings and endodontic treatment as not easily obtained. Residents stated that dentists were either absent or missing from their clinics for nearly 3 hours per day. To make matters worse, the oral health care delivery system in place does not have a child-oriented service. Unfortunately, such attitudes persist even today.
The DMF index using WHO criteria can range from 0 to 20 and cannot reduce in an individual child, even after treatment: cavities might transfer from d to m or f, but the total remains. However, in the present study, the decayed component included both cavitated and non-cavitated lesions and re-mineralization of the latter resulted in a statistically significant difference (Table 4).

We observed that decayed teeth fell from a mean of 3.53 to 2.00, while filled teeth rose from 0.11 to 0.70. This indicates that 0.59 of the 1.53 improvement in decayed teeth was due to treatment: that is 39% of the improvement in cavitated lesions was due to fillings. With the extractions after the intervention, there was a 0.08 impact on dmft, accounting for (0.67/1.53) or 44% of the effect is due to intervention.

The treatment needs (TN) for all categories of treatment (from 0 to 6) were described in Table 5. The need for treatment is reflected in the level of dental caries among the preschool children (Table 4). Of the preschool children who had caries with cavitation, the majority belonged to the category of TN 2 (50%). That is a majority needed fillings on more than 2 surfaces of a tooth. A minority of children needed TN 3 and TN 4, which is the need for crowns and bridge abutments. In contrast, more than 50% of preschool children were caries free and did not seek oral health services regularly consistent with the findings of the National Survey [6]. According to the NOHS 1994/95, six-year-old children needing preventive care was 70%, TN 1 was 46% and TN 2 was 53%. Another study in 2003 [9] found that more than 55% of preschool children in the Sri Lankan District of Kaluthara, needed preventive care, 46% TN 1 and 40% TN 2. In the Ratnapura District, Sri Lanka, 38.7% of 6-year-old children have received restorative treatment, 18.2% scaling, 26.1% extractions and 37.2% received only screening as evident by unpublished observations [18]. In the Udaipur district in India, the treatment need of preschool-aged children was not high compared to the general situation in Sri Lanka evident as above. In Udaipur the proportion of children needing TNP was 46%, TN 1 was 44%, TN 2 1.41%, TN 3 1.98%, TN 5 1.98% and TN 6 0.14% [29]. Whereas this study, undertaken in Padukka MOH area, showed that overall, more than 70% of the preschool children were in need of treatment for dental caries, which is high in comparison. Possible reasons could be that there aren’t any organized oral health care delivery systems in place for children. Coupled with the lack of knowledge and skills one could observe such high caries experience.

However, six months after the intervention, it was observed that a majority of children (54%) required no treatment for dental caries (Table 5). TN P for preschool children was reduced significantly as indicated in Table 5 (p<0.005). The TN 5 of preschool children has reduced significantly (p=0.003). This is likely to have resulted from mothers/caregivers of preschool children taking their children for treatment. Obviously, such primary prevention of dental caries could be successfully achieved through the most cost effective method of self-care practices, provided that the mother/caregiver and child fac-

tors are addressed correctly [25].

After the intervention, the prevalence of VP was reduced from 86% to 81% (Table 2). This may be due to the fact that the collection of data was done during afternoons and at a time when preschool children would have had their lunch. Since the intervention stressed brushing in the morning and at night after meals, the time of data collection might not have been an ideal time for the examination of the oral cavity for VP to evaluate the intervention. This was a limitation as collecting data very early in the morning or at night was not feasible.

The oral hygiene status of preschool children in the present study, as measured by the VPI, showed an improvement (Table 3). When post-intervention data were considered for the identified categories of plaque score the number of children with a plaque score of “0” increased. Encouragingly, the number of preschool children who had plaque scores more than 2.1 were very small (5) opposed to 39 during the pre-intervention stage. The majority of preschool children (44%) belonged to the plaque score category of 0.1-0.9. The same was observed by Ajithkrishnan et al in a similar study [29]. This emphasizes that the availability of oral health services combined with the commitment provided by relevant oral health care personnel, coupled with the motivation of mothers, could create an environment that promotes the oral health of preschool children.

This emphasizes that the availability of oral health services combined with the commitment provided by relevant oral health care personnel, coupled with the motivation of mothers, could create an environment that promotes the oral health of preschool children.

In summary, there was an obvious improvement in the oral health status and TN of preschool children who were studied. The improvements were statistically significant and are attributed to the effects of the intervention targeting mothers/caregivers of preschool children. It highlights the potential that the above target groups have in promoting the oral health of preschool children, with low-cost preventive strategies, which is well suited to a developing country like Sri Lanka.

Limitations
Due to time and monetary restrictions more follow-up could not be done as desired. Further integration of the intervention methods with existing oral health care system was not possible as much work on advocacy and social mobilization were needed, which the PI was not in a position to provide. PI acknowledges that it would be more effective in such a context. Further, residents in that area did not have access to professional topical fluoride application (gel or varnish) and if they did that would have improved the results even more.

Conclusion
Oral health promotion is a new concept in Sri Lanka, though the principles and methods have been adopted by many countries with similar socioeconomic backgrounds. Even with the unavoidable limitations, this study demonstrates a feasible
and cost-effective strategy where non-dental personnel has been used to promote the oral health of preschool children in a rural setting in Sri Lanka. However, the sustainability of such an attempt was not evaluated beyond the study period. Further, available oral health care facilities need to be consistent with the planned intervention otherwise disappointments experienced by the clients will negatively impact on. Incorporating such methods into the existing oral health care system will further enhance future interventions of this nature.

Ethical Approval: Obtained from the University of Colombo, Sri Lanka

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Promoting oral health of preschool children using non-dental personnel in rural Sri Lanka


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