

A Cross-Study to Evaluate the Effect of Two Methods of Oral Health Education on the Oral Health Status among Visually Impaired Children

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Abstract

Objectives: Visually impaired children can encounter specific problems like plaque-associated disease which if untreated could result in higher risk. Despite this, there is not much available data authenticating the efficacy of oral health education aids using verbal commands and tactile sensations. Therefore, the present study was aimed to evaluate the use of oral health education aids using verbal instructions through audio and music-assisted toothbrushing system and oral hygiene instructions and brushing methods through braille among visually impaired children and its outcome on their oral health status. **Study Design:** This cross-sectional study included a total of 50 visually impaired children divided equally into music-assisted toothbrushing method and oral hygiene instructions and brushing method through braille's categories. Oral hygiene status was assessed using Simplified Oral Hygiene Index (OHI-S), gingival index (GI), and plaque index (PI) at different time intervals. Analysis was performed using Student's *t*-test, Mann-Whitney *U*-test, and Welch's *t*-test. **Results:** The OHI-S, PI, and GI scores significantly decreased at different time intervals for both the groups ($P \leq 0.001$). Intergroup comparison regarding oral hygiene status between the braille and music groups at baseline to 6 months showed a significant improvement ($P \leq 0.001$). **Conclusions:** The current study highlighted an improvement in the oral hygiene status with audio instructions and music-assisted toothbrushing system than braille. Employing these specially framed oral health educations improvised greatly the oral health status in visually impaired children.

Keywords: Dental plaque index, music, oral hygiene index, oral hygiene, toothbrushing

INTRODUCTION

Blindness is a physically challenging condition defined as having a "visual acuity of $<3/60$ m or corresponding visual field loss in the better eye with the best possible correction."^[1] Low vision, i.e., partially blind, and nil vision, i.e., completely blind, are the two types of visual disability. In May 2009, the World Health Organization (WHO) estimated around 314 million people being visually impaired and 45 million of them blind globally.^[1] Total visual impairment is one disorder that could cause slow social development, frequent hospitalization, and at times separation from family.

Oral health has a strong biological, psychological, and social correlation on the overall health of a child, especially those with special health needs. Visual impairment has a harmful

impact on psychomotor and emotional development in a child. Poor oral hygiene, gingivitis, periodontal diseases, and high dental caries have been observed in visually impaired children.^[2] Such children pose a unique challenge to the dentist's skills and knowledge as they have poor oral hygiene due to disability-related factors or manual dexterity which is necessary to execute adequate oral hygiene skills.^[3]

Oral and dental hygiene guidance for visually impaired children is usually delivered by good verbal instructions, while tactile aids are used to refine the toothbrushing methods. The absence of visual stimuli acts as a barrier and is a herculean task

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to the dentist in motivating them, thus brushing methods and models were custom designed as self-educational manuals such as audio tapes, models of teeth, and audio tactile performance were introduced.^[4]

Visually impaired children depend much more on sound, speech, and touch to orient them to a situation. They require a special health education method by which they could easily master the correct brushing technique.^[4] Musical toothbrush and braille's technique are a state of the art technology of its kind that has been used off late to motivate the child to brush his/her teeth, and was observed to have a great potential in removing plaque, improving gingival health, and reducing halitosis effectively. However, there are not enough studies available to gauge and compare the efficacy of these two techniques. Therefore, the current study was designed to evaluate the use of oral health education aids using verbal instructions through audio and music-assisted toothbrushing system and oral hygiene instructions and brushing methods through braille among visually impaired children and its outcome on the oral health status of these children.

MATERIALS AND METHODS

Study design

This cross-sectional study was carried out on randomly selected visually impaired school children aged 6–15 years from August 2015 to March 2016. The institution's ethical committee approval (IRB REFERENCE NO: IGIDSIRB2014 NDP01PGVAPPD) and prior informed consent from parents/caretakers of these children and the respective authorities of the schools were procured. The study included visually impaired children who were completely blind, had not attended camps or acquired oral health education in the past 6 months, and could read braille and liked music. However, partially blind children who had attended camps or acquired oral health education in the past 6 months and those who could not read braille/do not like music were excluded from the study.^[5]

A total of fifty visually impaired children were selected in a nonrandomized before and after comparison trial. Sample size calculation was based on mean and standard deviation of 0.271^[5] from previous literature with error set at 5% and power set at 80%. Considering the dropout at 20%, 25 children were included in each group. They were categorized as Group A – audio oral hygiene instructions and music-based toothbrushing method. Group B – Oral hygiene instructions and brushing method were introduced through braille format.

Data collection

Phase 1: Interaction

A series of interaction with the visually impaired children was conducted to obtain familiarization and to understand their level of co-operation. These interactive sessions were kept assessing their knowledge and attitude toward maintaining good oral hygiene and to determine their capability of self-help.

A good rapport was established with the children in a relaxed and friendlier environment.^[5]

Phase 2: Recording case sheet and oral examination

A case sheet format was designed to record the demographic details of the child. A general questionnaire was developed to document the child's brushing habits, awareness of sugar intake/caries risk, and frequency of dental checkups. The questionnaire was read in their native language, and the answers obtained were entered. All the questions were asked privately, and confidentiality was kept. These children underwent a clinical examination on a simple chair in natural daylight in school premises with a sterile mouth mirror and probe. Before beginning the examination, each instrument and its uses were explained. Those children who were not familiar with dental procedures were permitted to handle the instruments. Simplified Oral Hygiene Index (OHI-S), gingival index (GI), and plaque index (PI) were recorded after interactive session.^[6]

Phase 3: Teaching

Children were then randomly divided into Group A and Group B. Group A received oral hygiene instructions through an audio and music-assisted toothbrushing method. Oral hygiene instructions and Fones brushing technique were recorded and played in speakers, which was setup in the hostel of children's restroom. The music was played for 2 min. Every 20 s, there was change in the music, which was an indication for brushing the buccal, lingual, and occlusal surfaces. Children were first asked to feel the teeth and brush on a large-sized model with the help of a toothbrush. The process was continued until the children were well versed and could perform with no difficulty. In addition to the investigator, the caretaker or warden was also given special instructions to monitor these children to confirm if they listened to it and followed the instruction. The caretaker who stayed with the children was asked to monitor their brushing technique during the day.

Group B received one-to-one oral health education and motivation in accordance with their tactile skills, especially their fingers, with the help of plastic models of the mouth and toothbrushes as instructional aids. Oral health instructions and Fones brushing technique were distributed as pamphlets (leaflets) printed in braille script in their native language with the help of their teachers. Special care was taken to ensure if the children fully understood the instructions and brushing techniques properly.^[7,8]

Phase 4

The baseline plaque scores of the children were recorded using OHI-S to document the amount of debris and calculus deposits present on tooth surfaces, PI was used to assess the thickness of plaque growth at the gingival margin of teeth, and GI was used to assess the gingival condition. These scores were recorded thereafter at 1, 3, and 6 months intervals.^[9]

Statistical analysis

Data were analyzed using R statistical software version 3.6.0. Intragroup analysis of OHI-S, GI, and PI was assessed using

Student's *t*-test, whereas the intergroup analysis of these indices was evaluated using Mann–Whitney test and Welch's *t*-test. *P* < 0.05 was considered statistically significant.

RESULTS

The mean age for the music group was found to be 10.28 ± 2.57 years and for the braille group was 11.04 ± 2.574. The study participants comprised 72% of males and 40% of females in the music group and 62% of males and 38% of females in the braille group.

There was a statistically significant difference noted in the distribution of all scores at 1 month, 3 months, and 6 months compared with baseline scores within each group over all time points [Table 1].

The mean reduction of OHIS score at baseline to 3 months and 6 months as well at different time points was observed to be significantly more in the music group than the braille group [Table 2].

Scores	Time point	Music group	<i>P</i>	Braille group	<i>P</i>
OHI-S	Baseline	3.27±1.36	<0.0001	2.98±1.45	<0.0001*
	After 1 month	3.06±1.41		2.74±1.39	
	After 3 months	2.8±1.42		2.62±1.36	
	After 6 months	2.59±1.41		2.49±1.32	
PI	Baseline	1.95±0.54	<0.0001	1.8±0.65	<0.0001*
	After 1 month	1.84±0.56		1.73±0.62	
	After 3 months	1.71±0.54		1.67±0.6	
	After 6 months	1.58±0.53		1.6±0.6	
GI	Baseline	1.97±0.52	<0.0001	1.8±0.61	<0.0001*
	After 1 month	1.86±0.54		1.73±0.58	
	After 3 months	1.71±0.55		1.66±0.58	
	After 6 months	1.6±0.54		1.59±0.58	

*Significant. OHI-S: Oral Hygiene Index-Simplified, PI: Plaque index, GI: Gingival index

	Group	Mean±SD	<i>P</i>
Baseline to 1-month difference	Music	0.204±0.150	0.4
	Braille	0.246±0.215	
Baseline to 3-month difference	Music	0.464±0.220	0.2
	Braille	0.366±0.266	
Baseline to 6-month difference	Music	0.676±0.277	0.03*
	Braille	0.496±0.287	
1-3-month OHI-S	Music	0.260±0.170	0.001*
	Braille	0.120±0.135	
1-6-month OHI-S	Music	0.472±0.255	0.0003*
	Braille	0.250±0.165	
3-6-month OHI-S	Music	0.212±0.132	0.01*
	Braille	0.130±0.104	

*Significant; *P*<0.05. SD: Standard deviation, OHI-S: Oral Hygiene Index-Simplified

A significant difference was noted in the distribution of reduction in plaque score at 1 month, 3 months, and 6 months compared to baseline plaque score in both the groups, With the mean reduction in plaque scores being significantly more in the music group compared to the braille group [Table 3].

A significant difference was noted in the distribution of reduction in gingival score at 1 month, 3 months, and 6 months compared to baseline gingival score in both the groups, with the mean reduction in gingival scores being significantly more in the music group compared to the braille group [Table 4].

DISCUSSION

Visually impaired children are challenged to learn the day-to-day skills, which include maintenance of proper oral hygiene. Hence, this current study was planned in visually impaired children to help improve their oral care using verbal instructions through audio and music-assisted toothbrushing system and braille instruction categories.

In the current study, children aged 6–15 years were considered, as the development of manual dexterity is related to chronological age. It is often believed that a 6-year-old child is capable of understanding instructions and independent brushing. In a WHO survey conducted in 2002, the estimated number of visually impaired children below the age of 15 years was almost 1.4 million; for this reason, children aged 6–15 years were included in the study.^[10,11]

On assessing the gingival index and plaque index scores in the braille group, a significant decline in the scores was observed in the current study. This indicated that visually impaired children were able to follow oral hygiene instructions and brushing techniques through braille pamphlets. This was in accordance with the study conducted by Kumar *et al.*^[12] where 26% reduction in the mean plaque scores compared to baseline through braille and verbal indirect instructions improved oral hygiene.

Our study revealed a steady drop in the gingival and plaque index scores of the music group. Similar results were observed by Ganapathi *et al.*^[13] wherein reduction in the plaque scores with the highest improvement was seen in the audio group. The significance of positive reinforcement through audio and verbal methods to improve oral health status was also suggested by Hebbal and Ankola^[14] through his study.

Our study also revealed mean OHI-S reduction, gingival, and plaque scores at all time intervals in both the groups in comparison to the baseline. Our comparison of OHI-S score between the braille group and the music group depicted that music group children performed better oral hygiene practices when compared to the braille group. The plausible reason for it could be that the audio instruction and music-assisted toothbrushing motivated the children to perform better toothbrushing and thus could have improved their oral hygiene. This was in harmony with the study conducted by Bansal^[15]

Table 3: Comparison of plaque index scores between braille group and music group at different time intervals

	Group	Mean±SD	P
Baseline to 1-month difference	Music	0.115±0.091	0.01*
	Braille	0.066±0.051	
Baseline to 3-month difference	Music	0.241±0.093	<0.0001*
	Braille	0.130±0.074	
Baseline to 6-month difference	Music	0.378±0.114	<0.0001*
	Braille	0.206±0.087	
1-3-month OHI-S	Music	0.126±0.043	<0.00001 (t)*
	Braille	0.064±0.041	
1-6-month OHI-S	Music	0.263±0.095	<0.00001 (Wt)*
	Braille	0.139±0.054	
3-6-month OHI-S	Music	0.136±0.069	0.0002 (t)*
	Braille	0.076±0.039	

*Significant. Wt: Welch's *t*-test, *t*: *t*-test, OHI-S: Oral Hygiene Index-Simplified, SD: Standard deviation

Table 4: Comparison of gingival index scores between braille group and music group at different time intervals

	Group	Mean±SD	P
Baseline to 6 months			
Baseline to 1-month difference	Music	0.112±0.073	0.000946 (M)
	Braille	0.068±0.070	
Baseline to 3-month difference	Music	0.254±0.110	<0.0001 (M)
	Braille	0.145±0.068	
Baseline to 6-month difference	Music	0.392±0.163	<0.0001 (M)
	Braille	0.205±0.180	
Different time intervals			
1-3-month OHI-S	Music	0.142±0.067	<0.00001 (Wt)
	Braille	0.077±0.027	
1-6-month difference	Music	0.261±0.104	<0.00001 (Wt)
	Braille	0.146±0.046	
3-6-month difference	Music	0.119±0.063	0.0006334 (Wt)
	Braille	0.070±0.034	

*Significant. M: Mann-Whitney test, Wt: Welch's *t*-test, SD: Standard deviation, OHI-S: Oral Hygiene Index-Simplified

who found a considerable improvement in OHI-S scores after imparting education through computerized auditory aid.

Our study revealed a significant decline in the gingival and plaque index scores in the music group in comparison to the braille group. Our findings were in accord with the study conducted by Shetty *et al.*^[16] who noted a dramatic decline from the baseline values up to the end of the corresponding periods in children using audio aids. This could be attributed to the ease of comprehending instructions through audio aid.

Thus, our study clearly illustrates that with a variation of the traditional approach, the oral health knowledge of visually impaired children can be established. There have been many studies^[17,18] emphasizing the relevance of educating these children only about the importance of teeth and brushing on the model using the Fones method with assistance.^[19,20] The introduction of music-assisted toothbrushing technique and braille's method and further gauging the efficacy of these two

techniques in visually impaired children adds strength to this study, thus filling the lacunae in the existing available literature.

The limitations of the current study were that it was of short duration and long-term retention of the knowledge after discontinuation of oral health education needs to be assessed. Visually impaired children below 6 years of age were excluded from the study. These young children, especially those below 6 years of age, require modified training, with new techniques to maintain good oral hygiene due to variations in cognitive ability and manual dexterity. Hence, additional studies are recommended with braille/music method in younger age group, so that better oral hygiene can be accomplished independently with the help of their parents and caretakers.

CONCLUSIONS

Audio and music-assisted toothbrushing system was found to be better and effective than braille in terms of learning, understanding, performing, and maintaining the oral hygiene among visually impaired children. Visually impaired children could sustain an acceptable level of oral hygiene when taught by applying special customized methods. However, reinforcement at regular intervals is required for the maintenance of oral hygiene with extensive broader research in younger age group as well children with other disabilities that compromise the manual dexterity.

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Conflicts of interest

There are no conflicts of interest.

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