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A comparative evaluation of oral health status among institutionalized totally blind children using different methods – A randomized clinical trial

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ABSTRACT

Background: To compare and evaluate the oral hygiene status among institutionalized visually impaired children using the Verbal, Braille, and Audio-Tactile method.

Materials and Methods: The present study was a single-blinded, randomized clinical trial with a total of 96 visually impaired children both male and female, aged 6–16 years old were included in this study from a residential school for blind. They were divided into three groups: Group 1 − Verbal method, Group 2 − Braille method, and Group 3 − Audio-Tactile method. Baseline oral hygiene scores were recorded using the debris index, calculus index, gingival index and hand scaling was performed for all the children. Fone's brushing technique was taught to all the groups and fluoridated toothpaste was given to the children with 3 and 6 months of follow-up. Periodic reinforcement of oral hygiene instructions was done for each group. The collected data were tabulated and analyzed using the ANOVA test with ($P < 0.01$).

Results: There was significant improvement in debris index, gingival index, and calculus index in all the three groups by the end of 6 months. All the three indices showed improvement in oral hygiene.

Conclusion: Visually impaired children could maintain a respectable level of oral hygiene when taught specialized methods. However, periodic reinforcement is mandatory for good oral hygiene maintenance. Hence, it is recommended to use the combination of Verbal, Braille, and Audio-Tactile method for the best treatment outcomes in these special children.

Key Words: Blindness, oral hygiene, positive reinforcement, questionnaire

INTRODUCTION

Visual impairment constitutes a significant proportion among all disabled children. It is estimated that over 1.4 million children worldwide are living with visual impairment and India holds the largest population, i.e., 15 million.[1] "Blindness" is defined as visual sense <3/60, or a corresponding visual field loss to <10°.[2] Visual impairment includes both low vision, partial blindness, and blindness.

Visual impairment at a young age can have cynical effects on physical, neurological, cognitive, and emotional development[3] and when talking about oral health, it is an inevitable component of overall

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health so should not be ignored. Various studies stated increased gingival and periodontal diseases in visually impaired population as compared to the normal population.[4,5] With probable reasons, these children lack in motor skills, proper brushing technique, good education, rely totally on their guardian, lack of public awareness, and motivation for these children which shows higher prevalence of dental diseases.[6]

To adapt to certain situation visually impaired individuals depend much on sound, speech, and touch.[7] Few of the previous data have focused much on improving oral hygiene skills[8,9] rather than their knowledge and importance of oral health. It is important to conduct programs on oral health promotion and preventive treatments that ensure patients with visual impairment have appropriate information regarding oral health care and its provision. Modification in oral health education by using alternative teaching aids such as use of Braille pamphlet, oral health talk, chemical plaque control, individual care, and training can be helpful in maintaining oral health.[10]

Techniques such as this should be designed in such a way that helps in the elimination of dental biofilm, functionality, and conservation of dental elements. To motivate these visually challenged individuals is a major challenge for dental personnel. Thus, the use of substitute teaching aids such as verbal, tactile, and oral health talk through an educative, interactive questionnaire session can be beneficial in providing good oral hygiene practice to the visually impaired children. Therefore, the aim was to compare the oral hygiene status among institutionalized totally blind children of age 6–16 years using verbal method, braille method, and Audio-Tactile method in the Gwalior city of Madhya Pradesh located in Central India.

MATERIALS AND METHODS

The present study was a single-blinded, randomized clinical trial. It was carried out on 96 visually impaired school children of 6–16 years in Madhya Pradesh, India. Permission was obtained from the residential institution for visually impaired children. The study procedure consisted of a baseline data, interventions, one reinforcement for allocated groups, and follow-up examinations after 3 and 6 months. Children were selected by the probability simple random sampling method and were divided into three groups [Table 1]. Study design and its purpose were explained to the school authorities, and former consent was procured by the parents/guardians of the children from the residential school for blind. An interactive session was conducted at the beginning of the study, in order to create a good rapport and understanding with the children. Documentation was done using a self-designed format that included personal details such as name, age, gender, and a questionnaire by reading out to students, assessing their knowledge about oral health practices and their constancy of regular dental visit.

Before the start of the study, baseline data of debris index, gingival index, and calculus index were recorded for Groups I, II, and III. Two individuals who were trained and calibrated before beginning the study to eliminate interexaminer and intraexaminer bias, performed the interview and clinical oral examination. In addition, kappa statistics were done to test inter-rater reliability and agreement was found to be 90%. Entire clinical examination was carried out by single pediatric dentist. During the examination, the children were made to sit on a wooden chair with an artificial light illumination with the school staff standing in close vicinity. Scaling for each participant was done using hand scalers. Individually, each participant was explained Fone's brushing technique, maintenance of good oral hygiene, and brush their teeth twice daily. Medium manual toothbrushes and toothpaste (Colgate Company, USA 0.15% w/w fluoride ion) were given to all the participants. Caretakers in the institution were advised and instructed to make a check on all the participants of their daily brushing frequency. For verbal group, Fone's brushing technique and oral hygiene instructions were explained verbally in the local language (Hindi). For Braille group, Braille formatted oral hygiene instruction pamphlets were given and in Audio-Tactile group they were made to feel the teeth on a large sized dental model followed by brushing on the model using Fone's method with assistance. This was repeated until the children could perform with ease. Periodic reinforcement was performed for all the children at an 3 week's interval. Oral hygiene index using debris, calculus,

Table 1: Group allocation

Groups	Type of intervention	Number of children
Group 1	Verbal group	32
Group 2	Braille group	32
Group 3	Audio-tactile group	32

and gingival index was recorded. Data obtained were entered into Excel sheet and analyzed using the SPSS version 22. Normality of the data was analyzed using the Kolmogorov − Smirnov test. Proportion was calculated using the Chi-square test to assess the relationship between the demographic (age and sex) variables and oral health status. ANOVA test was used to assess the difference between the groups and scores before and after health education.

Diagram below shows the CONSORT diagram depicting the flow chart of the study in Figure 1.

RESULTS

All the three groups were matched based on the age and sex of the visually impaired children, as depicted in Table 2. Self-designed closed-ended questionnaire was under taken to assess the knowledge about diet, knowledge about the maintenance of oral hygiene, and necessities of regular dental visits which showed that, most of the children had complete knowledge but lacked in applicability, as shown in Table 3.

At baseline, there was no significant difference seen between all the three groups for debris index, gingival index, and calculus index with F = 0.96 and $P = 0.62$. At the 3rd month time interval, there was a statistically significant difference seen with all the three groups for debris index with F = 2.36 and $P = 0.042$. At the 6th month time interval, there was significant difference seen for all the three groups for debris index, gingival index, and calculus index, as shown in Table 4.

The comparison of bebris index, calculus index, and gingival index within the groups at baseline, till 6 months as shown in Table 5.

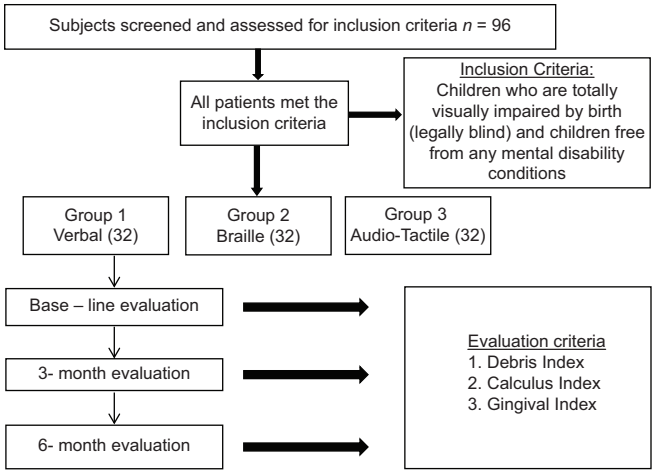

Figure 1: CONSORT diagram.

DISCUSSION

Education, in general, is one of the imperative factors responsible for behavioral change in children.[11] Particularly, oral health education is the key to prevent oral diseases, and it is always healthier to educate the school age group.[12] According to Zickert *et al*.,[13] schools are thought to be the most suitable environment to provide health information to children to achieve the goal of health education program. Hence, in this study, three different health education methods were undertaken by which these children could easily master the correct brushing technique.

The information obtained from the close-ended questionnaire related to their diet, knowledge about the maintenance of oral hygiene, and their visits to dentist, affirmed children are in institutionalized setting, they had knowledge but lack in applicability, although it did not influence the study results which was in accordance to Reddy *et al*.[14]

In accordance to the present study, Jain *et al*.[15] also stated that these children face difficulty in maintaining

Table 2: Distribution of participants on the basis of age and sex

Group	*n*	Age (mean)	Sex (female)	Sex (male)
Verbal	32	13.13	18	14
Braille	32	13.17	15	17
Audio-tactile	32	12.63	14	18

Table 3: Response to the questions by the study participants

Questions
Do you clean your teeth?
Yes - 96 (100%)
No - 0
How many times do you brush your teeth?
Once - 96 (100%)
Twice - 0
Material used to clean your teeth?
Toothpaste - 96 (100%)
Toothpowder - 0
Do you rinse your mouth after every meal?
Always - 68 (70%)
Sometimes - 21 (23%)
Never - 7 (7%)
Have you ever suffered from dental pain in past 12 months?
Yes - 29 (30%)
No - 67 (69%)
Have you ever visited to a dental hospital or clinic?
Yes - 21 (23%)
No - 75 (78%)

Table 4: Comparison of mean debris index, calculus index, and gingival index at different intervals

Index	Time	Groups	*n*	Mean	SD	*F*	*P*	Inferences
Debris index	Baseline	Verbal	32	1.60	0.74	0.96	0.62	NS
		Braille	32	1.87	0.89			
		Audio-tactile	32	1.73	0.66			
	3 month	Verbal	32	1.43	0.48	2.36	0.042*	S
		Braille	32	1.19	0.19			
		Audio-tactile	32	1.25	0.33			
	6 month	Verbal	32	1.01	0.13	17.42	0.01	S
		Braille	32	0.57	2.09			
		Audio-tactile	32	0.93	0.29			
Calculus index	Baseline	Verbal	32	1.36	0.24	1.13	0.70	NS
		Braille	32	1.54	0.27			
		Audio-tactile	32	1.31	0.29			
	3 month	Verbal	32	1.12	0.18	1.65	0.09	NS
		Braille	32	0.98	0.16			
		Audio-tactile	32	1.03	0.17			
	6 month	Verbal	32	0.23	0.09	21.12	0.01*	S
		Braille	32	0.11	0.06			
		Audio-tactile	32	0.19	0.07			
Gingival index	Baseline	Verbal	32	1.48	0.62	0.45	0.71	NS
		Braille	32	1.56	0.56			
		Tactile	32	1.51	0.50			
	3 month	Verbal	32	1.32	0.44	0.65	0.43	NS
		Braille	32	1.28	0.35			
		Audio-tactile	32	1.29	0.41			
	6 month	Verbal	32	0.67	0.22	7.35	0.01*	S
		Braille	32	0.44	0.15			
		Audio-tactile	32	0.65	0.31			

*Significant. S: Significant; NS: Not significant, SD: Standard deviation

Table 5: Comparison of debris index, calculus index, and gingival index for different groups at baseline and 6 months

Index	Groups	Time versus time	*P*	HS
Debris index	Verbal	Baseline versus 6months	0.002*	HS
	Braille	Baseline versus 6 months	0.001*	HS
	Audio-tactile	Baseline versus 6 months	0.001*	HS
Calculus index	Verbal	Baseline versus 6 months	0.022*	HS
	Braille	Baseline versus 6 months	0.001*	HS
	Audio-tactile	Baseline versus 6 months	0.001*	HS
Gingival index	Verbal	Baseline versus 6 months	0.023*	HS
	Braille	Baseline versus 6 months	0.001*	HS
	Audio-tactile	Baseline versus 6 months	0.001*	HS

*Highly significant. HS: Highly significant

optimal oral hygiene. Along with the children, teachers were also given the demonstration of tooth brushing and importance of positive reinforcement to these children as they were in an institutionalized setting, thus receptive to learn new things. The relevance of positive reinforcement in improving the oral well-being has been explained in a study by Hebbal and Ankola[16] where they reported, meticulous training and reinforcement by health educators lead to success of oral health programs.

Modified bass technique is superior in cleansing the interproximal areas and gingival third surfaces,[17] but Fone's brushing technique proved to be simpler, easily understood and remembered by the children[18] thus it was undertaken in this study. Children were also kept on fluoridated toothpaste as it being a known weapon in the prevention of dental caries.

In the present study, all the groups were comparable with respect to gingival, debris, and calculus index before starting the study and significant improvement in indices values among all the groups was seen at the end of 6 months follow-up.

Verbal group showed drastic improvement from baseline to 6 months in oral hygiene maintenance. At the beginning, the children's oral health knowledge applicability was not appropriate, but eventually following education and motivation, there was a remarkable improvement seen which was in accordance to Mahantesha *et al*.[19]

A salient factor in the present study is the Braille-formatted oral hygiene instructions. Braille group had better performances at 3 months, and

there was significant difference between the groups which was in accordance to Deshpande *et al*.[20] and Ganapathi *et al*.[21] who found that many students reached good score category who were initially classified as fair after using the Braille technique. Similar trend was seen in the current study where at the end of 6 months, the performance by the Braille group was not different when compared to other means. Braille group showed the least indices value at the end of 3 months follow-up with $P = 0.001$ but did not continue till 6 months with probable reason children kept losing the Braille pamphlet or some could not comprehend the scientific language as they have just started learning Braille at the age of 6 years.

In the present study, there was significant increase in hygiene index and customized methods such as Verbal and Audio-Tactile performance could maintain an admissible level of oral hygiene in visually impaired children which was in consonance to Krishnakumar *et al*.[22]

The Audio-Tactile group, dental models were given to children for better understanding of oral hygiene instructions which might be the reason it proved to be effective in improving the oral hygiene of these children as supported by Sreedevi *et al*.[23]

Keeping all the above points in mind, it is recommended to use a combination of verbal, braille text, and audio-tactile mode of oral health education to instill good oral hygiene practice in these special children, which was in accordance to Chowdary *et al*.[24] Proper education, motivation, and periodic reinforcement were the key behind this success.

Reducing the burden of oral diseases, especially among visually impaired population may have long-term benefits. Lack of time, knowledge, high cost, fear, and negative view point toward dental fraternity may prevent participants from availing appropriate dental treatment. Thus, special attention must be given to these underserved children by our dental fraternity.

What are the limitations of the study?

Further studies with larger sample size and longer duration follow-up must be conducted to evaluate and assess the retention of knowledge even after the discontinuation of oral health education.

CONCLUSION

Oral health education along with the skills to maintain its hygiene delivers paramount benefits in improving oral hygiene status for these special kids. For best results, we recommend a combination of all three methods i.e., Verbal, Braille text, and Tactile performance as it can be an additional aid in providing impactful results for these children. Fones method along with the use of fluoridated toothpaste gave the best outcome as it was easily remembered and understood by the children. Emphasis on positive reinforcement and gentle reminders proves to be helpful. Hence, measures mentioned above might reduce the further complicated treatment needs and facilitate in reducing dental incapacity.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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