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A 6-month comparison of toothbrushing efficacy between the horizontal Scrub and modified Bass methods in visually impaired students

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Objective. The aim of this study was to compare the efficacy of the horizontal Scrub and modified Bass methods of toothbrushing in visually impaired students for 6 months.

Methods. Sixty visually impaired students, aged 10–12 years, were recruited to a randomized controlled clinical trial. At baseline, plaque index (PI) and gingival index (GI) were assessed, and then subjects were randomly divided into the horizontal Scrub and modified Bass groups. Subjects received verbal and tactile toothbrushing instruction and used their assigned methods twice daily. They were recalled at 1 and 6 months for clinical measurement and reinforce of instruction. Significance of PI and GI over time was compared using the paired *t*-test and between brushing group at each time point using the *t*-test.

Results. Over the 6-month period, there were significant reduction from baseline for the mean PI and GI in both groups ($P < 0.001$). There were no significant differences between two methods at each time point ($P > 0.05$), however.

Conclusions. Both the horizontal Scrub and modified Bass methods can be effectively reduced plaque index and gingival index in visually impaired students. The efficacy of both methods was not different, however.

Introduction

Visual impairment includes low vision as well as blindness. Low vision is defined as visual acuity of <6/18, but equal to or better than 3/60, or a corresponding visual field loss to <20° in the better eye with best possible correction. Blindness is defined as visual acuity of <3/60, or a corresponding visual field loss to <10° in the better eye with best possible correction.[1] From the 2002 World Health Organization survey, the estimated number of childhood blindness below the age of 15 years was almost 1.4 million.[1] Although the number of visual impairment children is relatively small when compared to adults, it is an important defect for children. It could lead to emotional, social, and educational problems that cause delayed normal development.[2]

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The visually impaired children tend to have poorer oral hygiene than sighted children. It has been reported that the blind teenagers had a fair to poor oral hygiene and also presented significant higher plaque index when compared to the sighted teenagers.[3] Another two studies found that oral hygiene of the partially blind were healthier than the totally blind.[3,4] The oral hygiene status improved with age in partially sighted children but became worse in the totally blind students.[4]

The common methods of toothbrushing in children are the horizontal Scrub and modified Bass. The most popular brushing stroke is the horizontal in children.[5,6] Advantages of the horizontal Scrub are easy to learn and practice including effective plaque removal.[7–10] This toothbrushing method had the inferiority in cleansing at proximal and gingival sulcus of permanent teeth and may results in gingival recession and tooth abrasion, however.[11] The modified Bass method is superior in cleansing the gingival third of tooth surfaces, the interproximal area, and the gingival

crevice that results in improving periodontal status and preventing tooth abrasion. Nevertheless, the disadvantages of this brushing technique are difficult to practice and long-teaching time for the children.[12–15]

Several studies were conducted to evaluate the cleaning effectiveness of different toothbrushing methods in children. Disyam[16] found that the horizontal Scrub was the most effective plaque removal method for 9- to 10-year-old students when compared with the Roll and modified Bass. In agreement with Frandsen *et al.*,[17] the Charters and horizontal Scrub gave superior cleaning effective to the Roll method. Sangnes *et al.*[18] compared plaque removal efficacy between the horizontal Scrub and Roll methods in 5-year-old preschoolers. They found that brushing with horizontal Scrub technique significantly lowers plaque scores on buccal and lingual surfaces. No differences were found on proximal surfaces. In contrast, one study showed that horizontal Scrub and Bass technique combined with dental floss in 5th to 6th grade students was equal in plaque removing ability and gingivitis control.[9]

The brushing techniques for patients with disabilities who have fine and gross motor deficiencies should be effective and simple. One method often recommended is the horizontal Scrub because it is easy and can yield good results.[19] A survey of dental health status in Greek children and teenagers with cerebral palsy, mental retardation and visual disorders found that the individuals with problems of vision had better oral hygiene than the other handicapped children because they can comprehend the oral hygiene instructions better than others and also have higher kinetic skills.[20] In addition, the oral hygiene instruction programme followed by individual supervision and reinforcement to the blind children will encourage to improve their oral hygiene level.[21] According to lack of evidence support to find the appropriate toothbrushing method for visually impaired children, the objective of this study was to compare the efficacy of horizontal Scrub and modified Bass toothbrushing methods in a group of 10- to 12-year-old visually impaired students for 6 months.

Material and methods

This randomized controlled clinical study was carried out in 60 visually impaired students, aged 10–12 years, who were willing to participate in this study. Exclusion criteria included subjects who presented with (i) other deformity, (ii) abnormal mental development, (iii) periodontitis, (iv) orthodontic or prosthesis appliances, (v) on antibiotic therapy, or (vi) fewer than four teeth in each quadrant. After an explanation of the purpose of this study and risks as well as benefits to the parents and participants, informed consents were obtained from parents following approval of the research protocol by the Mahidol University Institutional Review Board, Thailand (MU_IRB 2008/135.1410).

All participants received thorough oral examination, and DMFT/dmft were recorded. Two weeks prior to the experiment, all participants received professional tooth cleaning and scaling by the dentist. At an initial screening, dental plaque was assessed using the plaque index of Turesky Modification of Quigley-Hein.[22] Gingival condition was also scored according to the criteria of a Gingival Index of Loe and Silness[23] by one dentist. The level of oral cleanliness of the participants may influence the results of this study; therefore, the plaque and gingival index scores obtained on the initial examination were used to categorize the participants by Isodata method.[24] Each group of participants who presented similar scores of plaque index and gingival index was randomly assigned into modified Bass group or horizontal Scrub group by coin flipping.

This study was conducted at the Bangkok Blindness School using the standard dental unit. At the beginning of the study, an examiner recorded the gingival condition of each participants using the gingival index system proposed by Loe and Silness.[23] Subsequently, dental plaque was stained with disclosing solution, and the plaque index scores was recorded using the Turesky Modification of Quigley-Hein.[22] Then, each participant was instructed individually in the toothbrushing method which was randomly assigned by verbal and tactile instruction. The length of

teaching time for each participant was also noted. The children soft, round end bristles, and straight angled toothbrushes (Berman® Plus child, Rinchokchai Company Limited, Bangkok, Thailand) were given to all participants at the beginning to be used throughout the experiment. They were instructed to brush their teeth twice daily (morning and before bedtime) at least two minutes. Oral examination, recording gingival index/plaque index, and individual toothbrushing instruction as described were conducted at 1 and 6 months.

All data were processed by SPSS software (17.0; SPSS Inc., Chicago, IL, USA). The mean and standard deviation of all indexes between modified Bass and horizontal Scrub groups were compared using *t*-test. The paired *t*-test was used to compare all indexes at different interval within the same group of toothbrushing method. A significance level of $P = 0.05$ was used in all statistical tests.

Results

The initial study comprised 60 visually impaired students (34 boys and 26 girls, mean aged 11 years). Nevertheless, the number of participants has dropped to 57 (34 boys and 23 girls). Three participants withdrew after baseline examination because they moved to another school. Twenty-eight participants were in the modified Bass group, and twenty nine were in the horizontal Scrub group. The oral health status of all participants could be shown by mean DMFT of 1.15 ± 1.63 and the mean DMFT of 1.53 ± 1.44. The mean plaque index and gingival index were 3.83 ± 0.33 and 2.71 ± 0.32, respectively.

Plaque index

Over the 6-month period, the pattern of plaque reduction from baseline to 6 months was similar in both groups as shown in Table 1. The mean plaque index of both groups reduced significantly from 3.89 ± 0.28 to 3.36 ± 0.56 ($P = 0.000$) in modified Bass group and from 3.78 ± 0.36 to 3.27 ± 0.56 ($P = 0.000$) in horizontal Scrub group. The mean plaque indexes from 1 to 6 months of both groups were not statistically significant difference ($P = 0.975$ and $P = 0.152$, respectively), however. The difference between the modified Bass and the horizontal Scrub groups were not statistically significant at baseline, 1, and 6 months ($P = 0.229$, $P = 0.645$, and $P = 0.533$, respectively).

Table 1. Mean (SD) of plaque index for the modified Bass and the horizontal scrub groups at baseline, 1, and 6 months.

Time	Modified Bass	Horizontal Scrub
Baseline	3.89 (0.28)*,++	3.78 (0.36)**,+
1 month	3.36 (0.42)*	3.41 (0.40)**
6 months	3.36 (0.56)++	3.27 (0.56)+

The same symbol shows significant difference ($P < 0.05$), *t*-test.

Gingival index

The mean gingival index of both groups reduced significantly from 2.78 ± 0.38 to 2.43 ± 0.34 ($P = 0.000$) in modified Bass group and from 2.65 ± 0.24 to 2.42 ± 0.28 ($P = 0.000$) in horizontal Scrub group over the 6 months as presented in Table 2. The mean gingival indexes from 1 to 6 months of both groups were slightly increased; however, there were not statistically significant difference ($P = 0.692$ and $P = 0.068$, respectively). There were no significant difference between different toothbrushing method groups at each visit ($P = 0.133$, $P = 0.343$, and $P = 0.912$, respectively).

Teaching time

The mean and standard deviation of the length of teaching time between the modified Bass and the horizontal Scrub groups were

Table 2. Mean (SD) of gingival index for the modified Bass and the horizontal scrub groups at baseline, 1, and 6 months.

Time	Modified Bass	Horizontal Scrub
Baseline	2.78 (0.38)*,++	2.65 (0.24)**,+
1 month	2.40 (0.27)*	2.35 (0.18)**
6 months	2.43 (0.34)++	2.42 (0.28)+

The same symbol shows significant difference ($P < 0.05$), *t*-test.

10.83 ± 1.53 and 9.04 ± 1.13, respectively. The length of teaching time in the modified Bass group was significant longer than the horizontal Scrub group ($P = 0.000$).

Discussion

This study has an objective to determine whether the modified Bass or the horizontal Scrub methods of toothbrushing is superior in terms of efficiency in removal of plaque when those methods were used by visually impaired children aged 10–12 years. Toothbrushing effectiveness has been related to psychomotor skills and hand function ability. Mescher *et al.*[25] found that hand function was an age-related factor and only 6th graders could master the skills required for sulcular brushing. Another study reported that chronological age was a reasonable predictor of toothbrushing ability and children's toothbrushing skills approach those of adults by 10 years of age.[26] Our study supported that the 10- to 12-year-old visually impaired children who participated in this study have proper physical dexterity required for toothbrushing. Both methods presented a significant reduction in plaque index and gingival index when compared the data from baseline to 1 and 6 months. There was no statistically significant difference between the modified Bass and the horizontal Scrub, however. Interestingly, they performed the modified Bass method effectively although this method required higher hand function skill than the horizontal Scrub method. Although the visual impairment was obstacle for learning because they could not see, it does not affect the hearing and physical dexterity. The visually impaired children could understand the verbal and tactile brushing instruction and practice well.

Although the modified Bass and the horizontal Scrub methods were effective toothbrushing methods to reduce plaque and gingivitis in visually impaired children aged 10 and above, the modified Bass method required longer period of time to teach than the horizontal Scrub technique. Thus, the appropriate technique for the visually impaired children aged 10–12 years should be selected for each situation. The horizontal Scrub method would be a suitable method for community setting or large number of students in the school because this technique showed effectively plaque removal and required less time to teach. For an individual case or a small group, the modified Bass method would be preferable because this method presented higher effective to remove plaque in some areas especially at cervical and interproximal areas than the horizontal Scrub and also reduce chance of developing gingival recession and cervical tooth abrasion, however.[12–15]

In addition, the appropriate verbal and tactile toothbrushing instruction and reinforcement are important to visually impaired children in the process of establishing effective toothbrushing. From 1 to 6 months, plaque index of the horizontal Scrub group was also slightly decreased but no significant difference, whereas constant level of plaque index was found in the modified Bass group. The gingival indexes were slightly increased in both groups but did not reach the level of baseline. Our results also supported Ivanovic and Lekic's[27] finding that a short-term preventive programme without professional instrumentation induces a transient improvement of gingival health. The visually impaired children had special attention to brushing at the beginning of this study and declined after nonreinforcement period which is similar to Cohen *et al.*[21] findings. Moreover, the mean gingival index scores at 1 and 6 months were rather high in both groups, whereas the results showed that gingival index were reduced significantly from baseline. It can reflect the level of participant's oral hygiene and the need of preventive programme including proper reinforcement for this group. The motivation can increase the children's awareness of the importance of oral hygiene practice. In fact, this study had planned to follow-up at 3 months but the school was closed because of summer holiday. Our study suggested that the frequency of recall period for visually impaired children should be every 3 months (similar to high risk patient) until the dentist noticed that they can practice and responsible for themselves well.

Conclusion

1 The efficacy of the horizontal Scrub and the modified Bass toothbrushing methods in visually impaired students was not different.
2 Both methods showed a significant reduction in plaque index and gingival index when compared to baseline.
3 The length of teaching time in the modified Bass group was significantly longer than the horizontal Scrub group.

What this study adds?
- The visually impaired children have proper hand function skill for oral hygiene practice.
- The modified Bass and horizontal Scrub are practical toothbrushing methods for visually impaired children aged above ten.
- The appropriate verbal and tactile toothbrushing instruction including proper reinforcement is important for the visually impaired students to improve their oral hygiene.

Why this study is important to paediatric dentists?
- Paediatric dentist can use this information to select the suitable toothbrushing methods or create the preventive programme for the visually impaired children

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