

# Efficacy of a Musical Tooth Brushing Drill in Maintenance of Oral Hygiene among Children at a Correctional Institute in Bengaluru City

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## Abstract

**Introduction:** Tooth brushing plays a vital role in effective plaque control, which depends on the method and the ease with which it is adopted. It is known that one of the major factors that lead to the occurrence of dental caries is the action of microorganisms. These micro-organisms harbor themselves onto tooth structure in form of bio-film, thus leading to the formation of dental plaque.

**Material and Methods:** A total of 130 children in the correctional home were screened and divided into control and intervention groups with 30 subjects each. The children will be assessed for baseline plaque scores using the using Turesky–Gilmore– Glickman modification of the Quigley–Hein plaque index. The plaque was assessed on the labial, buccal, and lingual surfaces of all the teeth after using a disclosing agent. The scores are given: 0: No plaque; 1: Separate flecks of plaque at the cervical margin of the tooth; 2: A thin continuous band of plaque (up to 1 mm) at the cervical margin; 3: A band of plaque wider than 1 mm but covering less than one-third of the crown of the tooth; 4: Plaque covering at least one-third but less than two-thirds of the crown; 5: Plaque covering two-thirds or more of the crown. The participants were subjected to a music and action routine for tooth brushing. Repetitive exercise for two weeks was done to condition the participants. Plaque scores were assessed using a two-tone disclosing agent at baseline, at the end of a two-week training drill, and four-week follow-up where the participants were asked to brush by themselves without any supervision.

**Results:** The difference in the mean dental plaque scores from baseline to the 30th day was found to be statistically significant among the intervention group. ( $p < 0.001$ ). On intragroup comparison, the differences in the reduction of these plaque scores over time from baseline to the 15th day were statistically significant ( $p < 0.001$ ). The inter-group comparison was statistically significant at baseline ( $p = 0.044$ ). There was a significant difference on the 15th day ( $p = 0.041$ ) and on the 30th day ( $p = 0.040$ ). **Conclusion:** The present study proves that there was a significant reduction in plaque scores ( $p < 0.001$ ) for a month with the use of a tooth brushing drill for two weeks under supervision. This shows behavior modification and healthy habit formation among the children. This also shows that children can be motivated and trained using music and simple drills.

**Keywords:** Tooth brushing • Musical tooth brushing drill • Oral hygiene

## Introduction

Tooth brushing plays a vital role in effective plaque control, which depends on the method and the ease with which it is adopted. It is known that one of the major factors that lead to the occurrence of dental caries is the action of microorganisms. These micro-organisms harbor themselves onto tooth structure in form of bio-film, thus leading to the formation of dental plaque [1]. WHO defined dental plaque as a specific but highly variable structural entity, resulting from sequential colonization of microorganisms on tooth surfaces, restorations & other parts of the oral cavity, composed of salivary components like mucin, desquamated epithelial cells, debris & microorganisms, all embedded in the extracellular gelatinous matrix [2]. The experimental model of gingivitis was proposed by Loesch. Concluded that the first sign of gingivitis occurs 10 days after plaque accumulation.

In 1965, Loe demonstrated that subjects with healthy gingiva developed clinical signs of gingivitis within two to three weeks of refraining from all oral hygiene practices due to undisturbed accumulation of dental plaque. On resumption of adequate oral hygiene, the gingival tissue inflammation subsided within a week [3, 4].

Studies by Lindhe and Smulow demonstrated that mechanical removal of supragingival plaque affects the nutrition of subgingival organisms to affect the microflora composition in shallow (4 mm) and moderate pockets (6 mm) [5, 6]. The attraction of microbes to pellicles begins at the delicate gingival margin, particularly on proximal surfaces. All these studies provide evidence that the removal of microbial plaque leads to the cessation of gingival inflammation, and cessation of plaque control measures leads to the recurrence of inflammation. The removal of plaque also decreased the rate of formation of calculus. Thus, eliminating plaque and calculus is the key to preventing the occurrence of periodontal disease or halting the progression of the disease. Hence, dental plaque being the primary etiological factor in the progression of gingivitis and periodontitis, prevention, elimination, and control of dental plaque formation are important steps in the prevention of gingivitis as well as minimizing the severity of the periodontal disease.

The daily disruption of dental plaque, at and above the gingival margin, appears to be critical in countering the potential of the plaque to cause gingival inflammation. The patient needs to maintain plaque at levels compatible with health in order to prevent the breakdown of microbial homeostasis. Individual skills and acquired behavior patterns determine how effective controls can be [7].

It has been suggested that mechanical and chemical plaque control measures are efficacious in the prevention of the occurrence of gingivitis and caries through the reduction of plaque [8]. The most efficient method in mechanical plaque control is tooth brushing those results in a significant decrease in plaque. Prevention has become the cornerstone of modern dental practice and effective plaque control is the basic password to the meaningful practice of preventive dentistry. Intraoral cleaning devices have been a part of human civilization for a long and a strong correlation exists between the severity of gingivitis and periodontitis and the accumulation of dental plaque [9].

Toothbrushes were first introduced in China as early as 1600 B.C. and have evolved to the present powered toothbrushes. Bratel and Berggren compared a manual toothbrush with an electric toothbrush and concluded that the electric toothbrush was not superior to the manual brush [10]. Similar findings were made by others when comparing manual brushes with electric brushes [11, 12]. Studies have also compared foam brushes, Collis-curve brushes, deep-ground brushes, and double-headed brushes with standard manual brushes with no or small site-specific differences in the ability of these devices to remove plaque mechanically [13].

Many young children are probably introduced to oral hygiene practices by their parents. However effective plaque removal in young children depends on their learning sequences of coordinated muscular movement and their

level of motor skill development. Deficits in oral hygiene skills and knowledge of adults and a strong social gradient regarding oral health indicate that society should take on responsibility here, too [14-19, 20, 21]. Thereby, prevention programs have been developed in several countries [22, 23]. These programs aim to enhance oral health in children and enable them to maintain oral health when they reach adulthood. Group prevention programs contain clear instructions for the way in which the children should brush their teeth, based on the cognitive and psychomotor abilities of the children as well as upon dental health purposes. In the case of children, the majority show noncompliance toward brushing and they try to hide themselves from daily brushing tasks because they it considered a tedious procedure and dislike brushing. At the same time, parents try to motivate the children to regularly brush by using different methods such as contingency management, gifts, and even pleasing them with bribes at times. Still, most parents fail to develop their child's interest in brushing. It is important to gain a child's interest in brushing by introducing some new devices that the child can enjoy brushing. In institutionalized children monitoring these children's personal hygiene practices become difficult. Most of the time they neglect tooth brushing. Toothbrushes are more for play than actual brushing. Motivating these children to brush their teeth becomes imperative. Dental health education using music, dance, and songs can provide a deeper message and provide a better learning experience for these children.

## Materials and Methods

Hence the aim of this study is to assess the efficacy of a musical tooth-brushing drill in the oral hygiene status of children.

### Objectives

To compare the change in plaque scores before and after the introduction of a tooth brushing drill.

A randomized control trial was conducted among the children of a state home for boys and girls.

A total of 130 children in the correctional home were screened those satisfying the inclusion and exclusion criteria were divided into control and intervention groups with 30 subjects each.

#### Exclusion criteria:

- Participants with poor manual dexterity
- Differently, abled children who require special assistance for brushing
- Those participants with any systemic and acute illness and under medication.

#### Inclusion criteria:

- Subjects aged between 12-15 years
- Subjects with the ability to follow instructions

The plaque scores before the training session for the groups were measured using the using Turesky-Gilmore-Glickman modification of the Quigley-Hein plaque index.

The plaque was assessed on the labial, buccal, and lingual surfaces of all the teeth after using DPI AlphaPlac Two Tone Disclosing Agent Dye. It is a two-color disclosing solution to locate old plaque (stained blue) and new plaque (stained pink).

- The scores given
- 0: No plaque;
- 1: Separate flecks of plaque at the cervical margin of the tooth;
- 2: A thin continuous band of plaque (up to 1 mm) at the cervical margin;
- 3: A band of plaque wider than 1 mm but covering less than one third of the crown of the tooth;
- 4: Plaque covering at least one-third but less than two-thirds of the crown;
- 5: Plaque covering two-thirds or more of the crown.

The participants were subjected to a music and action routine for tooth brushing. Repetitive exercise for two weeks was done to condition the participants. Plaque scores were assessed using a disclosing agent at baseline, at the end of a two-week training drill, and four-week follow-up where the participants were asked to brush by themselves without any supervision.

### Statistical analysis

The data analysis was carried out using Statistical Package for the Social Sciences (SPSS) 24.0. Paired and Unpaired t-test was carried out to measure the efficacy of the tooth-brushing drill.

## Result

There were no dropout cases subjects maintained their recall appointments. Paired t-test was used to check intra-group variables while an unpaired t-test was used to check intergroup variables.

**Table 1:** Mean plaque scores of the control and intervention groups.

Time of assessment	Control group					Intervention group				
	Mean±sd	Reduction from baseline	Reduction %	T	P value	Mean±sd	Reduction from baseline	Reduction %	T	P value
Baseline	0.84±0.23					0.92±0.17				
15 <sup>th</sup> Day	0.81±0.22	0.02±0.02	2.3	6.31	<0.001	0.74±0.29	0.17±0.20	18	4.68	<0.001
30 <sup>th</sup> Day	0.75±0.24	0.09±0.19	10	2.63	0.01	0.66±0.31	0.25±0.26	27	5.37	<0.001

p≤0.005 significant

The mean plaque scores of the control group at baseline, 15th, and 30th day was 0.84±0.23, 0.81±0.22, and 0.75±0.24 respectively. The difference in the mean dental plaque scores from baseline to the 30th day was found to be statistically significant among the control group (p=<0.001). The mean plaque scores of the intervention group at baseline, 15th, and 30th day were 0.92± 0.17, 0.74±0.29, and 0.66±0.31 respectively. The difference in the mean dental plaque scores from baseline to the 30th day was found to be statistically significant among the intervention group (shown in Table 1). (p= <0.001)

**Table 2:** Intragroup comparison of reduction plaque index scores in the control group at different time intervals

Controls	Mean	N	Std. Deviation	Std. Error Mean
Baseline	0.845	30	0.23412	0.04274
15th day	0.8163	30	0.22727	0.04149
30th day	0.753	30	0.24661	0.04502

The reduction in mean plaque scores of the control group from baseline to 15th day, baseline to 30th day, and 15th to 30th day were 0.02±0.02, 0.09±0.19, and 0.06±0.19 respectively. The differences in the reduction of these plaque scores over time from baseline to the 15th day were statistically significant (p=<0.001). There was no statistically significant difference from baseline to 30th day (p=0.014) and 15th day to 30th day among the control group (shown in Table 2). (p=0.034)

**Table 3a:** Intragroup comparison of reduction in plaque index scores in the intervention group at different time intervals.

Within Control Comparison							
		Paired Differences				T	P
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower		
Pair 1	Baseline - 15th day	0.02867	0.02488	0.00454	0.01938	6.312	<.001
Pair 2	Baseline - 30th day	0.092	0.19189	0.03503	0.02035	2.626	0.014
Pair 3	15th day - 30th day	0.06333	0.18683	0.03411	-0.00643	1.857	0.034
p≤0.005 significant							

**Table 3b:** Intragroup comparison of reduction in plaque index scores in the intervention group at different time intervals.

Intervention	Mean	N	Std. Deviation	Std. Error Mean
Baseline	0.924	30	0.17031	0.03109
15th day	0.7493	30	0.29423	0.05372
30th day	0.667	30	0.31532	0.05757

**Table 3c:** Intragroup comparison of reduction in plaque index scores in the intervention group at different time intervals.

Within Intervention Group Comparison							
		Paired Differences				T	P
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower		
Pair 1	Baseline - 15th day	0.17467	0.20461	0.03736	0.09826	4.676	<.001
Pair 2	Baseline - 30th day	0.257	0.26223	0.04788	0.15908	5.368	<.001
Pair 3	15th day - 30th day	0.08233	0.20394	0.03723	0.00618	2.211	0.035
p≤0.005 significant							

The reduction in mean plaque scores of the intervention group from baseline to 15th day, baseline to 30th day, and 15th to 30th day were 0.17±0.20, 0.25±0.26, and 0.08±0.20 respectively. The difference in reduction of the plaque scores over time from baseline to 15th day and baseline to 30th day were statistically significant (p<0.001) and reduction of the plaque scores from 15th to 30th day was also found to be statistically significant among the intervention group, p= 0.035 (shown in Table 3 a-c).

**Table 4:** intergroup comparison of reduction in plaque index scores.

Between-Group Comparison							
	Groups	N	Mean	Std. Deviation	Mean Difference	T	P
Baseline	Intervention	30	0.924	0.17031	0.079	1.495	0.044
	Control	30	0.845	0.23412			
15thday	Intervention	30	0.7493	0.29423	-0.067	0.987	0.041
	Control	30	0.8163	0.22727			

30th day	Intervention	30	0.669	0.24661	-0.084	0.651	0.04
	Control	30	0.753	0.24661			
p≤0.005 significant							

The inter-group comparison was statistically significant at baseline (p=0.044). There was significant difference at 15th day (p=0.041) and at 30th day, p=0.040 (shown in Table 4).

## Discussion

As the periodontal investigation began to discover the aetiological effect of dental plaque and the therapeutic role of oral hygiene became clear various mechanical and chemical agents were introduced for plaque control. Although these have been proven to be effective to some extent, mechanical plaque removal using a toothbrush remains the most popular and effective method.

In the present study, the tooth-brushing song (a didactic tool of group instructions/prophylaxis) was used to reinforce the modified bass technique which was the chosen brushing technique. Several clinical studies have reported the modified bass technique as an effective technique of tooth brushing. Damle stated that the modified bass technique is superior in cleaning the interproximal surfaces and gingival third of teeth than other techniques.

In the case of children, the major problem is to have their compliance in brushing their teeth twice a day. Most children use to refrain from brushing because they consider it a tedious procedure. Hence to motivate and reinforce the importance of brushing twice a day, a tooth-brushing drill was conducted for fifteen days under the supervision of the examiner. Each quadrant had a different instrumental playing, the examiner demonstrated the brushing technique, and the children were asked to follow. This was done every day for fifteen days. At the end of the fifteenth and thirtieth day, the plaque scores were recorded and compared.

In the present study, the mean plaque scores of the control group at baseline, 15th, and 30th days were 0.84±0.23, 0.81±0.22, and 0.75±0.24 respectively. The difference in the mean dental plaque scores from baseline to the 30th day was found to be statistically significant among the control group. (p= <0.001) The mean plaque scores of the intervention group at baseline, 15th, and 30th day were 0.92± 0.17, 0.74±0.29, and 0.66±0.31 respectively. The difference in the mean dental plaque scores from baseline to the 30th day was found to be statistically significant among the intervention group. (p= <0.001). Similar results were obtained by Ganesh M where the mean Plaque index (PI) score at baseline was 1.78 ± 0.21, which was reduced at all time intervals that are at 30, 60, and 90 days, the value of P < 0.001, therefore it was statistically highly significant.

The reduction in mean plaque scores of the control group from baseline to 15th day, baseline to 30th day, and 15th to 30th day were 0.02 ±0.02, 0.09±0.19, and 0.06±0.19 respectively. The differences in the reduction of these plaque scores over time from baseline to the 15th day were statistically significant (p=<0.001). There was no statistically significant difference from baseline to 30th day (p=0.014) and 15th day to 30th day among the control group (p=0.034).

The reduction in mean plaque scores of the intervention group from baseline to 15th day, baseline to 30th day, and 15th to 30th day were 0.17±0.20, 0.25 ±0.26, and 0.08±0.20 respectively. The difference in reduction of the plaque scores over time from baseline to 15th day and baseline to 30th day were statistically significant (p=<0.001) and reduction of the plaque scores from 15th to 30th day was also found to be statistically significant among the intervention group. (p= 0.035). A similar study conducted by Ganesh M compared the efficacy of a musical toothbrush and a regular toothbrush

and concluded that both brushes were clinically effective in the removal of plaque initially the musical toothbrush was more effective but as time period increased both brushes had similar results

The results in the present study have illustrated that there was a significant reduction in the plaque scores with the use of a tooth brushing drill for two weeks under supervision. The drill acted like a behavior modification and encouraged the children to brush effectively. In an institutional setup, peer influence is a major factor in any behavior modification. Hence this drill has effectively modified their approach to brushing. Although brushing is a simple and effective way to remove dental plaque, the prevalence of periodontal disease in the general population shows that it is insufficient [24-26]. Oral health education and training were effective in establishing good oral health habits among school children and also in enhancing the knowledge of their parents about good oral health [27, 28]. Sutcliffe concluded that oral hygiene instruction programs have potential value as a means of introducing young children to future dental procedures in a pleasant way as much possible [29]. Similar results were reported in other studies, where direct communication with the dentist and chairside motivation for oral hygiene measures were effective motivational tools in improving the oral hygiene and gingival health status of children [30, 31].

## Limitation

This study was conducted in an institution where children are together all the time. Hence learning and effectively implementing and monitoring new habits becomes easier.

## Recommendation

This study needs to be carried out on a larger sample size of children. As it has a potential value as means of oral hygiene instruction program.

## Conclusion

The present study proves that there was a significant reduction in the plaque scores ( $p < 0.001$ ) for a month with the use of a tooth brushing drill for two weeks under supervision. This shows behavior modification and healthy habit formation among the children. This also shows that children can be motivated and trained using music and simple drills.

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