Dental plaque removal efficacy of a battery powered and manual toothbrush

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Summary

Purpose. The purpose of this study was to compare the plaque removal effectiveness of a battery powered and manual toothbrush on plaque removal.
Materials and Methods. 60 patients were attended in this study. These patients were divided into two groups, using rotary or manual toothbrush twice a day. Plaque was scored after brushing at the baseline of the study and three months later, using Patient Hygiene Performance (PHP) at the sites of the following teeth: the maxillary right first molar on the disto-buccal area (1), the maxillary right central incisor on the disto-buccal area (2), the maxillary left first molar on the mesio-buccal area (3), the mandibular left first molar on the disto-buccal area (4), the mandibular left central incisor on the disto-buccal area (5) and the mandibular right first molar on the mesio-buccal area (6). These six sites were chosen as the representative status of the oral condition.
Statistical analysis was performed by Paired samples t-test and Independent samples t-test.
Results. Both toothbrushes mean differences between baseline and post-brushing plaque scores decreased. Battery powered toothbrush decreased the plaque index in first, second and sixth sites more than the manual toothbrush.
Conclusions. Crest SpinBrush plaque removal was more efficient on the recorded teeth of the right side of the oral cavity in comparison to manual toothbrush.
Key words: battery powered toothbrush, modified hygiene performance index.

Introduction

Supragingival plaque removal is an important factor in preventing periodontal diseases and caries. Tooth brushing remains the most reliable method of controlling supragingival bacterial plaque [1]. Utilization of dental floss, mouth rinsing and attending recalls every 6 months regularly are also important steps for oral health care [2].

Different types of toothbrushes, such as battery or electrically powered have been introduced onto the market. Powered toothbrushes have been produced in the 1960s as an alternative to the manual toothbrushes [3, 4, 5]. The main advantage of battery power toothbrushes is that they require no electrical energy.

Battery powered toothbrushes are recommended for children, disabled people and orthodontic patients. Individuals who are in high caries activity risk should also use these rotary toothbrushes.

The purpose of this study was to compare the efficacy of manual and battery powered toothbrushes on plaque removal.

Materials and methods

This study was randomized, controlled and examine-blind designed. A total of 60 students (ages between 13-17) were included in the present study.

Care was taken to ensure that the students included in the study did not have any systemic disease. Students with decayed, extracted teeth and who have not completed permanent dentition were excluded. Clinical examinations were conducted by two separate examiners.

Modified hygiene performance index of the students was evaluated by the observers in two recalls [6]. Six standard interproximal sites were examined: the disto-buccal surface of the maxillary right first molar (1), the disto-buccal surface of the maxillary right central incisor (2), the mesio-buccal surface of the maxillary left first molar (3), the disto-buccal surface of the mandibular left first molar (4), the disto-buccal surface of the mandibular left central incisor (5) and the mesio-buccal surface of the mandibular right first molar (6). These six sites were chosen as representatives of the oral status.

The evaluation of the scores is presented in *Table 1*.

After recording the index of 60 patients, manual toothbrushes (Crest, Procter & Gamble, OH, USA) and toothpastes (Ipana White Fluoristat Procter & Gamble, OH, USA) were given to 30 students.

Battery powered toothbrushes (Crest SpinBrush, Ipana, Procter & Gamble, OH, USA) and toothpastes (Ipana White Fluoristat Procter & Gamble, OH, USA) were given to the remaining 30 students. The training procedure for the utilization of rotary instrument was given for this group. The toothpaste (1450 ppm F^-) was recommended to be used in a length of 1/3 of a manual toothbrush for both groups. During the study, subjects were instructed to brush twice a day with the test toothbrushes.

At the end of the third month, the modified oral hygiene performance index was recorded for the same teeth. This procedure was undertaken by separate researchers who were not informed about the group dispersions of the individuals.

The consistency of the scoring between the first and second researchers was obtained by a preliminary education. The Kappa values were found as 1.0 for score 0, 0.98 for score 1, 0.92 for score 2 and 1.0 for score 3.

Statistical analysis was performed according to Paired samples t-test and Independent samples t-test.

Results

Thirty subjects completed the study in each group. A significant difference was obtained between the baseline and post-brushing plaque score in both groups ($p < 0.001$).

There was a significant difference between manual and Crest SpinBrush toothbrushes in the second and sixth sites ($p < 0.05$) *(Table 2)*.

Table 1. The evaluation of the scores in this study

Score	Description
0	no plaque
1	thin band on plaque at gingival margin
2	plaque covering and minimum bleeding in probing
3	extreme plaque covering and bleeding in probing

Table 2. Mean differences and standard deviations of comparison of the manual and Crest SpinBrush

	Mean	St. Dev.	Sig.
Manual	0.8000	0.8867	p>0.05
SpinBrush	0.8000	0.9965	
Manual	0.9000	0.7589	p<0.05
SpinBrush	1.3333	0.8023	
Manual	1.0667	0.6915	p>0.05
SpinBrush	1.0333	1.0334	
Manual	0.8333	1.0532	p>0.05
SpinBrush	0.9333	0.9444	
Manual	1.2333	0.7739	p>0.05
SpinBrush	0.9667	1.0334	
Manual	0.5333	0.7761	p<0.05
SpinBrush	1.1333	0.8604	

Discussion

The present study was performed to evaluate the plaque removal efficacy of a manual and a battery powered toothbrush. A standard flouridated toothpaste was used to reveal the variations between the different types of toothbrushes. Ipana White Flouristat does not contain any therapeutic agents such as triclosane or pyrophosphate. Instead, it only contains NaF (1450 ppm).

Many clinical studies have demonstrated that power toothbrushes deliver superior plaque removal compared to manual toothbrushes, leading to growing acceptance in the dental community that power toothbrushes offer superior plaque control relative to manual toothbrushes [1, 3, 7-24]. It was reported that scrubbing action resulting from rapid vibration of the brush head might result in effective cleaning [3].

The results of the current study showed that Crest SpinBrush plaque removal efficacy was higher on the right side of the recorded teeth of the oral cavity compared to manual tooth brushing. There was no difference in terms of plaque removal in the left side of the oral cavity between the manual and battery powered toothbrush.

One explanation for this situation may be that patients usually use their right hand for tooth brushing and it is more likely that the left side of the oral cavity is more efficiently cleaned.

In the present study, students were educated for the brushing technique and using the battery powered brush. Therefore, the manual toothbrushing group also showed an improvement regarding to plaque removal at the end of the study in comparison to the baseline data.

Trombelli et al and Wilcoxon et al assessed that plaque scores were lower in patients who used the counter rotary power brush rather than a manual brush by evaluating supragingival plaque for orthodontic patients [25, 26].

In representative post-brushing studies, power toothbrush removed 29% more plaque than a manual toothbrush following a single tooth brushing [5, 9].

In studies longer than a month in duration, greater plaque reductions (9.4-36.8%) were observed with the power toothbrush relative to three different manual toothbrushes [16-19].

Crest SpinBrush were also evaluated in other studies.

Results of two independent studies have reported that the Crest SpinBrush removes more plaque relative to an advanced design manual toothbrush (Colgate Navigator) [5, 27].

Results of another study showed that the Crest SpinBrush removed 55% more plaque than a leading battery-operated power toothbrush [5, 10, 28].

Many battery-powered toothbrushes have been shown to reduce existing gingivitis relative to manual toothbrushes after 30 days of brushing or more. The gingivitis reductions observed in these studies ranged from 8 to 40%. In addition, these power toothbrushes have also been shown to remove stain more effectively than a manual toothbrush [12, 14, 16-19, 29].

The results of the study suggested that conventional battery-powered and manual toothbrushes are effective in obtaining gingival health.

However, other studies reported that electric toothbrushes are considered inferior to manual brushing in removing plaque from the interproximal and lingual tooth surfaces [3, 8, 9, 30, 31]. There may be variations between toothbrushes, which are designed by different manufacturers [3].

Effective plaque control leads to additional oral health benefits, including reduced gingivitis and stain. The habit of utilizing toothbrush, dental floss and mouth rinses, the frequency of dental visits, nutrition and environmental factors are causing individual differences in terms of oral and dental health [4, 10, 29]. Manual or battery-powered toothbrush recommendation depends on the individual's oral status. Patients with high caries activity or periodontal disease and those who are undergoing orthodontic treatment may be advised to use battery-powered toothbrushes for a better-controlled brushing procedure.

Conclusion

According to the results obtained, both toothbrushes' mean difference between baseline and post-brushing plaque scores decreased.

Crest SpinBrush plaque removal was more efficient on the right side of the recorded teeth of the oral cavity in comparison to manual toothbrush.

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