Comparative Evaluation of Clinical Efficacy of Manual and Powered Tooth Brush

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Abstract

Background: It is now universally contended that prevention and inhibition of plaque accumulation on the tooth surfaces are likely to cause a major breakthrough to achieve optimum periodontal health. In the view of great importance of plaque removal, a number of techniques has been advocated for effective utility of tooth brushing. This study is an endeavor to find out if powered brushing is better than manual brushing.

Aims and Objectives: This study was conducted to compare the efficacy of the manual toothbrush and powered toothbrush on 45 patients, in the age group of 19-23 years over a period of 28 days. The aim was to study the effect of the powered toothbrush (Braun 2D) and the manual toothbrush (regular advantage plus) on removal of supra-gingival plaque and improvement of gingival health.

Materials and Methods: The selected subjects were classified under two groups: Group A (manual tooth brushing) and Group B (powered tooth brushing) and the subjects were evaluated over a period of 28 days.

Results: Statistical evaluation of clinical observations was carried out. Highly significant difference between pre- and post-brushing mean values was seen in both Group A and Group B (\(P < 0.001\)).

Conclusion: The results of the study showed that the powered toothbrush demonstrated clinical and statistical improvement in overall plaque and gingival scores. This also proved that Braun 2D Powered toothbrush is safe, superior, and an effective alternative to the manual toothbrush in the overall improvement of gingival health.

Keywords: Manual toothbrush, Periodontal health, Plaque, Powered toothbrush

INTRODUCTION

The history of man’s fight for health begins with known earliest existence, when he was completely at the mercy of nature with no effective means of combating its hazards. At present, enormous strides have been made for plaque control. However, periodontal disease still remains one of the widest spread of diseases affecting mankind. Supra-gingival plaque removal has been found to be remarkably effective in reducing total plaque specific subgingival species and showing sustained improvement in clinical parameters.¹

Power (electric) toothbrushes were largely seen as a niche item mostly suitable for special populations when first introduced, but several decades of innovation and technological improvements have resulted in a new generation of power brushes with greater efficacy and patient-pleasing features that can enhance compliance. In particular, the oscillating-rotating class of power toothbrushes was found in an independent meta-analysis of over 42 clinical trials to show statistically superior anti-plaque and anti-gingivitis abilities versus a manual toothbrush.²

The popularity of power brushes has soared as consumers have discovered their robust cleaning ability coupled with ease of use.³

Yet there remains a subset of individuals who have been reticent to trade their familiar manual toothbrush
and style of brushing for the somewhat unique brush head feel and modes of action of most marketed power toothbrushes, despite evidence that power brushes have been shown to provide superior plaque reduction.2-5

Thus, the purpose of this study is to evaluate the safety and efficacy of the (Braun 2D) powered toothbrush for the removal of supra-gingival plaque and improving gingival health and to compare it to a regular manual toothbrush (regular advantage plus).

Aims and Objectives
The aim was to evaluate and compare the efficacy of powered toothbrush (Braun 2D) and a manual toothbrush (regular advantage plus).

MATERIALS AND METHODS

This study was conducted in the Department of Periodontics and Oral Implantology, Rama Dental College Hospital, and Research Centre, Kanpur. 45 patients in the age group of 19-23 years participated in the study.

Criteria for Patient Selection
1. Moderate to good oral hygiene (oral hygiene index-S, Greene and Vermilion, 1964)
2. No dental caries
3. No adverse habits (smoking and pan chewing)
4. No previous experience with a powered toothbrush
5. Patients undergoing orthodontics therapy and with complicated prosthesis were not included in the study
6. Patients should have a minimum of 20 teeth
7. Subject had to be free from systemic conditions that might influence the gingival status
8. Subject must not have used nonsteroidal anti-inflammatory drugs, corticosteroids, or antibiotics at least for a month before the start of the study.

Study Design
A total number of 45 subjects, 15 males and 30 females were included in the study. They were then classified under 2 groups.

Group A: Consisted of 11 males and 12 females. Each of these subjects was allocated a manual toothbrush, regular advantage plus and a tube of toothpaste. They were instructed to use the modified Bass method of brushing.

Group B: Consisted of 4 males and 18 females who were allocated a powered toothbrush and toothpaste. They were instructed to use a brush with the bristles perpendicular to the gingival margin or sulcus.

Experimental Design
The duration of the study was for 28 days. The subjects were asked to report to the dental office on 0 day, 7th, 14th, and 28th days. All the subjects who participated in the study, underwent oral prophylaxis and were advised to refrain from brushing their teeth for 24 h prior to their appointment on “0” day.

On “0” Day
Each subject was made to sit on the dental chair. The pre-brushing plaque score was recorded in the prepared proforma using the Turesky–Gilmore–Glickman modification of the Quigley–Hein Plaque Index (1970). The gingival status for each subject was assessed using the gingivitis component of Sigurd Ramfjord’s periodontal disease index (1959) in relation to the six Ramfjord’s teeth and gingival bleeding was assessed by the gingival bleeding index.6

Following this, each subject was instructed to brush his/her teeth with the allocated toothbrush and toothpaste and the brushing technique in which they were instructed (Group A - Manual toothbrush, Group B - Powered toothbrush) for 2 min in the dental clinic. Each subject was then re-examined after tooth brushing with the disclosing solution, and the post-brushing plaque score was recorded using the Turesky–Gilmore–Glickman modification of the Quigley–Hein plaque index. The subjects were then asked to rinse the mouth with water.

After having recorded the above parameters, each subject was then instructed to brush twice a day for 2 min at home with the allocated toothbrush and toothpaste, using the brushing technique which they were instructed to follow. Subjects were given appointments to return on the 7th, 14th, and 28th day with the advice to abstain from brushing for 24 h prior to each of these appointments. The subjects were then discharged from the dental clinic.

On the 7th, 14th, and 28th Day
On the 7th, 14th, and 28th day when the subjects returned to the dental clinic as appointed, the same experimental procedures were conducted, and the same clinical parameters were evaluated and recorded as on the day “0” and these were then submitted for statistical evaluation.

Statistical Methods Applied
Results were obtained, and they were subjected to statistical analysis.

• Changes in clinical parameters from 0 day to 28th day were calculated and compared using t-test on paired observation
• Comparison between Group A (manual) and
Group B (powered) was done using unpaired \( t \)-test (\( t \)-independent test).

- 95% confidence interval was provided for all the estimates.

**Powered Toothbrush**

The Braun 2D is a new approach in toothbrush design. Instead of being a motor driven regular toothbrush this new rechargeable brush offers the convenience of sustained rechargeable cleaning power, combined with the clinically proven benefits of a rotating power head with crisscross bristles.

**Regular Advantage Plus**

The manual toothbrush used in the study was advantage toothbrush. It is a soft bristle toothbrush. Each brush has tufts, and each tuft has 35 nylon filaments. The toothbrush is divided into power tip and action cup.

a) **Power tip:** Consists of eight tufts arranged in a round fashion with a single tuft in the center surrounded with seven tufts. Here, the filaments are long and angled to reach around back teeth and in between teeth for more effective brushing.

b) **Action cup:** This consists of 17 tufts. Eight tufts arranged in two rows. Each row consisted of four tufts. Three rows of three tufts each slowly tapering. These filaments simultaneously clean the tooth surface along the gum line. The diameter of the filament is 0.008 inch for both translucent and colored. Out of 180°, end rounding in 154.8°.

**Armamentarium**

1. Mouth mirror
2. Blunt straight probe
3. Ultrasonic unit
4. Dappen dish
5. Polishing paste and rubber cups
6. Disclosing solution (plaksee)
7. Regular advantage plus manual toothbrush
8. Braun 2D powered toothbrush.

**RESULTS**

This study was conducted in Rama Dental College Hospital and Research Centre, Kanpur, Uttar Pradesh. To compare the efficacy of the manual toothbrush and powered toothbrush on 45 patients, 15 males and 30 females in the age group of 19-23 years. The subjects were classified under two groups - Group A (manual toothbrush) and Group B (powered toothbrush). Statistical evaluation of clinical observations was carried out.

On day 0, the pre-brushing mean Plaque Index score for Group A was 1.56 and 1.77 for Group B (Table 1). While the post-brushing mean Plaque Index score for Group A was 0.61 and 0.81 for Group B. On 28th day, the pre-brushing mean Plaque Index score for Group A was 0.71 and 0.70 for Group B. While the post-brushing mean Plaque Index score for Group A was 0.17 and 0.13 for Group B. The trend in the decline in the pre and post-brushing Plaque Index scores for both Group A and Group B was also noticed on 7th and 14th day. In all the occasions, a highly significant difference between pre- and post-brushing mean value was seen in both Group A and Group B (\( P < 0.001 \)). When comparing the Plaque Index scores for Group A subjects and Group B subjects, Group B subjects showed a borderline significance (\( P = 0.052 \)). The percentage of bleeding surfaces for Group A reduced from 21.74% on day 0 to 1.48% on the 28th day and for Group B the percentage of bleeding surfaces decreased from 14.94% on 0 day to 0 on the 28th day (Table 2). Group B subjects showed a statistically highly significant (\( P < 0.001 \)) reduction in the percentage of gingival bleeding surfaces when compared to Group A subjects.

**DISCUSSION**

Since bacterial plaque is the principal etiological agent for gingival and periodontal diseases, both prevention and treatment of these conditions must be based on a large extent on plaque control.\(^7\) Daily plaque removal with a toothbrush is an important component of oral hygiene programs intended to prevent and treat periodontal diseases.\(^8\)

This mechanical cleaning procedure is efficient, provided, the method used is sufficiently thorough and performed

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Table 1: Comparison of pre- and post-brushing mean Plaque Index scores for Group A and Group B subject, 0, 7th, 14th and 28th day

<table>
<thead>
<tr>
<th>Scores</th>
<th>0 day</th>
<th>7th day</th>
<th>14th day</th>
<th>28th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-brushing</td>
<td>Mean: 1.56</td>
<td>Mean: 1.77</td>
<td>Mean: 1.53</td>
<td>Mean: 1.43</td>
</tr>
<tr>
<td></td>
<td>SD: 0.44</td>
<td>SD: 0.34</td>
<td>SD: 0.54</td>
<td>SD: 0.54</td>
</tr>
<tr>
<td>Post-brushing</td>
<td>Mean: 0.81</td>
<td>Mean: 0.81</td>
<td>Mean: 0.58</td>
<td>Mean: 0.58</td>
</tr>
<tr>
<td></td>
<td>SD: 0.34</td>
<td>SD: 0.39</td>
<td>SD: 0.42</td>
<td>SD: 0.54</td>
</tr>
</tbody>
</table>

SD: Standard deviation
One of the primary reasons for the introduction of electric toothbrushes is to enhance cleaning of teeth, especially for people who are handicapped or who have poor manual dexterity. It is also of great use for those who are poorly motivated to brush their teeth. In general, the brush head of powered toothbrushes tends to be more compact than conventional manual toothbrushes. Movement of the brush head is powered from single battery units, magnetostrictive devices or electric elements mounted in the handle or stem of the brush. In addition to the effect of mechanical brushing, the concept of utilizing low-frequency acoustic energy to generate dynamic fluid activity and perhaps a mild cavitational effect has been developed to provide a “beyond the bristle tip” cleaning activity. These acoustic vibrations have been shown to have a significant effect in reducing the ability of oral bacteria to adhere to hard surfaces and are capable of disrupting dental plaque.

The result of this 4 weeks clinical trial demonstrates the effectiveness of the powered toothbrush 2D plaque removal and the manual toothbrush regular advantage plus in lowering plaque and gingivitis scores. Both clinically and statistically significant improvements in plaque and gingivitis scores were noted for both the manual and powered toothbrushes.

The time frame for this study was for 28 days (4 weeks), and the recordings were taken on the 0 day, 7th, 14th, and 28th day. This is in accordance with the studies designed by Killoy et al. 1989, Khocht et al. 1992, Stoltze and Bay 1994, Van der Weijden et al. 1994, where the safety and efficacy of the powered toothbrush with respect to plaque and gingivitis was assessed over a time period of 28 days (4 weeks).

Comparison of pre- and post-brushing mean Plaque Index scores of Group A and Group B on 0, 7th, 14th, and 28th day were found to be highly significant (P < 0.001). Thereby, indicating that both manual and powered toothbrushes effectively removed plaque on comparing the percentage of gingival bleeding surfaces between Group A and Group B showed a statistically highly significant reduction of bleeding surfaces to that of Group A.

**Table 2: The percentage of gingival bleeding surfaces for Group A and Group B**

<table>
<thead>
<tr>
<th>Groups</th>
<th>0 day</th>
<th>28th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>21.74</td>
<td>1.48</td>
</tr>
<tr>
<td>Group B</td>
<td>14.94</td>
<td>0</td>
</tr>
</tbody>
</table>

**CONCLUSION**

The present study was aimed at comparing the efficacy of the powered toothbrush (Braun 2D) to that of a manual toothbrush (40 regular advantage plus) for removal of supra-gingival plaque and improvement in gingival health.

The results of this study showed that all subjects who participated in the study showed a reduction in Plaque Index scores and improvement in gingival health whether they used a powered toothbrush or manual toothbrush. It is noteworthy, however, that on the 28th day subjects who used powered toothbrush showed a better reduction in Plaque Index scores and improvement in gingival health.

Within the limits of the design of the study, it was possible to make the following conclusions:

1. Group A (manual toothbrush) and Group B (powered toothbrush) subjects showed a decline in the Plaque Index from day 0 to 28th day
2. When comparing the Plaque Index scores for Group A subjects and Group B subjects, Group B subjects showed a borderline significance (P = 0.052)
3. The gingival index scores for Group A and Group B subjects showed that there was a reduction in gingival inflammation in both groups
4. There was no statistical significance when the gingival index scores for Group A subjects and Group B subjects were compared
5. Group B subjects showed a statistically highly significant (P <0.001) reduction in the percentage of gingival bleeding surfaces when compared to Group A subjects.

Though, the definite and gradual improvement in the reduction of plaque and health of gingiva in both groups was observed by the 4th week of this 28 days study. The results of the study showed that the powered toothbrush demonstrated clinical and statistical improvement in overall plaque and gingival scores. The findings of this study lend support to the argument that when compared with the manual toothbrush, the powered toothbrush has the potential to improve oral hygiene. Powered toothbrush offers an individual the ability to brush their teeth in a way that is optimum in terms of removing plaque and improving gingival health, thus conferring good brushing
technique on all those who use them, irrespective of manual dexterity or training. However, longitudinal studies are needed to assess the long-term effectiveness of these brushes on plaque and gingivitis.

REFERENCES


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