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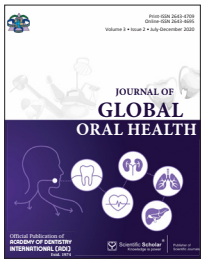

Research Article

A tailored tooth brushing program to control plaque accumulation and gingivitis among orphan children: A randomized trial

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ABSTRACT

Objectives: Poor oral hygiene among children is major cause of gingivitis, caries, and especially orphans constitute socially disadvantaged group. The objective of the study was to assess the efficacy of a tailored tooth brushing program to improve supragingival plaque control and gingival health among 13–17-year-old orphan children in Chennai city over a period of 21 days.

Materials and Methods: A double-blind parallel, controlled clinical trial was conducted among 60 orphan children (28 males and 32 females) with mean age of 15.24 years. Dental plaque was assessed using the Turesky modification of Quigley-Hein index; gingival inflammation was assessed using gingival index at initial visit and after 14 and 21 days. Subjects were randomly allocated into one of two groups (study – audiovisual and individual demonstration of brushing technique with reinforcement at 14 days follow-up/control – only individual demonstration) and instructed to brush twice daily using modified bass technique with the toothbrush and paste provided throughout the trial.

Results: The children who had audiovisual, individual demonstrations of brushing technique exhibited significantly superior total oral plaque control and significant reduction in the gingival inflammation at the end of 21 days trial ($P < 0.05$). The study group participants reported improved compliance and motivation to practice modified bass technique because of the reinforcement.

Conclusion: The children who had both audiovisual and individual demonstration exhibited superior total plaque control and gingival health compared to control group and continued to demonstrate modified bass technique without any reinforcement at the end of 21 days trial.

Keywords: Children, Gingivitis, Orphans, Plaque control, Toothbrush

INTRODUCTION

Dental plaque is considered to be one the primal causal factor for dental caries and gingivitis.[1-3] Plaque requires to be removed effectively on a daily basis, if not may lead to gingivitis which is characterized by bleeding gums and later may progress into periodontal disease.[4] The high incidence of gingivitis and periodontitis among adolescents suggests that adequate plaque control or removal is not performed on a daily basis. Manual toothbrush is the most common device used by individuals for personal oral hygiene practice. Evidence suggests that manual

toothbrushes are effective in removing plaque and preventing gingivitis,[5] but many people spend less than ideal time for brushing and practice suboptimal brushing technique.[6-8]

Manual toothbrushes are products sold over the counter and no specific instructions are provided regarding the direction of its use. Many tooth brushing techniques have been proposed for adequate plaque control and the most commonly recommended ones are Bass and Roll method. The Bass technique is considered to be more effective than Roll in plaque control adjacent to gingival margins, hence, a modification was proposed by Katz *et al*., to combine Bass and Roll method to improve supragingival plaque control.[9] The modified Bass method is considered to be very effective in supragingival plaque control compared to other techniques in many studies.[10,11] The use of modified Bass method requires manual dexterity and usually the patient finds it difficult to correctly replicate the technique without adequate reinforcement. Hence, we introduced a new technique to assist the individuals to effectively practice modified Bass method. The objective of the study was to assess the effect of a novel technique to effectively practice modified Bass technique and to control supragingival plaque among 14–17 years adolescents over a period of 21 days.

Null hypothesis

There is no difference in the supragingival plaque control using modified Bass technique among those using the device and those not using it.

MATERIALS AND METHODS

A randomized parallel group, double-blind clinical trial was conducted among 60 orphan children from January to March 2015 in the Department of Public Health Dentistry, Thai Moogambigai Dental College and Hospital, Chennai. The study protocol was approved by the Institutional Ethics Committee and the informed consent was obtained from the participants and caretakers before the start of the study.

Various orphanages around Chennai city were contacted regarding their interest to participate in the trial and out of the 14 homes contacted 10 agreed to participate. All the children were screened and enquired regarding their brushing practices; all those who have not heard about or practiced modified Bass technique, having a minimum of 20 natural teeth with scorable buccal and lingual surfaces, were requested to participate in the trial. Interested subjects and their caretakers signed the informed consent, complied with pre-visit oral hygiene, eating, and smoking restrictions. Participants were excluded if they were undergoing periodontal treatment or have periodontal disease, active carious lesions that required restorations, under active orthodontic treatment or any removable prosthesis, and subjects with any systemic disease or condition that may interfere with the study.

During the initial visit, participants were requested to abstain for oral hygiene practices for 48 h and the baseline plaque was were recorded using Turesky modification of the Quigley-Hein plaque index (TMQHPI);[12] severity of gingivitis recorded using gingival index. Those fulfilling the inclusion criteria of having a high plaque score and moderate gingivitis were included in the trial.

Intervention

The selected participants were randomly allocated into two groups by the second investigator using the lottery method. The study group children were educated using audiovisual presentation of the modified Bass technique and individual one to one demonstration of technique using cast and brush and reinforced by the SI on the 14 days follow-up. The control group subjects had only one to one individual demonstration at the start of the trial. All the subjects were provided half an hour to practice the technique, demonstrate it on the cast, and were dismissed only when they were confident. The participants were provided with an ADA approved soft toothbrush and non-fluoridated toothpaste (Dabur Red Paste, Dabur, Uttar Pradesh, India); and daily tooth brushing by the children was supervised by their caretakers in the home. Instruction was provided to care takers to abstain the children from any other oral hygiene practice during the trial duration. To ensure allocation concealment, the technique of brushing was taught in different rooms and control group also viewed a brushing video omitting the details of the strokes in the video. The plaque assessment was carried out by the principal investigator at the initial visit as baseline measurement and at 14 and 21 days who was unaware regarding group allocation, thus ensuring double blinding. All the participant's caretakers' phone number and home address were obtained to limit the loss to follow up. Each home was reminded the previous day through a phone call and text message on the day of follow-up.

Sample size

Sample size was determined based on the pilot study conducted among 10 participants randomly allocated to the study and control groups. The pooled variance was calculated based on results obtained. A difference of 1 in the scores between the baseline and the follow-up after 14 days in the Turesky Modification of the Quigley_Hein Plaque Index (TMQHPI) was considered to be clinically relevant.

The formula used for calculating sample is as follows:

$$N = \frac{2 X S^2 \left(Z_\alpha + Z_\beta\right)^2}{(d)^2}$$

Where, N is the sample size

S^2 is the pooled variance

Z^α is the desired level of confidence

Z^β is the desired power

d is the clinically expected difference

$$N = \frac{2 \times 1.82 \left(1.96 \times 0.842\right)^2}{(1)^2} = 29/\text{Group}$$

Data analysis

Data were summarized using SPSS V.16 and the within-group analysis was performed using repeated measure ANOVA and between-group analysis using Student's t-test. All the statistical tests were two sided; $\alpha = 5\%$ was used as an overall experiment error rate.

RESULTS

A total of 60 subjects participated in the trial and all (100%) completed the full duration of the trial. Females comprised 55% study population and the mean age of the participants was 16.24 years; it ranged from 14 to 17 years [Table 1]. Repeated measures ANOVA test showed a statistically significant reduction ($P < 0.05$) in mean plaque and gingival index scores from baseline to all subsequent follow-up in both groups. *Post hoc* analysis revealed significant reduction ($P < 0.05$) in the mean plaque and gingival index scores from baseline to day14 and baseline to day 21 for the study and control groups; but only study group elicited significant reduction in plaque, gingival scores from day14 to 21 [Table 2].

Between-group comparisons using Student's t-test are presented in [Table 3]. The baseline comparison between the groups is non-significant, thus ensuring the adequacy of randomization. At day 14, only the mean plaque scores were significantly reduced among the study group compared to controls ($P < 0.05$). At end of 21 days, the study group showed significant reduction in plaque and gingival index scores compared to controls.

Table 1: Summary of demographics of subjects who completed the trial.

Groups	Number of subjects		Age	
	Male	Female	Mean (SD)	Range
Study	10	20	16.3 (0.7)	13–17
Control	12	18	16.8 (0.3)	13–17

DISCUSSION

In this study, the efficacy of a novel device in improving the compliance to modified Bass technique, plaque accumulation, and gingival inflammation was evaluated in a single site, controlled, double-blind parallel trial. The study and control groups both were educated regarding the modified Bass method using an audiovisual presentation of the technique and individual one to one demonstration; only the study group was informed regarding the sound produced by the device with respect to modified Bass technique. Toothbrush is the most common plaque control method used by the general population and often times the only sole means of plaque removal. TMQHPI was used in our study to determine the plaque accumulation and it is a well-established index in clinical trials assessing the efficacy of toothbrush in plaque control,[13] gingival index is also a reliable index to assess the severity gingival inflammation. Tooth brushing requires manual dexterity and patience in learning the technique, without adequate reinforcement individuals tend to forget the details of the technique and revert back to their original brushing technique as found in

Table 2: Within-group comparisons of plaque and gingival index scores (Mean±SD) among the study and control groups at three different time intervals.

Variables	Time point	Mean (SD) Study[c]=30	Mean (SD) Control[d]=30	*P* value[a]	*Post hoc*	*P* value[b]
Plaque scores	Baseline	2.6 (0.9)	2.7 (0.7)	<0.001[c,d*]	Baseline-day 14[c,d]	<0.001[†]
	Day 14	1.2 (0.5)	1.7 (0.8)		Baseline-day 21[c,d]	<0.001[†]
	Day 21	0.6 (0.3)	1.4 (0.7)		Day 14-day 21[c]	<0.001[†]
Gingival index scores	Baseline	2.1 (0.3)	2.3 (0.5)	<0.001[c,d*]	Baseline-day 14[c,d]	<0.001[†]
	Day 14	1.6 (0.7)	1.9 (0.6)		Baseline-day 21[c,d]	<0.001[†]
	Day 21	0.7 (0.3)	1.5 (0.4)		Day 14-day 21[c]	<0.001[†]

[a]Results of repeated measure ANOVA test; *$P<0.05$ considered significant, [b]results of *post hoc* (HSD); [†]$P<0.05$ considered significant, [c]within-group analysis for study group, [d]within-group analysis for control group.

Table 3: Comparison of plaque and gingival index scores (Mean±SD) among the study and control groups at baseline, 14 and 21 days.

Evaluations		N	Plaque index Mean (SD)	*P* value[a]	Gingival index Mean (SD)	*P* value[a]
Baseline	Study	30	2.6 (0.9)	0.21	2.1 (0.3)	0.34
	Control	30	2.7 (0.7)		2.3 (0.5)	
Day 14	Study	30	1.2 (0.5)	0.03*	1.6 (0.7)	0.06
	Control	30	1.7 (0.8)		1.9 (0.6)	
Day 21	Study	30	0.6 (0.3)	<0.001*	0.7 (0.3)	<0.001*
	Control	30	1.4 (0.7)		1.5 (0.4)	

[a]Results of unpaired *t*-test , **P*<0.05 considered significant

our control group subjects. Manual brushes are found to be used for less than ideal time to remove plaque and improper technique being followed which is inefficient in removing plaque.[7,8] Long-term studies on plaque control concerning toothbrushes and other novel devices are usually scarce. Commonly employed single use trials only provide an indication of long-term effectiveness which may or may not be true.[14,15]

Comparison with the previous literature is not possible because this the first study to test the efficacy of such a technique. The study group showed statistically significant reduction in total plaque accumulation and gingival inflammation over a period of 21 days compared to controls. This finding can be attributed mainly to the reinforcement provided by the device to practice modified Bass technique. More than 60% of the control group subjects forgot the actual modified Bass technique presented to them at the start of the study and returned to their regular brushing pattern which was very ineffective compared to the study group. The study group participants reported increased compliance and motivation to practice modified Bass technique as the sound produced by the technique was a guidance factor. Hawthorne effect could have played a role since the reduction in total plaque was observed both in study and control groups which could be considered a limitation of the study, and contamination bias could have influenced participants but the provision of device to both the study and control groups prevented this bias. The merits of the study include the double-blind nature, allocation concealment, longer duration of the trial, and no loss to follow up. Plaque and gingivitis are universal and hence our study findings can be generalized to all those children suffering from it, but the nature and composition of plaque may be different based on regional and cultural practices. This factor cannot affect the generalizability of our study.

CONCLUSION

The study group subjects who used the novel device exhibited superior total plaque control and significantly lesser gingival inflammation compared to control group and continued to demonstrate modified Bass technique without any reinforcement at the end of 21 days trial.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lingström P, Van Ruyven FO, Van Houte J, Kent R. The pH of dental plaque in its relation to early enamel caries and dental plaque flora in humans. J Dent Res 2000;79:770-7.
2. Löe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodontol 1965;36:177-87.
3. Theilade E, Wright WH, Jensen SB, Löe H. Experimental gingivitis in man. II. A longitudinal clinical and bacteriological investigation. J Periodont Res 1966;1:1-13.
4. Page RC. The etiology and pathogenesis of periodontitis. Compend Contin Educ Dent 2002;23:11-4.
5. Hancock EB. Periodontal diseases: Prevention. Ann Periodotol 1996;1:223-49.
6. Macgregor ID, Rugg-Gunn AJ. Survey of toothbrushing duration in 85 uninstructed English schoolchildren. Community Dent Oral Epidemiol 1979;7:297-8.
7. Macgregor ID, Rugg-Gunn AJ. Toothbrushing duration in 60 uninstructed young adults. Community Dent Oral Epidemiol 1985;13:121-2.
8. Saxer UP, Yankell SL. Impact of improved toothbrushes on dental diseases. I. Quintessence Int 1997;28:513-25.
9. Katz S, McDonald JL, Stookey GK. Odontologia Preventiva en Accion. Buenos Aires: Editorial Medica Panamericana; 1997.
10. Patil SP, Patil PB, Kashetty MV. Effectiveness of different tooth brushing techniques on the removal of dental plaque in 6-8 year old children of Gulbarga. J Int Soc Prev Community Dent 2014;4:113-6.
11. Poyato-Ferrera M, Segura-Egea JJ, Bullon-Fernandez P.

Comparison of modified bass technique with normal toothbrushing practices for efficacy in supragingival plaque removal. Int J Dent Hyg 2003;1:110-4.
12. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of Victamine C. J Periodontol 1970;41:41-3.
13. Sharma NC, Qaqish J, Walters PA, Grender J, Biesbrock AR. A clinical evaluation of the plaque removal efficacy of five manual toothbrushes. J Clin Dent 2010;21:8-12.
14. Cronin MJ, Dembling WZ, Low MA, Jacobs DM, Weber DA. A comparative clinical investigation of a novel toothbrush designed to enhance plaque removal efficacy. Am J Dent 2000;13:21A-6.
15. Sharma NC, Qaqish JG, Galustians HJ, King DW, Low MA, Jacobs DM, *et al*. An advanced toothbrush with improved plaque removal efficacy. Am J Dent 2000;13:15A-9.

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