

# Effectiveness of Various Sensory Input Methods in Dental Health Education Among Blind Children- A Comparative Study

ARUNA KUMARI GANAPATHI<sup>1</sup>, SRINIVAS NAMINENI<sup>2</sup>, PHANI HIMAJA VAAKA<sup>3</sup>, VAMSILATHA K<sup>4</sup>,  
RUPALI DAS<sup>5</sup>, MARUTI DEVI<sup>6</sup>, ANITHA AKKALOORI<sup>7</sup>, ARAVIND KUMBAKONAM<sup>8</sup>

## ABSTRACT

**Aim:** The aim of the study is to evaluate effectiveness of various sensory input methods in dental health education among blind children. Oral hygiene status was assessed through visible plaque index and oral hygiene knowledge was assessed through questionnaire before and after oral health education.

**Materials and Methods:** The study involved of 200 blind children with the age range of 8 to 14 years of both genders from two blind schools similar in standard of teaching. The total study population (n=200) was randomized and divided into five Groups, comprising of 40 children in each Group. The first four were the experimental Groups who received dental health

education through different modes, while the fifth Group served as control. Oral health related knowledge and plaque scores were assessed in all the study Groups before and after dental health education.

**Results:** After intervention, the mean knowledge scores and plaque scores were statistically significant in all the study Groups when compared to the baseline scores.

**Conclusion:** The present study proved that blind children can maintain an acceptable level of oral hygiene when taught with special customized methods like multisensory approach with creative use of other senses which was found to be effective than unisensory method.

**Keywords:** Health education, Oral Health, Oral hygiene

## INTRODUCTION

Oral health care is an important component of general health, as it not only affects esthetics, communication but also has strong biological, psychological and social projection. In a country like India, with generally low dental awareness and the extensive presence of poor oral hygiene and less accessibility of oral health manpower, complete treatment for the entire community would not appear a practical proposition. Therefore, there is an obvious need to investigate the effectiveness of promotion of dental health through oral health education [1].

Health promotion regarding maintenance of oral hygiene is an important aspect for every individual, including children with special health care needs. Such children, with disabilities receive less oral care than the normal population, in spite of the high level of dental diseases among them. The oral health status of these Groups with disability should be improved by heightened awareness through paediatricians, health visitors, community and primary care teams.

Oral health education implies an explanation about the purpose of oral hygiene and demonstrations of tooth brushing and interdental cleaning which usually includes the use of visual aids such as disclosing agents and models. However there are occasions where such demonstrations and visual aids are not appropriate to be used, such as, when the child is blind or visually impaired.

There is some evidence in the published literature which highlighted the need to provide more oral health education for people with blindness [2]. This recommendation appeared to have been based on the conception that knowledge of dental health is important to endorse the maintenance of oral health [2]. These children must be aware of not only the causes of oral diseases but also preventive measures to avoid them. Absence of visual stimuli acts as a barrier and challenging for dentists in motivating these individuals to have appropriate oral hygiene. Providing comprehensive dental care for the blind children is not only rewarding but is also a community service that paediatric dentists should accomplish.

Compared to normal children a blind child depends much more on other senses like feeling and hearing to learn. This led to think about

which mode can be used for educating blind children about their oral care as vision; the primary sense for learning which is lacking in them. Methods and modes need to be custom designed according to patients needs, incorporating the basic principles. Various studies have been proposed in the dental literature on delivering oral health education (OHE) to the blind children such as use of self educational manuals, audio tapes, models of teeth, etc [3]. A modified teaching approach rather than change in basic methods of oral hygiene was tested in this study. The purpose of the study is to provide dental health education to blind children through various sensory input methods and compare the effectiveness of each method before and after oral health education.

## MATERIALS AND METHODS

The study was conducted by Department of Pedodontics and Preventive Dentistry in two Blind schools which were similar in standard of teaching from two different zones of Hyderabad city. Ethical approval was obtained from ethical committee of the institution. Consent was taken from the directors of respective schools (as children in both schools were residential) and parents of the respective children. The dental health education programme took place within a 6 month frame work which comprised of 200 children of 8-14 years of age including both girls and boys, who were randomized by simple random sampling and divided into five Groups comprising of 40 children in each Group. The first four were the experimental Groups who received oral health education through different modes, while the fifth Group served as control.

An inclusion criterion was the children whose parents were willing to let them participate in the study and total blind children (blind from birth, certified by ophthalmologist as 100% blind). Exclusion criteria were children who were partially blind, children with underlying systemic disease and/or other handicapping conditions, children undergoing orthodontic treatment and uncooperative children.

Instruments were sterilized using autoclave (RunyesTM-1210c for 5 minutes) before every visit to the school. Disposable masks and gloves were used for the examination.

## The study was divided into three phases

**PHASE 1:** On the predetermined dates all the enrolled participants of the respective schools were requested to assemble in their classroom. Children's oral health related knowledge was assessed using a questionnaire in English language printed in Braille script. The questionnaire comprised of 18 closed-ended questions which were utilized to assess oral health knowledge and practices in previous studies [4,5]. All the children were briefed regarding the questionnaires and were instructed not to leave any answers blank and it was made sure that no cross copying was done. Clinical examination was carried by making the children to sit comfortably on a chair and plaque scores were recorded under natural lighting conditions in the school premises. Plaque scores for all the children were recorded using Modified Quigley-Hein plaque index as it is considered to be most sensitive in visible plaque scoring [6].

**PHASE 2:** All the four Groups received dental health education by a trained single examiner using various sensory input methods which encompassed topics like importance of oral care, brushing techniques and the importance of brushing, inter dental cleaning, aetiology of dental caries and periodontal diseases, preventive methods-the role of fluorides for having a healthy mouth.

**Group I (Audio Group):** This Group received dental health education consisting of a single information session and the method of delivery of oral health education was through audio record.

**Group II (Braille Group):** This Group received dental health education by distributing the pamphlets (leaflets) printed in Braille script.

**Group III (Tooth models Group):** This Group received dental health education by explaining with the help of tooth models.

**Group IV (Multisensory Group):** This Group received dental health education by combination of all the above three sensory input methods (Multi-sensory mode).

**Group V:** The children in this Group received no informational session of oral hygiene instructions and served as the control.

**PHASE 3:** Children's oral health related knowledge was assessed 8 weeks after provision of oral health education using the same closed-ended questionnaire. The answered questions by the children were evaluated by single-blinded teacher from the blind school. Plaque scores for all the children were then recorded using Modified Quigley-Hein plaque index.

## STATISTICAL ANALYSIS

Data collected was tabulated and statistical analysis was done using SPSS version 17. Mean knowledge and plaque scores before and after intervention was compared using paired t-test. A p-value of <0.05 was considered as statistically significant. Mean difference in knowledge and plaque scores were compared among the study Groups using ANOVA followed by post-hoc test.

## RESULTS

**Knowledge scores:** Before the intervention, the mean knowledge scores of children in the four experimental Groups (Group I: 4.45, Group II: 3.27, Group III: 3.25 and Group IV: 3.05) were slightly higher than that of the control Group (Group V: 2.63) though this difference was not statistically significant [Table/Fig-1,2]. After the intervention, the mean knowledge score was 11.88 in Group I, 6.27 in Group II, 10.95 in Group III and 12.33 in Group IV [Table/Fig-

	1	2	3	4	Df	F value	p-value	Post-hoc test
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD				
Knowledge	-7.42 $\pm$ 2.14	-3.00 $\pm$ 2.11	-7.70 $\pm$ 2.55	-9.27 $\pm$ 2.50	(3,156)	53.23	<0.001 (sig)	1,3>4 2>1,3,4
Plaque	.94 $\pm$ 1.05	.38 $\pm$ .84	.75 $\pm$ .88	.83 $\pm$ .84	(3,156)	2.88	0.038 (sig)	1,3,4>2

[Table/Fig-3]: Inter Group comparison of knowledge and plaque scores

1,2]. Comparison of the baseline values with their respective post-intervention knowledge scores illustrated a statistically significant ( $p < 0.001$ ) increase in knowledge in Group I, Group II, Group III and Group IV. [Table/Fig-1,2].

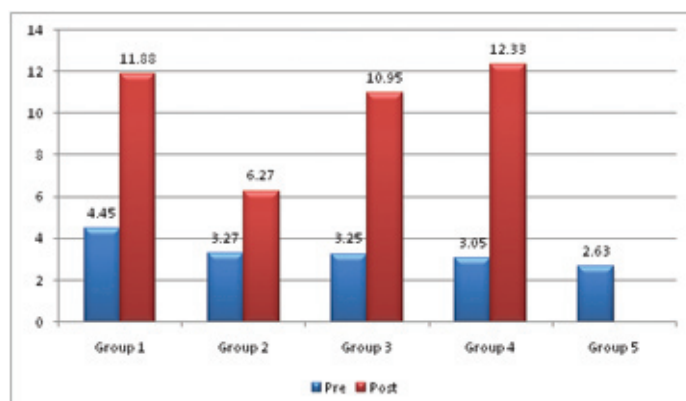
Inter-Group comparison of mean difference in the knowledge scores were obtained by subtracting the baseline from follow-up scores [Table/Fig-3]. Negative scores depict increase in knowledge [Table/Fig-3].

Further analysis using Newman-Keuls Multiple Comparison test (post-hoc test) revealed that the differences in knowledge gain were statistically significant between the four Groups and the increase was highest in Group IV followed by Group III and Group I and the lowest was in Group II [Table/Fig-3].

**Plaque scores:** Plaque scores in the five Groups were almost similar (3.02 in Group I, 2.73 in Group II, 2.61 in Group III, 2.63 in Group IV and 2.75 in Group V) and statistically non significant at

Group	Pre-questionnaire	Post-questionnaire	p-value
	Mean $\pm$ SD	Mean $\pm$ SD	
1	4.45 $\pm$ 1.78	11.88 $\pm$ 2.04	<0.001
2	3.27 $\pm$ 1.24	6.27 $\pm$ 1.52	<0.001
3	3.25 $\pm$ 1.53	10.95 $\pm$ 2.19	<0.001
4	3.05 $\pm$ 1.38	12.33 $\pm$ 1.97	<0.001
5	2.63 $\pm$ 1.17		

[Table/Fig-1]: Mean knowledge scores before and after intervention



[Table/Fig-2]: Intra-Group comparison of knowledge questionnaire (pre-post)

baseline. Comparison of the baseline values with their respective post-intervention plaque scores illustrated a statistically significant ( $p < 0.001$ ) decrease in all the study Groups (2.07 in Group I, 2.35 in Group II, 1.86 in Group III and 1.80 in Group IV) [Table/Fig-4,5].

Inter-Group comparison of mean difference in the plaque scores was obtained by subtracting the baseline from follow-up scores [Table/Fig-3,5] and positive score (plaque) depicts decrease in plaque scores [Table/Fig-3].

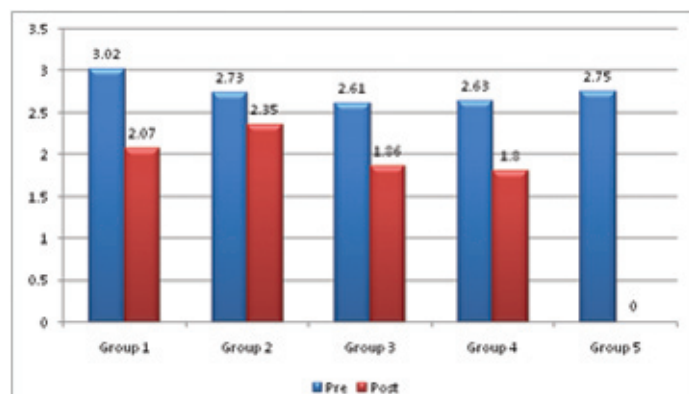
Within the Group comparisons revealed that there was a significantly decreased plaque scores in all the four experimental Groups [Table/Fig-3]. Group I had the least plaque score ( $p < 0.001$ ) followed by Group IV and Group III and further followed by Group II.

## DISCUSSION

Health education is a widely accepted approach in the prevention of oral diseases. It is a process of transmission of knowledge and skills

Group	Pre-plaque index	Post-plaque index	p-value
	Mean $\pm$ SD	Mean $\pm$ SD	
1	3.02 $\pm$ 0.90	2.07 $\pm$ 0.63	<0.001
2	2.73 $\pm$ 0.83	2.35 $\pm$ 0.47	<0.006
3	2.61 $\pm$ 0.82	1.86 $\pm$ 0.51	<0.001
4	2.63 $\pm$ 0.76	1.80 $\pm$ 0.45	<0.001
5	2.75 $\pm$ 0.51		

[Table/Fig-4]: Mean plaque scores before and after intervention



[Table/Fig-5]: Intra-Group comparison of plaque index (pre-post)

necessary for improvement in the quality of life. In the last few years, there is a conscious shift in public health education in India. Initiating public health programs not only bring about new behaviours, but also will reinforce and maintain healthy behaviours that will promote and improve individual, Group or community health [3].

It has been reported that dental treatment is the greatest unattended health need of the disabled people especially in blind who have oral health problems similar to or more than those seen in the general population [7]. Blind people deserve the same opportunities for oral health and hygiene as those who are healthy. It is necessary to emphasize the importance of oral care for these individuals as they cannot assess the oral hygiene maintenance visually [3].

**Pre and post questionnaire knowledge comparison:** Our study found that children are aware of some basic knowledge regarding the oral hygiene maintenance during pre oral hygiene instruction (OHI) questionnaire. This may be attributed to the school curriculum wherein some general information about the oral hygiene maintenance is taught to the children and also due to the fact that these children were staying in a residential school and lead a disciplined life style. Giving a questionnaire before OHI stimulated their thinking and probably might be the reason which elevated interest in them during the OHI.

In the present study, baseline knowledge scores of children in the four study Groups during pre-OHI questionnaire were almost similar. The teaching strategies, we adopted were education through pamphlets in Braille, Unisensory approach using audio (hear), tooth models with explanations (hear and feel) and a multisensory approach (combination of all the three) as perception of other senses like audio, touch, taste and smell are very sensitive in blind children.

Post-OHI questionnaire knowledge scores comparison was assessed 8 weeks after OHI, results of which had showed a statistical significance in all the study Groups [3,8-10]. It was encouraging to observe that the subjects improved their knowledge and oral hygiene status after OHI. However, the improvement was brought about by the effectiveness of the method of instruction with the increase in awareness among blind children [8].

**InterGroup comparison of knowledge scores post OHI:** Statistically significant increase in the knowledge scores was seen in multisensory method (combination) Group when compared to

other Groups because of repeated instructions which made them use the multisenses, might have provoked the knowledge regarding oral health through various modes like audio, Braille pamphlets and tooth models.

Auditory sense and tactile perception are considerably high in blind children, which made audio Group and tooth models Group achieve significant results. These two senses are usually applied in their daily routine, so these techniques were more perceived and can be considered as the next alternatives as there was no statistically significant difference between these two Groups.

Though there was an increase in the knowledge scores in Braille Group when compared to the pre-OHI questionnaire, it is considered as the least knowledge scoring Group. The reason may be the reception of the instructions was less because of the regular and non-interesting way they were presented and no individual attention paid for the education, whereas in other study Groups (audio, tooth models and multisensory mode) each child was given personal attention while giving oral hygiene instructions.

**Pre and post intervention plaque score comparison:** In this study we also assessed the change in plaque scores in the study Groups before and after OHI using visible plaque index (VPI). VPI is a quantitative method for measuring, scoring, and analysing dental conditions in individuals and Groups. It describes the status of individuals or Groups with respect to the oral condition being measured

The mean VPI scores in all the study Groups were almost similar and there was no statistical significance at baseline. When assessed after health education, it was noted that the mean plaque scores had lowered in all the study Groups and this reduction was statistically significant in line with similar studies previously [3,4,8,9,11-14]. Many studies reported that people with visual impairments, similar to other disabilities, tended to have a larger amount of dental plaque and were at a higher risk for dental diseases than sighted people [9].

**InterGroup comparison of VPI scores post OHI:** On comparison of the four study Groups, highest improvement was seen in audio Group. Tooth models Group and multisensory modes (combination) Group also showed reduction in plaque scores after post OHI and considered as the next effective method when compared to audio Group which indicates that though multisensory Group gained highest knowledge they did not put into practice what they had learnt through health education in maintaining the oral hygiene.

There was reduction in the visible plaque (VPI) scores in Braille Group when compared to the pre-OHI. Inter-Group comparison stated that, it was the least plaque reduction Group. The pamphlets without illustrations were distributed among the Group, where individual attention was not given to every child, whereas in other study Groups (audio, tooth models and multisensory mode) each child was given personal attention while giving oral hygiene instructions.

We adopted a multisensory approach using touch, hear, and feel to teach the students about oral hygiene. These strategies were found to be effective in the dental literature, which reported that the creative use of the other senses is the key when instructing persons who are blind in oral hygiene. The findings of our study support the need for an individualized approach and child-specific OHI program using multisensory mode for the blind children which should address their unique problems and must be extremely effective at the same time.

Hence, this method of health education was used to educate the Braille Group and control Group after the study as it would be unethical to leave any Group without receiving benefits.

After health education, children realized that their favourite food items like chocolates, toffees and sweets should preferably be eaten along with meals rather than at any time of the day. The fact that oral

health education increased awareness of the importance and role of fluoride, importance of flossing and area of interest on the tooth to remove plaque which was visualized in the higher number of correct answers from children in the study Groups [8].

This program can be of great value to level the barrier of visual impairment towards better communication of OHI in blind children. Modifications and improvements of the oral health education program can also be done for these children and also for children with other health care needs [4].

To improve the oral hygiene status of the individuals with disabilities is a daunting task, but it can be achieved if the parents or care takers are given suitable dental health education which is vitally important towards improving and maintaining the oral health and hence the overall general health of these children [15].

Organisations providing residential education for the blind children could help students improve their oral hygiene practices by including the oral hygiene maintenance as a part of the curriculum and implementing brushing teeth at bedtime and using both toothbrush with toothpaste and dental floss as a student's routine practice. An alternative to a dental education program may be to make these children visit dental hospitals and consult dental practitioners on oral hygiene practices regularly.

## LIMITATIONS

Limitations of this study were its short duration and long term retention of the knowledge after discontinuation of oral health education was not assessed.

However, further longitudinal studies engaging teachers, caretakers and parents regarding oral health education can be assessed. Long term retention of knowledge after discontinuation of health education for blind children at different intervals can be assessed. Researchers could make greater efforts to examine the oral health status of children with visual impairments in the future to ensure the quality of life of this population.

Good dental care helps in socializing, improves health, and heightens confidence for special children but perhaps even more for people who are blind.

## CONCLUSION

The present study proved that blind children can maintain an acceptable level of oral hygiene when taught with special customized methods like multisensory approach which was found to be effective than unisensory mode. It is recommended that regular contact be maintained with parents and care givers and educated on the need for diet modification, improvement in oral hygiene and regular dental visits for their wards. More attention has to be directed by the oral health authorities to establish school-based dental care programs in schools of special children.

## REFERENCES

- [1] Hebbel M, Ankola AV, Vadavi D, Patel K. Evaluation of knowledge and plaque scores in school children before and after health education. *J Dent Res*. 2011;8(4):189-96.
- [2] Avasthi K, Bansal K, Mittal M, Marwaha M. Oral health status of sensory impaired children in Delhi and Gurgaon. *Int J Dent Clin*. 2011;3(2):21-23.
- [3] Hebbel M, Ankola AV. Development of a new technique (ATP) for training visually impaired children in oral hygiene maintenance. *Eur Arch Pediatr Dent*. 2012;13(5):244-47.
- [4] Yalcinkaya SE, Atalay T. Improvement of Oral Health Knowledge in a Group of Visually Impaired Students. *Oral Health Prev Dent*. 2006;4(1):243-53.
- [5] Nandini NS. New insights into improving the oral health of visually impaired children. *J Indian Soc Pedod Prev Dent*. 2003;21(1):142-43.
- [6] Cugini M, Thompson M. Correlations between Two Plaque Indices in Assessment of Toothbrush Effectiveness. *J Cont Dent Pract*. 2006;7(5):1-11.
- [7] Bhambal A, Jain M, Saxena S, Kothari S. Oral health preventive protocol formentally disabled subjects – A review. *J Adv Dent Res*. 2011;2(1)21-26.
- [8] Chang CS, Shih YH. Teaching Oral Hygiene Skills to Elementary Students with Visual Impairments. *Journal of Visual Impairment and Blindness*. 2005;99(1):1-28.
- [9] Foster H, Fitzgerald J. Dental disease in children with chronic illness. *Arch Dis Child*. 2005;90(2):703-08.
- [10] Siddibhavi MB, Ankola AV, Arora D, Singhal D, Singh D, Naik K. Oral Health Attitude and Awareness among School Children. *World Journal of Science and Technology*. 2011;1(6):43-51.
- [11] Dawn B. An observational study of oral hygiene care for visually impaired children. University of Glasgow. 2008;33(2)1-22. From <http://www.gla.ac.uk/enlighten> on 12-03-2012.
- [12] Ahmad MS, Jindal MK, Khan S, Hashmi SH. Oral health knowledge, practice, oral hygiene status and dental caries prevalence among visually impaired students in residential institute of Aligarh. *J Dent and Oral Hygiene*. 2009;1(2):22-26.
- [13] Azrina AN, Norzuliza G, Saub R. Oral hygiene Original Article practices among the visually impaired adolescents. *Ann Dent Univ Malaya*. 2007;14(2):1-6.
- [14] Herwis K, Ali A, Elturk H, Khamis H. Oral Health Status of Visually-Impaired and Sighted Groups of Children in Benghazi: A Comparative Study. *Libyan Dent J*. 2013;3(2):1-5.
- [15] Tagelsir A, Khogli AE, Nurelhuda NM. Oral health of visually impaired school children in Khartoum State, Sudan. *BMC Oral Health*. 2013;13(33):1-8.

### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pedodontics, Mallareddy Dental College for Women, Telangana, India.
2. Professor and HOD, Department of Pedodontics, Sri Sai College of Dental Surgery, Vikarabad, Telangana, India.
3. Assistant Professor, Department of Oral Surgery, Mallareddy Dental College for Women, Telangana, India.
4. Assistant Professor, Department of Orthodontics, Mallareddy Dental College for Women, Telangana, India.
5. Assistant Professor, Department of Periodontics, Mallareddy Dental College for Women, Telangana, India.
6. Reader, Department of Oral Pathology, Mallareddy Dental College for Women, Telangana, India.
7. Assistant Professor, Department of Public Health Dentistry, Mallareddy Dental College for Women, Telangana, India.
8. Assistant Professor, Department of Oral Medicine and Radiology, Mallareddy Dental College for Women, Telangana, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Aruna kumari Ganapathi,  
Flat no: 501, #2-152, Venkatramnagar Colony, Suraram, Hyderabad-55, India.  
E-mail: aruna2thdoc@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jul 02, 2015**  
Date of Peer Review: **Aug 07, 2015**  
Date of Acceptance: **Sep 14, 2015**  
Date of Publishing: **Oct 01, 2015**