

# EFFECTIVENESS OF AN ORAL HYGIENE EDUCATION PROGRAM COMBINED WITH FLUORIDE MOUTHRINSE AMONG VISUALLY IMPAIRED STUDENTS IN BANGKOK, THAILAND

Malee Arunakul<sup>1</sup>, Yuwadee Asvanund<sup>1</sup>, Apirat Tantakul<sup>2</sup>, Kemthong Mitrakul<sup>1</sup>, Ratchapin Srisatjaluk<sup>3</sup> and Kutkao Vongsavan<sup>1</sup>

<sup>1</sup>Department of Pediatric Dentistry, Faculty of Dentistry, Mahidol University, Bangkok; <sup>2</sup>Private practice, Bangkok; <sup>3</sup>Department of Microbiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

**Abstract.** The objective of this study was to assess the effectiveness of oral hygiene education kits (OHE kits) and 0.05% sodium fluoride mouth rinse among visually impaired students (VIS) in Bangkok, Thailand. Seventy-five VIS aged 10-12 years were included in the study and examined for plaque index (PI), gingival index (GI) and mutans streptococci (MS) salivary levels at baseline and after intervention. The subjects were then randomly divided into three groups. Group 1 received OHE kits and 0.05% NaF mouth rinse and brushing instructions. Group 2 received only the OHE kits and brushing instructions. Group 3 (control) received only brushing instructions. PI, GI and MS levels, were reassessed 3 months after intervention. Pre- and post-intervention evaluation data were compared with the Wilcoxon match-pairs test ( $p < 0.05$ ). The post-intervention results were significantly better in all 3 groups compared to the pre-intervention result ( $p < 0.01$ ). Group 1 had the lowest PI and the PI was significantly lower than the other groups ( $p < 0.05$ ). The GI was significantly lower in Group 1 than Group 3, Group 2 than Group 3 ( $p < 0.05$ ). MS level was reduced significantly in group 1 and 2 compared to control ( $p < 0.001$ ,  $p = 0.038$ , respectively). All groups showed the reduction of PI, GI, and MS levels. However, students who either received OHE kits with or without sodium fluoride mouthrinse showed significantly lower gingival index and lower number of MS than control group.

**Keywords:** oral hygiene education program, visually impaired, mutans streptococci, fluoride, gingival index, plaque index

## INTRODUCTION

Low vision is defined by the World Health Organization (WHO, 1992) as visual acuity of less than 20/60 but better than

20/200 or a corresponding visual field loss to less than 20 degrees in the better eye with best possible correction. Blindness is defined as visual acuity of less than 20/400 or a corresponding visual field loss to less than 10 degrees in the better eye with best possible correction. Visually impaired child (VIC) may have either low vision or blindness. Sixty-six percent of VIC report difficulty in tooth brushing which leads to

---

Correspondence: Dr Yuwadee Asvanund, Department of Pediatric Dentistry, Faculty of Dentistry, Mahidol University, 6 Yothee Street, Ratchathewi, Bangkok 10400, Thailand.  
E-mail: yawadee.asv@mahidol.ac.th

an inadequate plaque removal and poor oral hygiene (Ahmad *et al*, 2009, Shetty *et al*, 2010). Their visual impairment put them at higher risk or developing gingival inflammation and dental caries compared to non-VIC (Ahmad *et al*, 2009; Dean *et al*, 2011). A number of studies have reported VIC have a higher caries prevalence than non-VIC (Al-Qahtani and Wyne, 2004; Jokic *et al*, 2007; Reddy and Sharma, 2011). It is a challenge for VIC to follow regular oral hygiene instructions (OHI) because they learn by touch. Thus, OHI must be modified to fit them. The recommended method is using a finger to locate the teeth position, know the differences in tooth anatomy and place the toothbrush in the right area. A dentist can guide them by place child's hand on top of the dentist's in order to demonstrate to them the correct brushing motion (Lebowitz, 1974).

One study reported electric toothbrushes are more effective for visually impaired children (Sharma *et al*, 2012) but another study found no differences between brushing techniques (Smutkeeree *et al*, 2011). Both of these studies among visually impaired students (VIS) measured the differences using mean of plaque indexes and gingival inflammation levels. Some researchers have focused on the oral health education program rather than the brushing technique or type of toothbrush (Scardina *et al*, 2008; Hebbal and Ankola, 2012; Kadkhoda *et al*, 2014). Oral health education programs are used to motivate oral hygiene care behavior. The results of previous studies about oral health education program are inconclusive (Yalcinkaya and Atalay, 2006; Scardina *et al*, 2008; Kadkhoda *et al*, 2014). One study found no change in oral health after oral health education programs (Scardina *et al*, 2008).

The addition of using chemical plaque control agents as a part of a preventive

program might help improve oral hygiene among VIC. A low concentration of fluoride can effectively inhibit carbohydrate metabolism of oral streptococci and growth of *S. mutans* which are associated with dental caries (Tanzer *et al*, 2001, Yoshihara *et al*, 2001; Kaneko *et al*, 2006). Colonization with MS at a young age is a major risk factor for caries development (Tanzer *et al*, 2001; Shetty *et al*, 2010). The salivary MS level is a useful monitor for caries activity and response to preventive measures (Tanzer *et al*, 2001).

Fluoride mouth rinse is effective in controlling caries and reducing MS level among children (Yoshihara *et al*, 2001, Zanela *et al*, 2002; Kaneko *et al*, 2006). Sodium fluoride (NaF) mouth rinse is commonly used because its effectiveness, ease of formulation and storage, low cost and lack of taste or tooth staining (Hind, 1999).

The Department of Pediatric Dentistry, Mahidol University has developed an oral hygiene education (OHE) kit for VIC. The kits comprised of an illustrated book written in braille and a DVD with a video presentation. The subject matter covers basic knowledge about teeth, oral hygiene, diet for healthy teeth, oral diseases including dental caries, gingivitis and periodontal disease and treatment. Several studies have been done to evaluate the effectiveness of oral hygiene instructions, oral health education programs and the use of antimicrobial supplements for VIC (Kaneko *et al*, 2006; Ahmad *et al*, 2009; Kadkhoda *et al*, 2014). However, none have studied the effectiveness of the program supplemented with fluoride mouth rinse among VIC. The purposes of this study were to evaluate the effectiveness of the OHE kit alone and the kit combined with 0.05% NaF mouth rinse among VIS by evaluating with the plaque index (PI), gingival index (GI) and salivary MS level.

## MATERIALS AND METHODS

### Mouth rinse preparation

The 0.05% NaF was prepared by the Department of Pharmacy, Faculty of Dentistry, Mahidol University. Each bottle contained 10 ml of mouth rinse for a single use.

### Subject selection

This randomized control clinical trial study was approved by the ethics committee for human research of the Faculty of Dentistry/ Faculty of Pharmacy, Mahidol University. The purpose of the study and the risks and benefits were explained to the parents and participants and informed consent was obtained prior to participation. We studied 75 visually impaired students aged 10-12 years who attended the Bangkok School for the Blinds. All subjects were healthy and able to rinse well without swallowing the mouth rinse. Subjects who had at least 1 cavity or plaque index score of  $\geq 2$  (Silness and Loe, 1964) categorized as moderate to severe inflammation were accepted. Subject who had received antibiotics during the 1 month prior to the study or had a professional fluoride application during the 2 weeks prior to the study or during the study, were excluded. Subjects who had been taking regular fluoride supplements were also excluded.

Pediatric dentist performed an oral examination and determined the number of decayed, missing and filled teeth (DMFT) then performed full mouth scaling and polishing. Two weeks later, a plaque index (PI), gingival index (GI) and salivary MS level (assessed by a Dento-cult® SM Strip; Orion Diagnostica, Espoo, Finland) were determined and used as a baseline. Subjects were then randomly divided into three groups, each receiving the same brushing technique instruc-

tions: Group 1 subjects received an OHE kit and 0.05% NaF mouth rinse; Group 2 subjects received an OHE kits only; Group 3 subjects did not receive any additional intervention. The MS level, PI and GI were reassessed 3 months later. All participants used the same amount of fluoride toothpaste to minimize the quantity of topical fluoride used daily.

### Statistical analysis

Data were analyzed with SPSS version 18.0 (IBM, Armonk, NY). The mean of PI, GI and MS levels were calculated. The Kolmogorov-Smirnov (KS) test was used to test the distribution of the data. Differences among three groups were analyzed using the Wilcoxon match-pairs signed rank test. A  $p < 0.05$  was considered statistically significant.

## RESULTS

### Baseline

Of the 75 visually impaired students included in the study, 53.3% were boys and 46.7% were girls. There were no significant differences among the three groups by sex, age, and number of dmft/DMFT. The mean number of DMFT for each group were shown in Table 1. The mean baseline MS levels for the 3 groups were not statistically different from each other.

### Three month follow-up exam results

At 3 months, the mean PI and GI for all the groups improved significantly from baseline. The mean MS level improved significantly in group 1 and 2 by 3 months but not in group 3 (control) (Table 2, 3, 4).

## DISCUSSION

The prevalences of dental caries and gingivitis are higher among VIC (Vignehsa *et al*, 1991; Shyama *et al*, 2001; Jokic *et al*, 2007). In Thailand, an oral hygiene

Table 1  
Mean age, dmft/DMFT, and MS levels of all VIS in three groups.

Mean	Groups		
	1 (OHE+ 0.05% NaF)	2 (OHE)	3 Control
Age	11.16	10.88	11.76
Male/female	13/12	13/12	14/11
dmft	0.24	0.36	0.28
DMFT	1.6	1.76	1.52

dmft, decayed, missing, and filled primary teeth; DMFT, decayed, missing, and filled permanent teeth; OHE, oral hygiene education; MS, mutans streptococci; NaF, sodium fluoride; VIS, visually impaired student.

Table 2  
Mean plaque index, gingival index and salivary MS levels among VIS group.

Mean	Groups		
	1 (OHE+ 0.05% NaF)	2 (OHE)	3 Control
Plaque Index			
Baseline	2.47 ± 0.19 <sup>a</sup>	2.56 ± 0.19 <sup>a</sup>	2.50 ± 0.19 <sup>a</sup>
3 month	1.35 ± 0.12 <sup>b</sup> ( <i>p</i> <0.01)	1.44 ± 0.12 <sup>b</sup> ( <i>p</i> <0.01)	1.59 ± 0.76 <sup>b</sup> ( <i>p</i> <0.01)
Gingiva Index			
Baseline	1.59 ± 0.19 <sup>a</sup>	1.58 ± 0.18 <sup>a</sup>	1.52 ± 0.19 <sup>a</sup>
3 month	1.04 ± 0.05 <sup>b</sup> ( <i>p</i> <0.01)	1.04 ± 0.06 <sup>b</sup> ( <i>p</i> <0.01)	1.18 ± 0.11 <sup>b</sup> ( <i>p</i> <0.01)
MS levels			
Baseline	1.32 ± 0.75 <sup>a</sup>	1.28 ± 0.74 <sup>a</sup>	1.32 ± 0.80 <sup>a</sup>
3 month	0.76 ± 0.52 <sup>a, b</sup> ( <i>p</i> <0.01)	0.80 ± 0.71 <sup>a, b</sup> ( <i>p</i> =0.038)	1.12 ± 0.67 <sup>a</sup> ( <i>p</i> =0.244)

OHE, oral hygiene education; MS, mutans streptococci; NaF, sodium fluoride; VIS, visually impaired student. Wilcoxon matched-pair signed rank test showing significant difference (*p*<0.05). Sharing the same superscript letter (within rows) means not significantly different.

Table 3  
*P*-value of the difference of plaque index (PI) among 3 groups at 3 months.

Group	<i>p</i> -value
1 and 2	<0.05
1 and 3	<0.05
2 and 3	<0.05

Wilcoxon matched-pair signed rank test showing significant difference (*p*<0.05).

care protocol for VIC has not yet been established. This is the first study of using OHE kit combined with NaF mouth rinse among VIS. Our results showed a reduction of PI, GI and MS levels among VIS who received either the OHE kit alone or the kit combined with NaF mouth rinse. This is different from a previous study that showed no improvement with the OHE kit alone (Scardina *et al*, 2008) possibly due

Table 4  
P-value of the difference of gingival index (GI) among 3 groups at 3 months

Group	p-value
1 and 2	>0.05
1 and 3	<0.05
2 and 3	<0.05

Wilcoxon matched-pair signed rank test showing significant difference ( $p < 0.05$ ).

to a different age range. One study done among non-visually impaired subjects found no different in the mean MS level one month after using 0.05% NaF mouth rinse (Zanela *et al*, 2002).

A limitation of our study was not assessing participant compliance directly; however, we believed the reported compliance levels are accurate since they reflect the result. We attempted to control for confounding factors by recruiting all the subjects from a boarding school which reduced the variation in eating habits, oral health care attitude influenced by family and their oral care. Our result suggest if mechanical plaque control is performed correctly, it can result in a reduced MS level.

The OHE kit was designed to teach the use of touch to brush more effectively. The additional use of NaF mouth rinse gave an additional benefit. The visually impaired subjects in this study had mild to moderate caries rates, gingival inflammation level and the MS levels. A study with a larger sample size and higher MS levels might better test the effectiveness of the OHE kit and NaF mouth rinse.

In summary, this study found PI, GI and MS levels improved in all groups. The greatest reduction was seen in the group that received both OHE kits and NaF mouth rinse. The VIS awareness of oral

health was improved with the OHE kit, which result in better oral health.

## REFERENCES

- 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 Oral Hyg* 2009; 1: 22-6.
- Al-Qahtani Z, Wyne AH. Caries experience and oral hygiene status of blind, deaf and mentally retarded female children in Riyadh, Saudi Arabia. *Odontostomatol Trop* 2004; 27: 37-40.
- Dean JA, Avery DR, McDonald RE, eds. Special patient. In: McDonald and Avery's dentistry for the child and adolescent. 9<sup>th</sup> ed. Maryland Heights: Mosby Elsevier, 2011: 205-22.
- Hebbal M, Ankola AV. Development of a new technique (ATP) for training visually impaired children in oral hygiene maintenance. *Eur Arch Paediatr Dent* 2012; 13: 244-7.
- Hind V. Orthodontic products update: Fluoride mouthrinse. *J Ortho* 1999; 26: 242-3.
- Jokic NI, Majstorovic M, Bakarcic D, Katalinic A. Dental caries in disabled children. *Coll Antropol* 2007; 31: 321-4.
- Kadkhoda Z, Rezaei A, Amiri A. Effect of visual impairment education on the improvement of oral hygiene and reduction of periodontitis prevalence. *Int J Med Dent* 2014; 18: 8-12.
- Kaneko N, Yoshihara A, Ida H, *et al*. Influence of a fluoride mouthrinse on mutans streptococci in school children. *Caries Res* 2006; 40: 501-7.
- Lebowitz EJ. An introduction to dentistry for the blind. *Dental Clin North Am* 1974; 18: 651-69.
- Reddy K, Sharma A. Prevalence of oral health status in visually impaired children. *J Indian Soc Pedod Prev Dent* 2011; 29: 25-7.
- Scardina GA, Buonamente A, Messina P. [Efficacy of an oral health training programme

- for visually impaired individuals]. *Ig Sanita Pubbl* 2008; 64: 509-16.
- Sharma A, Arora R, Kenchappa M, Bhayya DP, Singh D. Clinical evaluation of the plaque-removing ability of four different toothbrushes in visually impaired children. *Oral Health Prev Dent* 2012; 10: 219-24.
- Shetty V, Hegde AM, Bhandary S, Rai K. Oral health status of the visually impaired children--a south Indian study. *J Clin Pediatr Dent* 2010; 34: 213-6.
- Shyama M, Al-Mutawa SA, Morris RE, Sugathan T, Honkala E. Dental caries experience of disabled children and young adults in Kuwait. *Comm Dent Health* 2001; 18: 181-6.
- Silness J, Loe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Act Odont Scand* 1964; 22: 121-35.
- Smutkeeree A, Rojlakkanawong N, Yimcharoen V. A 6-month comparison of toothbrushing efficacy between the horizontal scrub and modified Bass methods in visually impaired students. *Int J Paedia Dent* 2011; 21: 278-83.
- Tanzer JM, Livingston J, Thompson AM. The microbiology of primary dental caries in humans. *J Dent Educ* 2001; 65: 1028-37.
- Vignehsa H, Soh G, Lo GL, Chellappah NK. Dental health of disabled children in Singapore. *Aust Dent J* 1991; 36: 151-6.
- World Health Organization (WHO). International statistical classification of diseases and related health problems. 10<sup>th</sup> ed. Geneva: WHO, 1992.
- Yalcinkaya SE, Atalay T. Improvement of oral health knowledge in a group of visually impaired students. *Oral Health Prev Dent* 2006; 4: 243-53.
- Yoshihara A, Sakuma S, Kobayashi S, Miyazaki H. Antimicrobial effect of fluoride mouthrinse on mutans streptococci and lactobacilli in saliva. *Pediatr Dent* 2001; 23: 113-7.
- Zanela NL, Bijella MF, Rosa OP. The influence of mouthrinses with antimicrobial solutions on the inhibition of dental plaque and on the levels of mutans streptococci in children. *Braz Oral Res* 2002; 16: 101-6.