Tongue Cleansing Effect and Reduction in Oral Malodor Using a 360-Degree Rotating Head and Sonic Vibratory Electric Toothbrush

Jin-Sil Kim¹, Yun-Hee Mun², Seung-Chul Shin³

¹Department of Oral Health, Post Graduate School of Dankook University, Cheonan, ²Department of Dental Laboratory Technology, Daejeon Health Institute of Technology, Daejeon, ³Executive Committee, Asian Academy of Preventive Dentistry, Cheonan, Korea

Objective: This study was performed to investigate the effects of a newly developed 360-degree rotating head-type electric toothbrush on tongue plaque and oral malodor in comparison with traditional manual brushing.

Methods: In total, 60 adult volunteers who received compensation participated in this clinical study and were stratified to use either the experimental 360-degree rotating head electric toothbrush or a 360-degree head manual toothbrush control group. Tongue plaque index and volatile sulfur compound (VSC) measurements were calculated using the B&B checker (mBA-21; Plustech) after tongue cleansing instructions were given to both the groups (baseline). Similar data were further collected at 1 week, 2 weeks, and 4 weeks of using the study toothbrushes, and the values of the experimental and the control groups were compared at each period.

Results: Significantly different plaque index values between the two groups were observed at 1, 2, and 4 weeks; more specifically, lower values were recorded in the experimental group ($p < 0.05$). VSC level was also lower in the experimental group than in the control group ($p < 0.05$).

Conclusion: Use of the 360-degree rotating head-type sonic-care electric toothbrush is recommended over a manual toothbrush because of its effectiveness in mitigating tongue plaque and malodor in dental patients complaining of malodor.

Keywords: dental plaque, malodor, oral hygiene, sonic-care toothbrush

Introduction

Oral malodor is defined as an unpleasant smell that spreads throughout the oral cavity. Its main causative components volatile sulfuric compounds from materials such as the epithelial cells, food debris, metabolic bacterial components involved in proteolysis, and saliva [1]. Proper brushing of the teeth and tongue is the conventional method for controlling dental or tongue plaque and the onset and severity of malodor [2]. It has been determined that the dorsum of the tongue is one of the important sites for the growth of oral bacteria, especially Streptococcus mutans [3]. Therefore, this site in particular should be cleaned by proper tooth-brushing and tongue-brushing [4].
Tooth-brushing has been suggested to cleanse teeth by eliminating the dental plaque, gingival stimulation; it also controls oral malodor by eliminating the tongue plaque. Further, the onset of dental diseases such as dental caries and periodontal disease could be mitigated by tooth-brushing through the elimination of dental plaque or continued gingival stimulation because eliminating the tongue plaque removes causative factors for oral halitosis, located on the dorsum of the tongue [5-7].

To date, previous studies on the use of electric toothbrushes have mainly focused on plaque removal or the prevention of dental caries, or periodontal disease [8], but, to the best of our knowledge, there is limited information about tongue plaque removal or malodor control. Moreover, investigations considering outcomes obtained while using 360-degree rotating head electric toothbrushes are even rarer [9]. Therefore, in this study, we aimed to compare the results of tongue plaque removal and oral halitosis control using 360-degree head manual toothbrush and the electric toothbrush.

Materials and Methods

1. Subjects

Samples were collected using the G*power 3.1.9 program (Heinrich-Heine-University Dusseldorf, Dusseldorf, Germany), which suggests the minimum number of subjects required to obtain statistical significance if the study model had been decided upon. Therefore, the ideal sample was suggested as 65 subjects with a 0.25 effect size, and 95% credible rate and was tested with 5% of the decision level. Finally, 60 patients participated in this clinical study. All subjects were adult volunteers older than 20 years of age who provided written informed consent to participate. Some monetary compensation was given to all the participants for their four visits for oral examinations. This clinical study was performed after receiving institutional review board approval (DKU 2018-07-017) from the Research Institute, Dankook University.

2. Methods

Two types of 360-degree head-type toothbrushes were used, specifically MEGATEN DOROTHY (One Star International Co., Incheon, Korea) by the experimental group and LUX 360 for adults (One Star International Co.) by the control group, respectively (Figure 1).

The tongue plaque index [10] score with a maximum of 9 points and relative amounts of volatile sulfuric compounds were checked before the experiment, in all participants of both groups. Tooth-brushing instructions were given to both the groups which directed participants to brush 10 times repeatedly on the dorsum of the tongue from the end to the tip of the tongue. Tongue plaque index and oral malodor measurements were then calculated at 1 week, 2 weeks, and 4 weeks later the same standards and method. The tongue plaque index was estimated as the sum of the number of sectors in which tongue plaque was found, after dividing the dorsum of the tongue surface into nine sectors. Oral bad breath was checked for the relative amounts of volatile sulfuric compounds using the B&B checker (mBA-21; Plustech, Daejeon, Korea) [11]. The standardization of oral malodor with B&B value (BBV) level was as follows: normal, 0-50 BBV; mild, with slight malodor 50-70 BBV; moderate, with malodor possibly requiring some treatment, 70-90 BBV; and severe, with malodor definitely requiring some treatment, over 90 BBV.

The collected data were analyzed and compared between...
Table 1. Tongue plaque index

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Before</th>
<th>1 week</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>Time</th>
<th>Group</th>
<th>Time×Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp</td>
<td>30</td>
<td>4.20±1.00</td>
<td>2.93±0.91</td>
<td>2.40±0.62</td>
<td>2.03±0.76</td>
<td>0.00**</td>
<td>0.00**</td>
<td>0.00**</td>
</tr>
<tr>
<td>Con</td>
<td>30</td>
<td>3.90±0.88</td>
<td>3.67±1.15</td>
<td>3.37±1.00</td>
<td>3.90±0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are presented as number only or mean±standard deviation. Exp: experiment group, Con: control group. **p < 0.01 by repeated measure ANOVA test.

Table 2. Oral malodor

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Before</th>
<th>1 week</th>
<th>2 weeks</th>
<th>4 weeks</th>
<th>Time</th>
<th>Group</th>
<th>Time×Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp</td>
<td>30</td>
<td>71.37±13.59</td>
<td>55.57±8.82</td>
<td>49.01±7.93</td>
<td>45.70±7.23</td>
<td>0.00**</td>
<td>0.04*</td>
<td>0.00*</td>
</tr>
<tr>
<td>Con</td>
<td>30</td>
<td>66.17±19.19</td>
<td>62.70±18.29</td>
<td>59.53±17.73</td>
<td>62.53±16.08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are presented as number only or mean±standard deviation. Exp: experiment group, Con: control group. *p < 0.05, **p < 0.01 by repeated measure ANOVA test.

Results

1. Tongue plaque index

The tongue plaque index values for the experimental and control groups were 4.20±1.00 and 3.90±0.88 at baseline, 2.93±0.91 and 3.67±1.15 at 1 week, 2.40±0.62 and 3.37±1.00 at 2 weeks, and 2.03±0.76 and 3.90±0.96 at 4 weeks, respectively. There were significant differences observed between the experimental and control group at all three time points after the baseline (p<0.05). However, it was revealed that the tongue plaque index values progressively decreased with the use of both kinds of toothbrushes (p=0.005) (Table 1, Figure 2).

2. Oral malodor

Separately, in the experimental and control group, oral malodor value were 71.37±13.59 BBV and 66.17±19.19 BBV at baseline without a significant difference between the two groups (p>0.05). However, the values were subsequently adjusted to 55.57±8.82 BBV and 62.70±18.29 BBV at 1 week, 49.03±7.93 BBV 59.53±17.73 BBV at 2 weeks, and 45.70±7.23 BBV and 62.53±16.08 BBV at 4 weeks. These findings, in contrast to those at baseline, were significantly different (p<0.05).

These findings suggest that, in comparison to the manual toothbrush, the experimental toothbrush appeared to be the superior option for oral malodor control because of its stronger ability to decrease the amount of volatile sulfuric compounds (Table 2, Figure 3).

Discussion

Tooth brushing is the most effective method for eliminating dental and tongue plaque to maintain good oral hygiene [12]. It has been found that the most important factor in oral malodor is tongue plaque among the many other etiological factors for oral halitosis such as dryness of the mouth, dental caries, periodontal disease, poor oral hygiene, and systemic disease. Therefore, the proper type of toothbrush must be recommended not only to effectively remove dental plaque but also tongue plaque [4]. A 360-degree rotating head-type toothbrush was previously introduced to remove dental and tongue plaque [13]. In this study, we compared the effects of using this toothbrush and a comparable 360-degree head manual toothbrush on tongue plaque index and oral malodor.

It was revealed that the tongue plaque mitigation effect was stronger in the group who used the electric toothbrush than in...
the group who used the manual toothbrush, despite both toothbrushes having similarly shaped heads, at 1 week, 2 weeks, and 4 weeks of use. This suggests that tongue plaque could be more effectively eliminated using the 360-degree rotating head-type electric toothbrush than the manual toothbrush. This may be because the electric toothbrush offers both direct and mechanical cleansing on the dorsum of the tongue.

It was considered that the tongue plaque removal effect may be even stronger if proper oral hygiene education had been deployed in both the groups. Further, oral malodor may be affected due to supply of fluent water or moisture in the oral cavity. Therefore, it is recommended that the 360-degree rotating head-type electric toothbrush should be used instead of the manual toothbrush for controlling tongue plaque and decreasing oral malodor in dental patients in clinical settings.

Conclusion

We clinically experimented to elucidate the effects of tongue plaque removal and oral malodor control achieved using a 360-degree rotating head-type electric toothbrush in comparison with a similar-shaped manual toothbrush over a 1-month period. Tongue plaque index values and relative volatile sulfurous compound levels were measured and compared between the experimental and control groups at baseline, 1 week, 2 weeks, and 4 weeks. The obtained results were as follows:

1. The tongue plaque index was more strongly controlled in the experimental group who used the 360-degree rotating head-type electric toothbrush than in the control group who used the manual toothbrush, and there was a significant difference between the two groups (p<0.05).

Therefore, it is recommended that the 360-degree rotating head-type electric toothbrush should be used in dental patients with poor oral hygiene due to tongue plaque and oral malodor.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References