Original Article

Efficacy of the lift-the-lip technique for dental plaque removal in preschool children

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ABSTRACT

Objective: The objective of this study was to compare the efficacy of two dental brushing techniques in relation to the lift lip method to control oral hygiene. **Methodology:** This controlled and randomized field trial included 40 preschool children aged 24–59 months, divided into four groups: Group A (modified bass without lift the lip), Group B (modified bass with lift the lip), Group C (horizontal technique with lift the lip), and Group D (horizontal technique without lift the lip). The dental plaque accumulation was recorded through the O'Leary index. In addition, to perform hygiene control, the plaque index was performed in the initial evaluation at 7 and 14 days. **Results:** ANOVA and Friedman test were applied to compare oral hygiene in each group. Finally, Kruskal–Wallis test was applied to compare groups at 7 and 14 days. The children with the modified Bass associated to the lift the lip had significantly more plaque removed at 7 (P = 0.041) and 14 days (P = 0.027) than other techniques. **Conclusions:** The modified Bass related to the lift-the-lip technique was the most effective for plaque removal in preschool children at 7 and 14 days.

KEYWORDS: Dental plaque, oral hygiene, toothbrushing

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Introduction

To our knowledge, dental plaque is one of the primary etiological factors involved in the appearance and evolution of dental caries. In fact, an adequate plaque control is important for early childhood caries (ECC) prevention.[1] Considering toothbrushing is the most common method used to remove dental plaque, a limitation for young children is the ability to clean their own teeth effectively.[2-8] Therefore, parents are recommended to clean their children's teeth at least until they reach school age.

Although no toothbrushing technique has proven to be significantly more effective than other for children,[9] Smutkeeree *et al*.[10] stated that the common methods of toothbrushing in children are the modified Bass and the horizontal techniques.[11]

Recently, a new method named "lift the lip" has been developed as a visual, nontactile technique used for caries assessment in several national health and nutrition examination surveys.[12,13] Only few studies such as Shackleton *et al*.[14] used this technique to investigate inequalities in dental caries experience

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in New Zealand children and showed to be an easy technique to carry out in 2–3 min. To help parents and caregivers in child's oral hygiene, new methods of plaque removal must be constantly tested, and considering that lift-the-lip technique enables a complete visualization of tooth surfaces, it seems interesting to investigate the influence of the lift the lip in toothbrushing as an additional maneuver to remove dental plaque. Furthermore, to the best of our knowledge, there is a lack of research in use the lift-the-lip technique for better efficacy of toothbrushing.

Hence, the objective of this study was to assess and compare the efficacy of modified Bass and horizontal toothbrushing related to the lift-the-lip technique for plaque removal in preschool children.

Methodology

This controlled randomized field trial study assessed and compared the efficacy of modified Bass and horizontal toothbrushing related to the lift-the-lip technique for plaque removal in preschool children. This paper was reviewed and approved by the Ethics Committee of Universidad Científica del Sur, Lima, Peru, with the approval number 000443 and was made according to the CONSORT guideline.

The sample size was determined by a pilot test of 20 children using the formula to compare two means with a 95% confidence level, a statistical power of 90%, an accuracy of 8 dental-stained surfaces, and a variance of 32 dental-stained surfaces. The resulting sample size adjusted to losses of 15% was ten children per group. Finally, 40 children were randomly divided into four groups according to the modified Bass or horizontal toothbrushing techniques related or no to the lift-the-lip maneuver.

The sample was selected according to the following criteria: children between 2 and 4 years old who possess at least 20 natural teeth with facial and lingual surfaces in good general health. Volunteers who were cooperative with no mental or physic disability were ready to participate in the study. Children with systemic health problems, children showing oral or dental anomalies, children with untreated caries lesions and periodontal involvement; or children who received prophylaxis within a month prior to the study were not considered.

The procedure was fully explained to the parents and caregivers of all the children involved in the study, and their informed consent was obtained. Oral examination was performed under natural daylight using a tongue depressor. The teeth were dried and a disclosing agent (Erythrosine Sodium; Angelus®, Brazil) was placed over the teeth surfaces for 10 s. Each child was randomly assigned to one of the four toothbrushing groups: A, B, C, or D. The parents and caregivers were verbally instructed about dental care issues and were assigned to perform the toothbrushing technique to each child. Afterward, each group was explained their toothbrushing technique in a macromodel for 15 min. Finally, it was reinforced individualized in one child for each group. Every group received a toothbrush and toothpaste with 1100 ppm F at the beginning to be used throughout the interventions.

At baseline (T0), 7 (T1), and 14 (T2) days, the children were evaluated, the disclosing agent was used, and O'Leary Plaque Index was scored. For the score, the total number of stained surfaces was added, then the number obtained was divided by the total number of surfaces present in the mouth and multiplied by 100.[15] Efficacy of dental plaque removal was evaluated with an acceptable cutoff point of 20%[9] and was compared each time in the same children. In the same way, the results recoded by group were contrasted between each one of them. Data were analyzed using SPSS 24 (SPSS Inc., Armonk, NY, USA) software for Windows. The Shapiro–Wilk test was analyzed to evaluate normality. ANOVA and Friedman test were used to compare the efficacy of dental plaque removal each time (T0, T1, and T2) within the same group of toothbrushing method. The intergroup comparison was accomplished for each evaluation time (T1 and T2) separately using the Kruskal–Wallis test. A significance level of $P < 0.05$ was used in all statistical tests.

Results

Of 40 children who participated in the study, 21 were male (52.5%) and 19 were female (47.5%). The mean age of the children was 2.9 years with a range of 2–4 years. The study population characteristics of the four groups are summarized in Table 1.

The children from the four groups had a similar initial plaque index at baseline with a mean of 88.80% ($P = 0.343$). Plaque scores were individually compared at baseline (T0), 7 (T1), and 14 (T2) days follow-up each group using ANOVA and Friedman test. Plaque scores in the four groups reduced from baseline (T0) score to follow-up scores (T1 and T2), and these reductions were statistically significant ($P < 0.005$). Plaque score mean in the four groups at baseline, 7 days, and 14 days are shown in Table 2. Comparison was made between the four groups for plaque scores at 7 and

Table 1: Study population characteristics of child according to gender and age

Variables	Categories	Frequency (%)
Gender	Male	21 (52.50)
	Female	19 (47.50)
	Total	40 (100)
Age (mean±SD)	2.90±1.48	

SD=Standard deviation

14 days follow-up, and the results were analyzed using Kruskal–Wallis test. The children with the Bass technique with lift-the-lip maneuver (Group B) had significantly more plaque removed at 7 (P = 0.041) and 14 days (P = 0.027) than those who received only the Bass technique (Group A). However, the addition of the lift-the-lip maneuver in the horizontal technique did not show significant differences either at 7 (P = 0.875) or at 14 days (P = 0.612). These results are shown in Table 3.

Interclass correlation and kappa values for interexaminer agreement for the stained surfaces (number and percent) were almost perfect (>0.90).[16]

Discussion

Plaque-associated diseases have a high prevalence in the general population. This is especially true for children since they depend on their parents or caregivers to carry out or supervise oral hygiene for preventing ECC.[17] The objective of this study was to compare the efficacy of modified Bass and horizontal toothbrushing related to the lift-the-lip technique for plaque removal, optimizing the cleaning of the teeth in preschool children. To avoid sample selection bias, a pilot study was performed to ensure the reliability of the techniques for plaque removal. In addition, the interexaminer agreement for O'Leary Plaque Index scores was almost perfect (>0.90) ensuring the reliability of the data.

Before any intervention, dental plaque scores observed were similar for the four study groups. This condition was modified when the toothbrushing techniques for dental plaque remove were taught because at 7 and 14 days, significant differences were observed in the groups (P < 0.005). Thus, any technique well learned and applied for parents or caregivers effectively controls the dental plaque in child. Furthermore, it has been demonstrated that the parents brush the children's teeth more efficiently after instructions.[18,19]

Table 2: Mean plaque index scores evaluated at baseline (T0), 7 days (T1), and 14 days (T2) for each group of brushing technique

Groups	Mean±SD			*P*
	Baseline	7 days	14 days	
Group A	70.50±8.40	49.30±7.80	36.00±9.20	0.001*
Group B	71.20±7.30	38.30±7.20	23.80±8.60	0.001*
Group C	62.90±15.90	46.40±11.40	33.40±8.60	0.005**
Group D	70.60±10.10	45.60±11.10	31.70±5.80	0.005**

*ANOVA test (Bonferroni test was significant on all comparisons P<0.05), **Friedman test (Wilcoxon test was significant on all comparisons P<0.05). SD=Standard deviation

Table 3: Mean plaque index scores comparison at 7 days (T1) and 14 days (T2) for each group of brushing technique

Groups	Mean±SD	
	7 days	14 days
Group A	49.30[a]±7.70	36.00[a]±9.20
Group B	38.30[b]±7.20	23.80[b]±8.60
Group C	46.40[a]±11.10	33.40[a]±8.60
Group D	45.60[a]±11.10	31.70[a]±5.80
P	0.041*	0.027*

*Kruskal–Wallis test. Different letters mean different significant (Mann–Whitney test). SD=Standard deviation

The efficacy of a toothbrushing on removing dental plaque is dependent on the correct technique, position of the bristles, and patient compliance.[20] The literature report that toothbrushing is inefficient among children younger than 8 years due to their inability to wield toothbrush for poor manual dexterity and perhaps due to lack of motivation.[17] For that, nowadays parental plaque removal for a young child is advisable. When the parents carry out or supervise oral hygiene, child learns better how to brush their teeth properly. Furthermore, they increase the value that child gives to oral health and adopt healthier oral health habits in general.[21]

Dentist advice parents to carry out tooth cleaning in babies and child with several devices such as pediatric toothbrushes, finger-adapted brush, tooth wipes, wet cloth, or wet gauzes.[22] However, Smutkeeree *et al*.[10] and Das and Singhal[20] reported that toothbrush still remains the most efficient device for removing dental plaque in children. This is the reason why different studies are designed based on researching the effectiveness of techniques, brushes, toothbrush grips, toothpaste, time of toothbrushing, parenteral involvement, frequency, and supervision.[9,10,23,19,20-22]

For children, the modified bass and the horizontal techniques are frequently evaluated as common methods of toothbrushing.[24-27] Furthermore, these techniques have been used for evaluating toothbrushing efficacy in visually impaired students.[10,28] Thus, these techniques can be used as options for testing new methods for plaque removal. It is interesting to notice that previous researches evaluated the efficacy of modified Bass or horizontal toothbrushing techniques in children of 10–12 years,[10] 10–11 years,[24] 6–8 years,[27] and 4–15 years.[28] Nevertheless, the effect of parenteral toothbrushing with the lift-the-lip technique in children of 1–5 years old is unknown.

In this study, lift-the-lip technique turned out to be effective in the modified Bass at 7 (P < 0.041) and 14 days (P < 0.027). This may be due to parents and caregivers when done the lift-the-lip technique had better display of the gingival third of tooth surfaces and interproximal areas. However, no significant differences in dental plaque removal with horizontal technique plus lift-the-lip maneuver were observed either at 7 (P = 0.875) or at 14 (P = 0.612) days. These results may have been influenced by the familiarity of the technique in adult brushing or preexisting

brushing techniques in parents. The results of the present study confirm that the lift-the-lip technique has a positive effect on the plaque removal when the modified Bass toothbrushing is used. Poyato-Ferrera *et al*.[29] stated that some disadvantages of the modified Bass toothbrushing technique are difficult to practice and long teaching time for the children. Therefore, based on the results of this investigation, the addition of the lift-the-lip maneuver can represent an alternative maneuver to integrate the modified Bass technique into everyday life of children. Furthermore, the results of this study did not show statistically differences between the horizontal and Modified Bass toothbrushing techniques at either 7 or 14 days. Similar results were also found by Smutkeeree *et al*.[10] and Robinson[24] who concluded that the efficacy of both techniques was not different.

Dental plaque evaluation can be assessed using several plaque indexes as Turesky Modification of Quigley–Hein[10,26,30] or Sillness and Loe.[27,28,31] However, even though the two plaque indexes above have good reference in the literature, O'Leary is one of the most well-known and widespread plaque indexes commonly used at surveys, universities, and dental clinics in Latin-American child,[9] and so it is important as a word alternative of dental plaque evaluation.

This study had some limitations. First, it used short evaluation periods (7 and 14 days). However, this period is important to maintain periodical assessment of reinforcing the technique. Some authors assessed the efficacy of toothbrushing techniques at 24 h even.[27] Second, the small sample size of the child was evaluated. Nevertheless, there was the number established by a sample calculation and was similarly assessed in the studies of Das and Singhal[20] and Davidovich *et al*.[30]

Although the results of this study are promising, additional studies are necessary using the lift-the-lip maneuver with other plaque removal methods as Fones or Roll techniques and child of different ages. In the pediatric field, it would be interesting to compare the lift-the-lip maneuver with the clinical assessment to identify ECC. Furthermore, this maneuver can be included in oral health programs for children of different ages, educations, and familiarities.

Conclusions

The modified Bass toothbrushing technique related to the lift-the-lip maneuver was efficacy for plaque removal in preschool children at 7 and 14 days. The modified Bass and the horizontal toothbrushing techniques showed a significant reduction in plaque removal when compared to baseline.

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Conflicts of interest
There are no conflicts of interest.

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