Educational intervention on the plaque score among hearing impaired children
A. S. Seema Alse, Latha Anandkrishna, Prakash Chandra, M. Ramya, Punitha S. Kamath, Ashmitha K. Shetty
Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, M.S. Ramaiah University of Applied Sciences, Bengaluru, Karnataka, India

Abstract
Background: Oral health is an integral part of overall health of all children. The maintenance of oral health of hearing impaired children is a challenging problem; due to lack of communicative skills and access to dental care. There is a need to improve oral health of children with hearing impairment (CHI). The aim is to evaluate the impact of oral health education (OHE) intervention on the plaque scores among hearing impaired children.

Materials and Methods: A total of 56 institutionalized CHI aged range 5-17 years were selected for this study. Oral hygiene status was assessed using Turesky-Gilmore-Glickman modification of the Quigley-Hein plaque index, dentition status along with decayed, missing, filled, surfaces were recorded. OHE along with the proper tooth brushing technique was demonstrated using a tooth model and a brush. Oral hygiene status was reassessed after 21 days and the data obtained were analyzed.

Results: A paired t-test and one-way analysis of variance was used to test the difference between the groups. In all the above tests, \( P < 0.05 \) was accepted as indicating statistical significance. A significant reduction in the plaque scores was seen in all the primary (0.323), mixed (0.231) and permanent dentition of children (0.200), with the plaque score reduction being more in the permanent dentition (\( P < 0.001 \)).

Conclusion: OHE was effective in reducing the plaque scores in hearing impaired children. Different modalities for constant motivation and reinforcement in maintaining a good oral hygiene methods should be evaluated in children with special health care needs.

Keywords
Hearing impairment, oral hygiene education, plaque scores, tooth brushing techniques

Introduction
Oral health plays an important role in the overall health of children, and, in particular it is more important for children with special health needs. Children are prone to oral health problems when their oral hygiene maintenance is poor. Dental caries is the most prevalent and widespread disease seen in children and among the disabled it is the greatest unattended health need.\(^{[1]}\)

One such category is the children with hearing impairment (CHI) who lack adequate oral health awareness to maintain their oral health due to their communication barriers.\(^{[2,3]}\)

Hearing impairment (HI) forms major disability affecting many children world-wide. There are 23,000-25,000 children (aged 0-15 years) who are permanently deaf or hard of hearing in UK.\(^{[4]}\) According to National Sample Survey Organization in India, 0.4% of 1065.40 million children are hearing impaired, and every child in 1000 live births suffers from HI.\(^{[5]}\) HI primarily influences communication, on which it can have a devastating effect.\(^{[6]}\) Psychological, emotional and social disturbances are seen to be more noticeable as the degree of loss increases, whose extent also depends on the age of onset, training, and acceptance of disability.\(^{[6]}\) Various factors contribute to the significant problems experienced by this population group in accessing health care and in communicating with doctors such as lack of sign language and the shortage or absence of aids to communication.\(^{[4]}\)

People with disabilities deserve the same opportunities for oral health and hygiene as their healthy counterparts. Previous studies have found hearing impaired children have poorer oral hygiene than non-hearing impaired children.\(^{[7,8]}\) Plaque and gingival indices in disabled children after a mechanical plaque control were significantly different compared with those of
non-disabled children. Although numerous plaque control methods have been proposed, tooth brushing using a correct technique is effective in controlling plaque, is safe, easy to use and cost effective.

With respect to the importance of assessing the oral health care needs among these special groups of population and lack of studies carried out on this issue in the pertinent population, the study aimed to assess the effectiveness of an oral hygiene instruction on the plaque scores among hearing impaired children.

**Materials and Methods**

An interventional study was conducted in National Residential School for Deaf, Bangalore, an institution for the deaf and dumb children which comprised of 72 children. Permission was obtained from the school, and the intervention was explained. Written consent was obtained from the parents and children. Ethical clearance was obtained from M.S. Ramaiah Dental College and Hospital Ethical Committee.

A total of 56 children participated in the study that included both male and female aged between 5 and 17 years. Children present on the day of the examination were included. Those who were not willing to participate or those unwell were excluded. Information about the respondent’s oral hygiene habits and practices were obtained using a questionnaire. Dental examination was performed using a dental mirror and a probe in broad daylight in accordance with American Dental Association Type III specification, by a single trained examiner. The examiner was calibrated against professor (gold standard) in the Department of Pedodontics and Preventive dentistry for assessment of plaque scores (interexaminer reliability, $\kappa = 0.85$; intraexaminer reliability $\kappa = 0.90$). Oral examination included: number of teeth present, presence of caries, restorations and number of extracted teeth and plaque score. Acquired data were entered in the dental records for each patient. For the assessment of dental caries, the decayed, missing, filled, surfaces (dmfs/DMFS) index was used and the Turesky-Gilmore-Glickman modification of the Quigley-Hein plaque index (1970) was used to assess the plaque score. Plaque was assessed on the facial and lingual surfaces of all the teeth. A plaque score per person was obtained by totaling all the plaque scores and dividing by the number of surfaces examined. A score of 0-5 was assigned to each facial and lingual non-restored surface of the tooth.

Following initial examination, oral health education (OHE) regarding the importance of maintaining good oral hygiene, development of dental caries was given with the help of the school teacher using the sign language and the tooth brushing technique was demonstrated manually using brush and tooth models. Children were then made to demonstrate the same brushing technique after the demonstration. The technique of tooth brushing demonstrated was dependent on the age group of the child. Horizontal scrub technique was demonstrated to children younger than 8 years, because of their limited manual dexterity and those older than 8 years, modified bass technique was demonstrated. A soft bristle toothbrush and fluoridated toothpaste were given to all the participants to standardize the study. It was seen that almost all of the children showed a keen interest to learn the proper brushing technique.

Children were instructed to use a toothbrush and toothpaste provided and also to follow the brushing technique demonstrated to them. After 3 weeks, plaque scores in the primary, mixed and permanent dentition were recorded and compared with baseline scores.

**Statistical analysis**

Data were analyzed using Statistical Package for Social Science (SPSS 10.0.5, Inc., Chicago, IL, USA) package. Normality of data was tested using Shapiro-Wilk test. Univariate analysis of the dichotomous variables encoded was performed by means of the Chi-square test. A paired t-test was performed to determine whether there was difference between the pre- and post-measurements. One-way analyses of variance were used to test the difference between groups. In all the above tests $P < 0.05$ was accepted as indicating statistical significance.

**Results**

Frequency of distribution according to the dentition it was seen that 21.4% were of primary dentition, 19.6% mixed dentition and 58.9% comprised of a permanent dentition [Table 2]. Out of the total 56 children, 20 were female (35.70%) and 36 were males (64.30%) [Table 3]. The mean dmfs score in the primary dentition (5.33) was more as in comparison

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<th>Table 1: Plaque score and inference</th>
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<td>Score</td>
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<p>| Table 2: Distribution of study subjects according to type of dentition |
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<tr>
<th>Dentition status</th>
<th>Frequency</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Primary</td>
<td>12</td>
<td>21.4</td>
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<tr>
<td>Mixed</td>
<td>11</td>
<td>19.6</td>
</tr>
<tr>
<td>Permanent</td>
<td>33</td>
<td>58.9</td>
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<tr>
<td>Total</td>
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with the mixed dentition (4.45) and the permanent dentition (2.24) [Table 4]. Similarly, the mean plaque score in the primary dentition before the OHE was comparatively higher (0.437) than the mixed dentition (0.335) and the permanent dentition (0.284). After the intervention with the OHE it was seen that the mean plaque score reduced to a greater extent in the permanent dentition (0.200; \( P < 0.001 \)) than the mixed dentition (0.231; \( P = 0.003 \)) and the primary dentition (0.323; \( P = 0.009 \)) [Table 5; Graph 1]. All children showed a uniform oral hygiene habit of brushing once a day with a toothbrush and paste in a horizontal direction.

**Discussion**

The AAPD defines special health care needs as any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs.\(^{[13]}\) Oral health is an inextricable part of general health and well-being. Individuals with special health care needs may be at an increased risk for oral diseases throughout their lifetime.\(^{[14]}\) Physical disability such as HI can result in difficulties to reach an ideal health status of the teeth.

To deliver quality health education, various approaches can be planned to have a better communication as it is a key factor in conveying dental health education to the CHI.\(^{[15]}\) Oral hygiene brushing instruction should be in accordance with the child’s developmental stage and motor skills. Individual training of each child is also essential to achieve desired benefits of the technique and especially with younger children, variations in the ability to brush should be considered.

In the present study, the higher plaque score before OHE confirms poor oral hygiene status in CHI similar to earlier studies.\(^{[3-5,16,17]}\) Hence, the prime motive of this study was to instill appropriate oral health awareness in these children.

After the initial examination, a toothbrush and fluoridated toothpaste were given to the children to standardize the study that also motivated them towards active participation in the program. Considering the anticaries effect of toothpastes with different fluoride concentrations on children and adolescents\(^{[18]}\) or on primary dentition of preschool children,\(^{[19]}\) the scientific-based recommendation is that a small amount of toothpaste with 1000 ppm F can be used, irrespective of child’s age.\(^{[20]}\) In the present study, it was seen that mean dmfs/DMFS score in the younger age children was considerably high. Hence it was decided to use 1000 ppm of fluoride in all age groups.

| Table 3: Distribution of study subjects according to gender |
|----------------------------------|----------------------------------|----------------------------------|
| Dentition status | Gender | Total |
|                   | Male | Female | %     |
| Primary (N=12)   | 58.3 | 41.7   | 100.00|
| Mixed (N=11)     | 63.6 | 36.4   | 100.00|
| Permanent (N=33) | 66.7 | 33.3   | 100.00|
|                   | 36   | 20     | 56    |
| Total             | 64.30| 35.70  | 100.00|

Graph 1: Comparison of Plaque Scores before and after oral hygiene education by dentition Status.
Kropf\cite{21} reported that modified bass method to be significantly more efficacious than horizontal scrub method. Kremers et al.\cite{22} and Zhang et al.\cite{23} showed that Bass technique effectively removed interdental plaque when compared with other techniques. Horizontal scrub technique has been reported as a method of choice in young children in various studies because of the inability to apply other tooth brushing techniques.\cite{24-26}

In the present study majority of children used the horizontal scrub technique. Tooth brushing skill and the required manual dexterity for tooth brushing are developed in children aged 8 years and above.\cite{27} Mescher et al.\cite{28} reported that children aged 6 years and younger do not have the hand functions which are required for tooth brushing, and hence concluded that the sulcular brushing technique could be mastered by children 8 years and above.

Age comparison between older and younger age groups shows differences in the maintenance of oral hygiene that is seen in the present study. Tooth brushing ability is dependent on the chronological age, and it is seen that manual tooth brushing skills are gained after 4-5 years of age.\cite{29} Williford et al.\cite{30} reported significant improvements in oral health among the adolescents when intervened with educational lectures. According to Simmons et al.\cite{31} children aged between 2 and 4 years do not understand the use of prepositions such as “on top of,” “inside,” “behind,” etc. Thus, teaching tooth brushing skills to these children with just words is difficult. In the present study, there was a significant plaque reduction in high school children (12-16 years) compared with primary school children (5-7 years) and middle school children (8-11 years) indicating better motivational and performance skills in the older age group children compared with younger ones. This can be said to be influenced by the greater cognitive ability and the manner of learning and initiation in older age groups.

The results of this study showed that the OHE program was effective in improving the plaque levels of CHI.

**Conclusion**

To instill a good oral hygiene practice in CHI it is essential to provide these children a good OHE. To deliver effective, oral health education different modes of reinforcement and motivation could be evaluated.

**Acknowledgment**

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**References**


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