

Comparison of Efficacy of Different Supervision Methods of Toothbrushing on Dental Plaque Scores in 7–9-year-old Children

Fawaz Pullishery¹, Basem M Abuzenada², Nawal M Alrushnudi³, Maram M Alsafri⁴, Wafa M Alkhaibari⁵, Mawadda F Alharbi⁶, Jaidaa AS Aladani⁷, Zahra Mohammed⁸

ABSTRACT

Background and objectives: The efficiency of mechanical plaque control in children not only depends on the type of oral aids they use but also on the instructions, training, and motivation given to them. To compare the efficiency of different methods of personal supervision of toothbrushing in reducing the dental plaque levels in 7–9-year-old schoolchildren.

Materials and methods: A parallel designed double-blinded randomized study was conducted in a private school in Jeddah, Saudi Arabia from September 2018 to December 2018. The children were allocated randomly into two groups based on the type of supervision given. Plaque scores examination was carried out at four intervals as baseline, 7th day, 14th day, and 90th day.

Results: Plaque scores reduced after 7 days in all groups, even though there was no statistically significant difference observed. At the final examination of plaque scores (90th day), there was a highly statistically significant reduction observed in group I and II compared to group III where the reduction was less evident.

Conclusion: Supervision of toothbrushing in the correct way was effective in reducing the plaque scores. Our study benefited both parents and children in understanding the correct method of brushing and the importance of plaque control.

Keywords: Dental education, Plaque removal, School, Toothbrush.

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INTRODUCTION

Schools act as a fitting and appropriate place to establish oral health programs into practice since the students are at a favorable age to engage in preventive and educational programs to accomplish health habits and to avoid or minimize the incidence of oral diseases. The control of dental plaque is an important oral hygiene measure in preventing dental caries and periodontal problems. Effective dental plaque control measures depend on two main factors: the proper use of appropriate oral hygiene devices and the efficiency of these devices in removing the dental plaque which is very much related to the instructions, training, and motivation given to the child.¹

In the kingdom of Saudi Arabia, there is very little information available on the methods of toothbrushing used by children. Studies and health reports show that Saudi Arabia has a high prevalence of dental caries among school-going children.^{2,3}

Many of the determinants related to oral health or disease are under the control of individuals and are usually modifiable ones. Understanding these determinants is the key to improve health outcomes. Despite the availability of good oral hygiene devices in the kingdom, the prevalence of dental caries is high.^{4,5} The main reason for this could be insufficient knowledge regarding the use of appropriate toothbrushing techniques and other oral hygienic measures both by the children and parents. The technique of toothbrushing is more important than the type or design of toothbrushes used in plaque control.⁶ Children are introduced to toothbrushing at an early age and parents especially mothers play a vital role in these practices.⁷ In children,

¹Division of Community Dental Practice, Faculty of Dentistry, Batterjee Medical College, North Obhur, Jeddah, Kingdom of Saudi Arabia

²Division of Operative Dentistry, King Abdulaziz University and Batterjee Medical College, Jeddah, Kingdom of Saudi Arabia

^{3–8}Dentistry Program, Batterjee Medical College, Jeddah, Kingdom of Saudi Arabia

Corresponding Author: Fawaz Pullishery, Division of Community Dental Practice, Faculty of Dentistry, Batterjee Medical College, North Obhur, Jeddah, Kingdom of Saudi Arabia, Phone: +966 549331486, e-mail: drfawazp@gmail.com

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the effective toothbrushing technique depends on coordinated muscular movements and the level of motor skill developments.⁸ Children need to learn and master the appropriate toothbrushing technique to improve their oral hygiene status. In the Kingdom of Saudi Arabia, there is a dearth published literature regarding the effectiveness of different types of toothbrushing supervisions on the plaque score in schoolchildren. Our study aimed to assess and compare the efficacy of three different approaches to supervision of toothbrushing on the oral plaque levels of schoolchildren in the city of Jeddah, Saudi Arabia.

MATERIALS AND METHODS

This was a double-blinded, parallel design randomized trial carried out in 7–9-year-old female schoolchildren of Jazeera Al-aloum School in Jeddah, Saudi Arabia. The study was conducted after obtaining consent from the parents and also approval from the School management. The ethical committee of Batterjee Medical College gave ethical approval to carry out the study (Res-2017-0018).

A minimum sample of 34 was calculated for the study in each group. Initially, 164 children were assessed for the eligibility criteria. Inclusion criteria required consent from both the child and parent or guardian. Children who visited some dentist regularly or have received oral health education through any other source were excluded. We included only participants (both child and parents) who are right-handed brushers. Finally, a sample of 131 children who satisfied the inclusion criteria was selected for our study. The attrition rate was 9.9% due to various reasons (Flowchart 1).

The study consisted of three groups which included: Supervised brushing by an investigator (group I), Supervised brushing by caregiver or parent (mother) (group II), and non-supervised brushing (group III) are planned for this study. The study was conducted over 3 months. In group I, an expert (dentist) will supervise each child a modified bass technique method of toothbrushing with the active participation of the child.⁹ Supervision was carried out thrice during

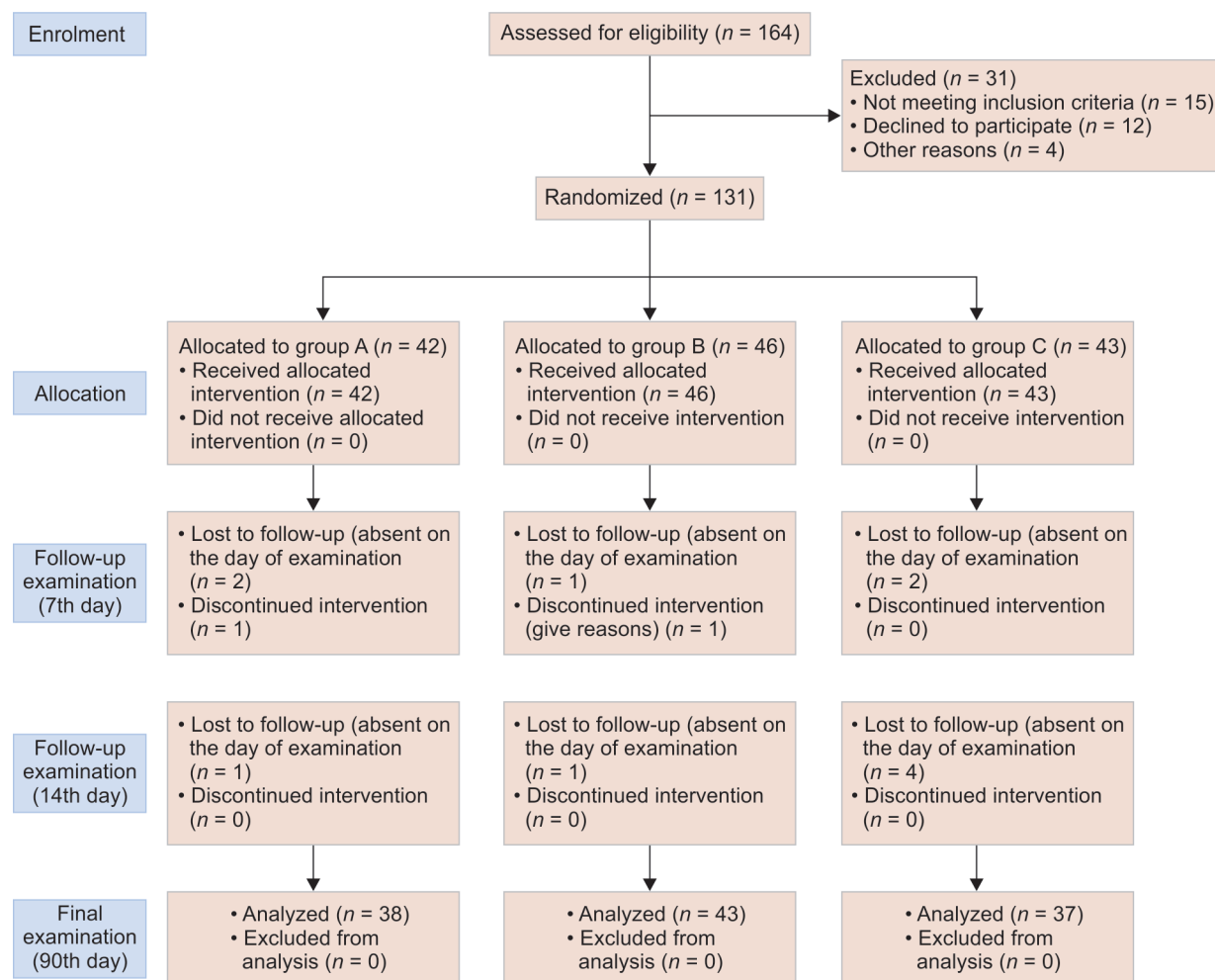
the period just after the plaque scores are examined in the school premises.

In group II, the investigator demonstrated the modified bass technique to the mothers and was instructed to follow the same technique when they supervise the child each time. During the first session of the program, the investigator monitored the mother's supervision and rectified any mistakes in the technique and this was done repeatedly at each interval. Mothers/guardians were provided with a video and a pamphlet depicting the same technique. In group III, there was no supervision, but only demonstration (using models and also videos) of the same brushing technique, and this was also repeated at each interval. The children were instructed to adhere to the same technique as demonstrated.

All the participants were instructed to brush twice daily using a pea-size amount of fluoridated toothpaste supplied to them by the investigator. All the participants were supplied with new toothpaste and toothbrush, which were similar in specifications, and were instructed to stick to the same materials during the time period of the study.

A disclosing agent (0.5% erythrosine) was used using a cotton applicator to record the plaque score. Another co-investigator who is unaware of the study group's allotment recorded the plaque scores of the children using the plaque index (Turesky Modification of Quigley Hein Plaque Index, 1970)¹⁰ before and after

Flowchart 1: Schematic representation of flow of participants



the intervention. One blinded investigator clinically evaluated the plaque scores at baseline and at 7th day, 14th day, and 90th day. The parents, neither the children were informed about the time and date of recall examination to minimize the performance bias. The study was conducted from September 2018 to December 2018.

DATA MANAGEMENT AND ANALYSIS

Data were entered and managed using SPSS ver. 23.0. Descriptive statistics were used to characterize the plaque scores using frequencies and percentages. The mean plaque scores between each group at each level were compared using ANOVA. The comparison of plaque between-subject and within-subject factors were done analyzed using a two-way repeated ANOVA mixed model.

RESULTS

In our study, the mean plaque scores at the baseline examinations were essentially identical in all three groups ($p > 0.05$) (Table 1).

At the second examination (after 7 days), the mean plaque scores who were under the supervision of the dentist (group I) significantly reduced from the previous scores. Also, in group II and group III, the plaque scores were found reduced. When the mean plaque scores were compared between the three groups, there was no statistically significant difference found ($p > 0.05$) (Table 1).

The mean plaque scores were seen reduced again from the previous scores (7th-day scores) in all the groups after 14 days and the reduction was more in group I compared to other groups. The comparison of mean scores of three groups after 14 days showed a statistically significant difference ($p < 0.05$) (Table 2).

The final examination after 90 days (3 months) showed a reduction again from the previous scores (14th-day scores) and the mean reduction was seen more in group I followed by group II. In group III, the reduction was very less evident. The comparison of the mean scores of the three groups showed a statistically significant difference, $p < 0.01$ (Table 1).

The estimated marginal means of plaque scores of each group at different time intervals are depicted in Figure 1.

The two-way repeated ANOVA using a mixed model between-subject and within-subject factors revealed that Mauchly's test of sphericity has been violated, $X^2(5) = 345.613$, $p > 0.05$ (Table 2). This gives the interpretation that there were significant differences in plaque scores between the three groups at different time intervals. Since the sphericity assumption has been violated, the Greenhouse–Geisser correction has been taken into consideration for multivariate analysis (Table 3).

The Greenhouse–Geisser correction showed that there were no statistically significant effects or changes seen between the three groups of participants ($p > 0.05$), even though there was a significant reduction in overall plaque scores across the study (Table 3).

The *post hoc* comparisons of the plaque scores showed a significant difference between group I and group III at the end of the 90th day (Table 4).

DISCUSSION

The role of dental professionals and parents in imparting dental health education to schoolchildren has been widely studied and documented.^{11–13} In Saudi Arabia, the role of parents, mothers, guardians, or dentists in improving the dental health of children needs to gain some attention due to the increasing prevalence of dental caries. This study was an attempt to figure out the effect of different methods of toothbrushing supervision on the plaque scores of 7–9-year-old schoolchildren in Saudi Arabia.

At baseline, the plaque scores in all three groups were found to be identical. There was a dramatic reduction in the plaque levels in all three groups after 7 days of the program. It is noteworthy that this program was effective in educating the children as well as the parents about the correct method of toothbrushing. The findings comply with other studies that reported the oral health behavior and attitude of schoolchildren provisionally improved irrespective of the educational approach applied.^{14–16}

Table 1: Plaque scores at three intervals

Intervals	Groups	Mean	SD	95% CI for mean	Min.	Max.	F test	p value
Baseline	I	2.458	0.959	(2.142, 2.773)	1.00	4.25	0.874	0.420
	II	2.204	0.935	(1.916, 2.492)	0.80	4.25		
	III	2.221	0.939	(1.908, 2.534)	0.78	4.20		
7th day	I	0.626	0.441	(0.4815, 0.771)	0.00	1.60	0.095	0.910
	II	0.608	0.378	(0.492, 0.725)	0.00	1.70		
	III	0.585	0.414	(0.447, 0.723)	0.00	1.70		
14th day	I	0.262	0.232	(0.186, 0.339)	0.00	0.75	3.329	0.039
	II	0.407	0.287	(0.319, 0.495)	0.00	1.50		
	III	0.395	0.298	(0.295, 0.494)	0.00	1.32		
90th day	I	0.158	0.155	(0.107, 0.209)	0.00	0.60	7.818	0.001
	II	0.275	0.189	(0.216, 0.333)	0.00	1.00		
	III	0.356	0.290	(0.259, 0.453)	0.00	1.37		

Table 2: Mauchly's test of sphericity

Within subjects effect	Mauchly's W	Approx. Chi-square	df	Sig.	Epsilon		
					Greenhouse–Geisser	Huynh–Feldt	Lower bound
Time	0.048	345.613	5	0.000	0.410	0.420	0.333

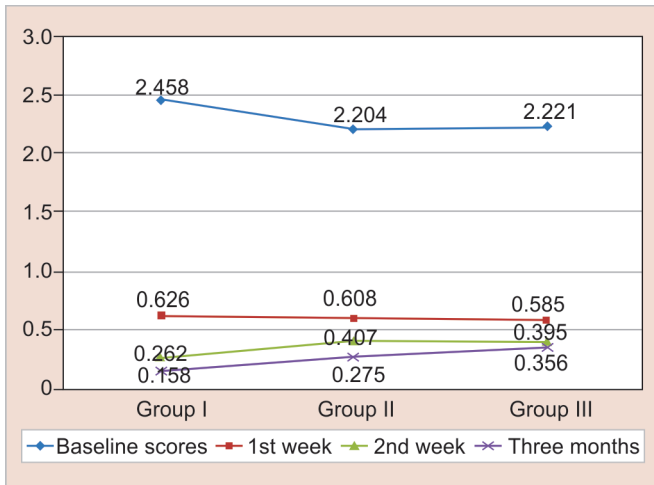


Fig. 1: Estimated marginal means of plaque scores

After 14 days of intervention when the plaque scores were re-examined, there was a reduction from the previous week's scores, but the reduction was comparatively less in the non-supervised group (group III) compared to two other groups. This could be due to the reason that the children in this group did not get an effective reinforcement in the toothbrushing method like the other two groups. These findings suggest that oral health education programs need to be continuously supervised, reinforced, and monitored at definite intervals. The school environment acts as a vital component in promoting oral health as this will have a positive impact on the attitude of these children.^{17,18}

At the final examination after 3 months, surprisingly the plaque scores were again reduced from the previous scores in group I and II, but there was a minimum reduction seen in group III. This gives us a glimpse that supervision and reinforcement have a crucial role to play in oral hygiene practices especially in plaque control. Children should not only be supplied with modern oral

Table 3: Tests of within-subjects effects for plaque scores

Source		Type III sum of squares	df	Mean square	F	Sig.	Partial Eta squared
Time groups*	Sphericity assumed	2.814	6	0.469	1.834	0.092	0.031
	Greenhouse-Geisser	2.814	2.461	1.143	1.834	0.154	0.031
	Huynh-Feldt	2.814	2.518	1.118	1.834	0.153	0.031
	Lower bound	2.814	2.000	1.407	1.834	0.164	0.031
Error (time)	Sphericity assumed	88.211	345	0.256			
	Greenhouse-Geisser	88.211	141.525	0.623			
	Huynh-Feldt	88.211	144.766	0.609			
	Lower bound	88.211	115.000	0.767			

*p > 0.05, no clinical significant

Table 4: Result of post hoc comparisons for plaque scores (Bonferroni test)

Dependent variable	Groups (I)	Groups (J)	Mean difference (I-J)	Std. error	Sig.*	95% Confidence interval	
						Lower bound	Upper bound
Baseline scores	Group I	Group II	0.25327	0.21037	0.693	-0.2578	0.7644
		Group III	0.23681	0.21822	0.840	-0.2934	0.7670
	Group II	Group I	-0.25327	0.21037	0.693	-0.7644	0.2578
		Group III	-0.01647	0.21187	1.000	-0.5312	0.4983
	Group III	Group I	-0.23681	0.21822	0.840	-0.7670	0.2934
		Group II	0.01647	0.21187	1.000	-0.4983	0.5312
7th day scores	Group I	Group II	0.01794	0.09152	1.000	-0.2044	0.2403
		Group III	0.04122	0.09494	1.000	-0.1894	0.2719
	Group II	Group I	-0.01794	0.09152	1.000	-0.2403	0.2044
		Group III	0.02328	0.09218	1.000	-0.2007	0.2472
	Group III	Group I	-0.04122	0.09494	1.000	-0.2719	0.1894
		Group II	-0.02328	0.09218	1.000	-0.2472	0.2007
14th day scores	Group I	Group II	-0.14468	0.06109	0.059	-0.2931	0.0037
		Group III	-0.13256	0.06337	0.116	-0.2865	0.0214
	Group II	Group I	0.14468	0.06109	0.059	-0.0037	0.2931
		Group III	0.01212	0.06153	1.000	-0.1374	0.1616
	Group III	Group I	0.13256	0.06337	0.116	-0.0214	0.2865
		Group II	-0.01212	0.06153	1.000	-0.1616	0.1374
90th day scores	Group I	Group II	-0.11670	0.04851	0.053	-0.2345	0.0012
		Group III	-0.19761*	0.05032	0.000	-0.3199	-0.0754
	Group II	Group I	0.11670	0.04851	0.053	-0.0012	0.2345
		Group III	-0.08091	0.04885	0.301	-0.1996	0.0378
	Group III	Group I	0.19761*	0.05032	0.000	0.0754	0.3199
		Group II	0.08091	0.04885	0.301	-0.0378	0.1996

*The mean difference is significant at the 0.05 level



hygiene aids and devices but should also be taught the correct method to use them. Proper plaque reduction is achievable only while toothbrushing is supervised considering the age of the child as this is very much related to the cognitive capacity and developmental stage.^{19,20}

According to Benadof and colleagues, there are four stages how a child learns to brush their teeth.²¹ Stage 1 (usually 13–31 months) is the “*initiation of oral hygiene and entirely dependent toothbrushing*” which describes the start of oral hygiene practices such as cleaning the child’s gum, brushing the teeth, and/or play with the toothbrush. Stage 2 is the stage of “*assisted toothbrushing*” and the age ranges from 2 to 3 years. In this stage, the child has developed some motor control and they understand the instructions and explanation about toothbrushing. The next stage (Stage 3) is known as the “*road to toothbrushing independence*” and the age ranges from 4 to 9 years. The children in this age group had better motor control and understood the importance of brushing methods in maintaining good oral hygiene. Children at this stage usually brush themselves and/or sometimes need assistance. The final stage (Stage 4) is “*independent toothbrushing*” and at this stage, children are capable of brushing their teeth without assistance. The age of children in this stage ranges from 4 to 16 years old and the understanding of information regarding toothbrushing is better than the previous stage. Our study included female children of 7–9 years old and this age category could be regarded as an appropriate age group to do this intervention.²¹

Some of the factors should be considered as shortfalls or limitations of the study while interpreting our findings. Even though participants were strictly instructed to follow the proper method, there are no clear idea of how much duration did each participant spent at home for brushing as this has a relationship with plaque removal.¹⁵ We also did not record the socioeconomic and educational level of the parents or caregivers as these factors could influence the supervision of toothbrushing.^{22,23} Significant reduction in the plaque scores was seen in the first-week follow-up in all three groups. This clearly reflects that the awareness and knowledge regarding the proper toothbrushing method were poor before the program in both children and the parents/caregivers. This could also be explained based on the “*Hawthorne effect*”, as this phenomenon may have improved the attitude and behavior of both parents and child, as they are aware that they are contributing to this intervention.²⁴

CONCLUSION

In Saudi Arabia, a systemic school oral health program at the national level has not been established. The results of this interventional study provide us with an impression that the supervision helped educate both the children and the parent on the correct method of toothbrushing and also found to be effective in reducing the plaque levels irrespective of the groups. The study recommends that there is an urgent need to establish a well-organized school oral health program in the country, which should primarily focus on oral health education, proper toothbrushing techniques, and other preventive methods including the use of fluoride supplements.

CLINICAL SIGNIFICANCE

- In pediatric dentistry, especially in preventive dentistry education and motivation both parent and child motivation is a crucial factor in plaque control.

- During dental health education programs, the pediatric dentist can involve both parent and the child to actively involved in oral hygiene instructions as it could reduce the struggle and effort of dentists in conveying the actual message.
- The pediatric dentists can plan a crucial role in preventive programs, especially in giving oral hygiene instructions considering the age of the child.

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