

The Utilization of Oral Hygiene Instructions using Braille Method on Visually Impaired School Children

Afsary Jahan Khan, Tanti Irawati Rosli, Ahmad Shuhud Irfani Zakaria, Mas Suryalis Ahmad, Alida Mahyuddin *

Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia

ABSTRACT

Background: Poor oral health among visually impaired (VI) children has been reported to associate within effective delivery of oral hygiene (OH) instructions. This study aimed to assess the changes in OH status of a group of VI school-children after implementing OH instructions using verbal and tactile methods with/without the addition of instructions in Braille.

Methods: The study was conducted on VI children (13-17 years old) of a Special Education School. The study participants were divided into 2 groups depending on the delivery method of OH instructions: The Non-Braille Group (NBG) and Braille Group (BG). Oral examination was performed and OH instructions given and repeated after 1- month and 3-months.

Results: A total of 91 study participants were recruited. The OH status was measured using the OHI-S index. The majority had fair OH status initially (39.6%). The median OHI-S score for NBG and BG had reduced significantly after OH instructions intervention at 1-month (from 1.67 to 1.33 and 1.33 to 1.09) and 3-months intervals (from 1.33 to 1.17 and 1.09 to 0.83), $p < 0.001$ and $p < 0.001$, respectively. After 3-months interval, the BG showed better median OHI-S score than NBG but was not statistically significant ($p = 0.629$).

Conclusions: The delivery of OH instructions in the form of verbal and tactile methods with or without Braille instructions is an effective tool and well perceived by the VI children. Continuous reinforcement and motivation at regular intervals are more important to achieve good OH levels in VI individuals.

Key words: Braille, Oral hygiene instructions, Simplified oral hygiene index (OHI-S), Visually impaired

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Corresponding author: Alida Mahyuddin

e-mail ✉: alida@ukm.edu.my

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INTRODUCTION

Individuals with a disability often face difficulties in accessing health services due to various environmental and social barriers. This also includes dental care, which has been considered one of the most arduous health care services to access [1]. There is evidence suggesting that disabled groups have a higher incidence of dental diseases, missing teeth, poorer oral hygiene (OH), increased tooth wear, increased trauma but experience greater difficulty acquiring dental care than any other population [2].

It has been stated that two-thirds of the population with visual impairment (VI) have co morbidities that impact significantly on their oral health [3]. It may not be easy for them to maintain good oral health as they are not likely to detect early tooth decay symptoms that are typically recognized through vision [4,5].

Poor oral health status in VI children has been reported previously. A study on healthy, deaf and blind children revealed that the latter had higher gingivitis and plaque

scores than those who were healthy or deaf [6]. High DMFT scores were reported among vision loss school children in India between the age group 6-12 years. A total of 37% of the VI children were affected by dental caries and gingivitis [7].

Another survey on the oral health of the VI individuals showed that their OH was remarkably distinct from the general population [8]. They reported poor OH, gingivitis, and periodontal disease among the visually challenged group. A noteworthy study on caries experience, OH status and oral health knowledge of students with VI was evaluated in the largest VI school in Istanbul, Turkey [9]. The results showed that only 26.40% of children were caries-free and just 2.2% had good OH.

Mohd-Dom, et al. [10] reported on OH practices and knowledge and periodontal status of adults with vision loss; they found more inferior periodontal status in the VI group than the general population [10]. Tooth sensitivity (53.8%), inflamed and painful gums (43.6%), plaque accumulation 81.7%, and bleeding sites were 35.1% among the expected findings. Bleeding on probing was also significantly higher among the VI group [10].

Children with visual impairment are part of those individuals with special health care needs that have an

increased risk to developing oral diseases due to their disabilities. They may face limitations in carrying out routine OH practices as well as other barriers to accessing dental care such as poor oral health literacy. As with people with disability, oral health education is of utmost importance. A crucial fact to remember is that vision is the major sense for learning [11]. Unfortunately, conventional teaching methods such as using OH visual aids and disclosing agents are not suitable for the visually compromised group. They are competent to understand in a different way i.e. their own way. Although they have no or limited vision, they can still learn through their other senses such as hearing, touch, smell and taste [12]. These senses can be utilized in their teaching and learning techniques at the same time as verbal instruction and description. Thus, special aids are needed to educate and improve their oral hygiene and knowledge [13]. The inclusion of verbal instructions with other specific oral health education tools will certainly have a positive impact on oral health, periodontal status and effective for improvement of self-esteem of visually challenged [4].

A highly effective and widely used learning method for students with disabilities is through tactile training involving the use of different objects-macro or micro models or relevant real objects. Modification of oral health education using alternative teaching aids such as model of dental structures and tactile training on OH instructions can be effective to show the VI children on how to take care of their oral health and to make them understand the process of brushing, using of floss, cleaning gum or tongue and also to detect any problems such as swollen or bleeding gums. Through tactile experiences, the VI children will have a mental image in his/her brain.

Braille is the only existing tactile reading and writing system for the blind and VI people who are unable to access print materials¹⁴ and through this, they can visualize and understand almost everything in their surroundings. Maintenance of OH and their performances can be assessed by using the Braille method on VI children. Despite that, there are very limited studies in which VI people are given Braille instructions as a part of oral health education. Therefore, this study aimed to determine the changes in the OH status of VI school children after the implementation of OH instructions delivered using Braille along with verbal instructions and tactile methods.

MATERIALS AND METHODS

This interventional study was conducted at the only secondary school for visually impaired children in the capital city of Malaysia, Kuala Lumpur. SQUIRE reporting guidelines were used to ensure the quality of the methodology and reporting [15]. A standard formula [16] was used to calculate the sample size where a total of 98 participants were required taking into consideration an attrition rate of 15%. Before the commencement of the study, approvals from the Ministry of Education, school authority and the relevant research ethics committee

were obtained. The school consisted of 137 students, ages ranging from 13 to 17 years old. A total of 72 students were diagnosed to be blind while 65 were found to have low vision. Students with all types of visual impairment and able to communicate in Malay or English were invited to participate in the study. Written consent was also taken from parents or legal guardians of the study participants.

The exclusion criteria were students who were unable to communicate and understand Malay or English and those who refused to cooperate for the oral examination. A total of 100 students that matched the selection criteria were included into the study through convenience sampling. They were randomly assigned to 2 groups. The first group consisted of participants that received OH instructions through verbal, tactile and Braille methods (BG) and in the second group, those who received instructions through verbal and tactile methods only (NBG). There were 49 participants in each group.

A modified WHO assessment form was used to determine the socio demographic characteristics (name, age, gender and, ethnicity) and OH status (plaque and calculus score) of the participants. A pilot study was conducted on 6 Braille teachers at the school in which 1 teacher were visually impaired. This study was comprised of 2 components which were oral examination and oral health education.

Clinical oral examination

Clinical oral examination was conducted on study participants to determine the existing OH status. Simplified Oral Hygiene Index (OHI-S) was used to assess the oral hygiene status which comprised of 2 components- Debris Index and Calculus Index. A total of 6 index teeth (all first permanent molars, upper right and lower left permanent central incisors) were selected for score recording. Labial surfaces were examined for all the teeth except for lower molars where the lingual surfaces were assessed. The OHI-S index score was determined by summing the Debris Index and Calculus Index. The oral hygiene status of every participant was defined as good, fair, poor or very poor depending on the scores: very poor (≥ 3), poor (2.0-2.9), fair (1.0-1.9) and good (≤ 0.9).

The oral examination was performed by a single calibrated examiner with more than 5 years of clinical experience. A total of 10% of the study participants were randomly selected and re-examined after 2 weeks to determine the intra-examiner reliability for the OHI-S index score. Cohen's kappa test revealed a good level of intra-examiner agreement ($K=0.92$, $p<0.001$). A modified WHO assessment form was used to record the socio-demographic profile and plaque and calculus score of the participants. Information regarding socio-demographic profiles was obtained through a face-to-face interview.

Oral health education

The oral health education consisted of OH instructions and oral health information which included advice on diet, oral hygiene and a healthy lifestyle. The oral hygiene

instructions were given via verbal, tactile and Braille methods. The brushing technique (Modified Bass method) and oral health information were explained to the students in both Malay and English.

A dental cast model was used as an instructional aide to increase the understanding of the study participants on how to brush and floss teeth. In addition, brushing and flossing techniques and tongue cleaning were also carried out directly on them. The tactile sensation was used for the placement of the brush or floss in an accurate position inside the oral cavity. Toothbrushes, toothpaste and dental floss were provided to all the study participants as tokens. All of them received the tactile method of OH instructions to maintain a healthy oral cavity.

A pamphlet of OH instructions and tooth brushing method (Modified Bass method) were translated from English to the Malay language through a professional translator. The information was then translated into Braille text with the help of a Braille printing organization and was distributed to the study participants in the BG group (verbal, tactile and Braille method). Advice on oral health was delivered which included:

- Diet and nutrition: Eat a balanced diet consisting of all basic food groups; avoid fermentable carbohydrates such as chocolates, sweets, junk foods and snacking in between meal times.
- Oral hygiene: Brush teeth twice a day using adult fluoridated toothpaste, once in the morning and before sleep at night. Teeth must be flossed at least once daily and rinse mouth after every meal.
- Healthy lifestyle: Avoid smoking, chewing betel-nut and alcohol because they are bad for the health. Visit a dentist every 6 months.

The oral examination and oral health education were carried out at baseline, after 1-month and at 3-months intervals. During the post-baseline visits, OH instructions were reinforced using verbal, tactile and Braille methods according to the respective groups. Oral examination was also carried out and the OH status of the participants was recorded. Braille pamphlets were given out to the participants in the BG group that have lost their pamphlets from the first visit.

The data were analyzed using the Statistical Package for

the Social Sciences (SPSS-statistics for windows, version 24.0) software. The p-value was considered to be significant when less than 0.05 (confidence interval of 95%). Comparison within the groups was carried out using the Wilcoxon Signed Ranks Test and Mann-Whitney U Test was conducted between 2 groups to determine the difference between OHI-S before and after providing OH instructions. A Chi-square Test was used to find any association between OH status and gender/age group/type of blindness.

RESULTS

Demographic analysis

A total of 91 study participants completed the study giving a response rate of 91% (BG=46 and NBG=45). The participants who had to be excluded from the study were involved in several personal and social development programs including school examinations that were mandatory as part of their curriculum. The mean age of the study participants was 15.64 (SD 1.7). For gender, the majority of the respondents were male (n=56, 61.54%) and 35 (38.5%) females. Of the male participants, 29 were completely blind and 27 had low vision. As for the female participants, 15 were blind and 20 had low vision. In total, there was a slightly higher proportion of partially or low vision study participants (n=50, 55%) as compared to those who were completely blind (n=41, 45%).

Oral hygiene status (OHI-S) of VI children (Baseline Data)

The mean OHI-S score of the study participants was 1.68 (SD 0.87). The mean Debris and Calculus indices were 1.55 (SD 0.74) and 0.13 (SD 0.20), respectively. For gender, age group and type of blindness, more than 60% of the study participants from all subgroups were found with 'good' and 'fair' OHI-S scores (Table 1). However, a higher proportion of female than male participants, those in the older age group and blind had 'poor' and 'very poor' OHI-S scores. However, there was no statistically significant association found between OHI-S score and gender, age and type of blindness, $p=0.86$, 0.32 and 0.65 , respectively.

Table 1: Oral hygiene status of study participants by gender, age group and type of blindness.

Variables	OHI-S score (%)				p-value
	Good	Fair	Poor	Very poor	
Gender					
Male (n=56)	18 (32.1)	22(39.3)	11(19.6)	5 (8.9)	0.863
Female (n=35)	10 (28.6)	14(40.0)	9 (25.7)	2 (5.7)	
Age (years)					
13 - 15 (n=42)	15 (35.7)	17(40.5)	9 (21.4)	1 (2.4)	0.32

> 15 (n=49)	13 (26.5)	19(38.8)	11(22.4)	6 (12.2)	
Type of blindness					
Blind (n=44)	13 (29.5)	17(38.6)	9 (20.5)	5 (11.4)	0.65
Low vision (n=47)	15 (31.9)	19(40.4)	11(23.4)	2 (4.3)	
*significant at p-level<0.05					

Comparison of oral hygiene status within groups at 1-month and 3-months intervals

The OH status of both groups (NBG and BG) was re-examined at 1-month and 3-months intervals. At baseline, the median OHI-S score for NBG and BG was 1.67(IQR 1.83) and 1.33(IQR 1.00), respectively (Table 2). At a 1-month interval, changes were observed in the

median OHI-S score in both NBG and BG which were statistically significant (both p<0.001). At 3-months intervals, again both NBG and BG showed a decrease in the median OHI-S scores within groups, 1.17 (IQR 1.25) and 0.83 (IQR 0.74), respectively, which were also statistically significant (both p<0.001).

Table 2: Comparison of the median of OHI-S score within non-braille group (NBG) & braille group (BG) at different intervals.

Timeline (Interval/month)	Median of OHI-S score (IQR)			
	NBG (n=45)	Comparison between baseline-interval (p-value)	BG (n=46)	Comparison between baseline-interval (p-value)
Baseline	1.67(1.83)	-	1.33(1.00)	-
1-M	1.33 (1.41)	<0.001*	1.09 (1.00)	<0.001*
3-M	1.17 (1.25)	<0.001*	0.83(0.74)	<0.001*
Wilcoxon Signed-Ranks Test *significant at p-level<0.001.				

Comparison of oral hygiene status between groups at baseline, 1-month and 3-months intervals

Mann-Whitney U test was carried out to compare the OH status between 2 groups after 1-month and 3-months intervals. After the 1-month interval, the study participants in NBG showed better improvement (from baseline 1.67 to 1.33) in oral hygiene in comparison to BG (from baseline 1.33 to 1.09). However, the opposite

was observed after 3-months intervals, whereby, the study participants in BG showed a better reduction of the median OHI-S score (from 1-month 1.09 to 0.83) when compared to NBG (from 1-month, 1.33 to 1.17) (Table 2). However, the median OHI-S scores between the groups (from baseline to 3-months intervals) were not statistically significant (Table 3).

Table 3: Comparison of OHI-S score between groups at baseline, 1-month and 3-months intervals.

Timeline (Interval/month)	NBG	BG	p-value
Baseline	1.67 (1.83)	1.33 (1.00)	0.19
1-M	1.33 (1.41)	1.09 (1.00)	0.23
3-M	1.17 (1.25)	0.83(0.74)	0.63
Mann-Whitney U Test *significant at p-level <0.05.			

DISCUSSION

Children with vision loss have limitations in interacting with the environment, owing to their inability to see the facial expressions of parents, teachers and also shortcomings in perceiving social behaviours. Oral health is an intrinsic part of general health and well-being. Usually, individuals with disabilities are not capable of showing their needs, pain or sufferings. In many cases, they are not even able to take care of their OH independently because of their disabilities. VI children start their lives with healthy gums and sound teeth as normal children. However, their eating pattern, dietary habit, physical limitations, medications, the inability to clean their teeth

and parental attitude may contribute to the poor state of oral health [17].

Our findings revealed that the majority of the study participants had a fair standard of OH (39.6%) followed by good OH (30.8%) which was almost similar to previous studies that showed individuals with visual impairment had acceptable levels of oral hygiene [3,18]. The possible reasons for having fair to good OH in our study participants may be due to several factors. Firstly, school dental services visit the school once a year to conduct dental check-ups and provide oral health education. The school is also located in an urban part of Kuala Lumpur, the country's capital, which has easy

access to dental care in terms of the availability of both private and government dental clinics in the area. As was reported from an earlier study [19], people living in rural and periphery-city regions often face greater unmet dental needs and subsequently report poor oral health status compared to those living in urban regions.

Although there has not been much information on school dental services and their impact on the VI school children in Malaysia, Azrina, Norzuliza and Saub [20] highlighted the importance of providing more oral health education in the VI group. Thus, good co-operation between educational institutions and dental service providers has to be made to ensure good oral health in children with VI. Special consideration must be given to this group regarding OH maintenance.

In the present study, about 22% and 7.7% of the study participants were in the poor and very poor OH category, whereas, a study conducted by Nandini, et al. reported only 8% of children with poor OH at baseline [7]. This might be the case for totally blind children who could not see inside their mouth at all and is challenging for them to practice good OH. Another possible reason could be the lack of assistance during tooth brushing as they were living in a hostel or poor motivation. Although the OHI-S score showed significant improvement after the implementation of oral hygiene instructions, further studies can be carried out to explore possible contributing factors linking to the poor oral hygiene condition.

In comparison to the OH status of the normal population, in several studies, the visually impaired group has been reported to show poor OH condition and a high prevalence of dental caries [21,22]. Likewise, it was also recorded that most visually challenged children exhibit poor OH [23]. A comparative oral health study conducted between blind and normal school children reported 60% caries prevalence among blind children and only 31.5% in normal school children. Carrying out the appropriate dental care may be a difficult task for the VI group because of their inability to follow OH instructions properly. They then would have to completely depend on their parents or guardians to do regular tasks including oral care as well [24].

It was also reported high periodontal disease and dental caries prevalence because of the dental plaque accumulation [25]. They were found to have problems in making sure whether debris has been removed and to notice gums bleeding or any black spot within teeth.

In the present study, the study participants received OH instructions which included the technique of tooth brushing and its importance, brushing times and other instructions related to OH and maintaining a healthy mouth. At the 1-month interval, OH instructions were reinforced and the delivery method was through verbal instructions, pamphlets printed in Braille script (in the BG); tactile aids hands-on training were given with the help of tooth brush-paste on tooth models. A significant improvement was seen among the study participants in OH status even after a 1-month interval. Similar results

were also observed from other studies conducted on VI participants Chowdary, et al. [26], Smutkeeree, et al. [27]. In another local study, the majority of study participants had a fair to a poor level of OH which was in contrast to the present study Shahabudin, et al. [28]. However, they also confirmed that the median plaque score in the blind group had a statistically significant reduction after only a 1-month interval.

There was no significant difference in terms of OH level between the Braille and non-Braille groups. This may indicate that although the OH instructions printed in Braille could have benefitted those who were blind, approaching the study participants individually as well as the reinforcement visit might have played a greater role in improving the OH of the study participants. Most of the teaching programs for this category of children were based on verbal, tactile senses, Braille and audio methods. This reveals that visually challenged individuals could have the same levels of oral health as sighted people if adequate oral instructions were given. Proper OH instructions will have a good impact on periodontal status and oral health. However, this result is in contrast with several studies where no statistically significant difference was found even after the delivery of oral health education [28-30]. This might be because the importance of oral health was not emphasized enough and there was also no review dental visit [29,30].

Like any other investigation, our study also faced certain limitations. Small sample size was one of them as the study was conducted involving secondary school students of a single school in Kuala Lumpur. Hence, the findings cannot be generalized to the entire blind population. A further study is recommended on a larger population involving children, adolescents and, adults with VI to obtain a more generalized result.

CONCLUSIONS

In conclusion, the delivery of OH instructions in the form of verbal and tactile methods with or without Braille instructions is an effective tool and well perceived by the visually challenged group. Continuous reinforcement and motivation at regular intervals by the dental team are more important to achieve good oral hygiene levels in visually impaired individuals.

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