A Six-Week Clinical Evaluation of the Plaque and Gingivitis Efficacy of an Oscillating-Rotating Power Toothbrush with a Novel Brush Head Utilizing Angled CrissCross® Bristles Versus a Sonic Toothbrush

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Abstract

• **Objective:** To compare the efficacy of an oscillating-rotating power toothbrush with a novel brush head incorporating angled CrissCross® bristles (Oral-B® Triumph® with SmartGuide with Oral-B CrossAction® brush head) versus a sonic toothbrush (Sonicare® DiamondClean) for plaque and gingivitis reduction over a six-week period.

• **Methods:** This was a single-center, randomized, examiner-blind, two-treatment, parallel group study involving 65 subjects per group. Subjects presenting with mild-to-moderate gingivitis at Baseline were randomly assigned to either the oscillating-rotating brush or the sonic brush. They were instructed to use their assigned toothbrush and a standard fluoride dentifrice for two minutes twice daily at home for six weeks. Gingivitis and plaque were assessed at Baseline and Week 6 using the Modified Gingival Index (MGI), Gingival Bleeding Index (GBI), and Rustogi Modified Navy Plaque Index (RMNPI). Data were analyzed using an Analysis of Covariance (ANCOVA), with baseline as the covariate. Subjects also completed a consumer perception questionnaire to evaluate their brushing experience.

• **Results:** One-hundred and thirty subjects were enrolled in the study and randomized to treatment. Sixty-four subjects per group completed the trial. Both brushes produced statistically significant reductions in gingivitis and plaque measures at Week 6 relative to Baseline (p < 0.001 for all). The oscillating-rotating brush with the novel brush head demonstrated statistically significantly greater reductions in all gingivitis and plaque measures compared to the sonic toothbrush. The benefits for the oscillating-rotating brush over the sonic brush were 32.6% for gingivitis, 35.4% for gingival bleeding, 32% for number of bleeding sites, 22% for whole mouth plaque, 24.2% for gingival margin plaque, and 33.3% for approximal plaque (p ≤ 0.001 for all measures except gingival margin plaque, where p = 0.018). Analysis of the consumer perception questionnaire results showed subjects using the oscillating-rotating brush rated it higher for overall use experience and key attributes related to cleaning, gentleness, and brush head shape/size versus subjects in the sonic brush group. There were no adverse events reported or observed for either brush.

• **Conclusion:** This six-week randomized, examiner-blind, comparative clinical study showed the oscillating-rotating toothbrush, with a novel brush head incorporating angled CrissCross bristles, was significantly better than an advanced sonic power toothbrush at reducing gingival inflammation and bleeding, as well as reducing whole mouth plaque, plaque along the gumline, and in the approximal regions.

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Introduction

An oral hygiene regimen that is highly effective at controlling plaque biofilm, performed at least twice a day, will help treat and prevent gingivitis, the first stage of periodontal disease. Early signs of gingivitis include red or swollen gums that may bleed when brushing or using interdental cleaning devices. If not treated, gingivitis can lead to more advanced disease, including periodontitis, which currently affects 10–15% of the adult population worldwide.

Optimizing supragingival plaque biofilm removal by tooth brushing is fundamental to maintaining good gingival health. One significant advance in manual toothbrush design was the introduction of Oral-B® CrossAction®. This brush has an innovative design in which filament tufts are arranged in a unique CrissCross® pattern, with filaments inclined at 16° angles. Since its introduction, the Oral-B CrossAction has proven to be a leading manual toothbrush that maximizes plaque biofilm removal, as demonstrated in both laboratory and clinical studies. A five-year literature review (2000–2005) found the brush consistently demonstrated significant advantages for plaque removal relative to other marketed toothbrushes in laboratory, single-brushing, and longer-term studies.
Another significant advance in toothbrush technology was the introduction of the oscillating-rotating power toothbrush. With this technology the brush head moves back and forth, with alternating turns clockwise and counter-clockwise. Contemporary advanced models provide 8,800 oscillations per minute. The benefit of oscillating-rotating toothbrushes on plaque removal and gingival health has been demonstrated in more than 150 clinical studies; safety has been assessed as an endpoint in more than 100 trials. A systematic review of clinical trials comparing powered and manual toothbrushes for plaque removal and gingivitis reduction found only the oscillating-rotating brush technology to be better than manual toothbrushes at removing plaque and reducing gingival inflammation. No other powered designs were as consistently superior to manual toothbrushes.10-11

The oscillating-rotating action of the toothbrush is one factor in the mechanical means of plaque biofilm removal; another is the design of the brush head, including angulation of the bristles. The direction of the bristles relative to the tooth surface is critical to applying a shear force necessary for effective plaque biofilm removal. The motion of vertical bristles has been shown to be effective at removing plaque on smooth surfaces, but penetration of approximal areas is poor.12

Recently, the 16° angle inclined bristle filament design of the CrossAction manual toothbrush has been applied to an oscillating-rotating power brush head in the Oral-B CrossAction (Figure 1). The outer ring of the brush head has an angle of +16° for the oscillation’s forward direction, while the inner ring has an angle of −16° for the backward direction. The angled bristles fan open in a controlled manner, covering a broad area of the tooth surface. The central tuft contains straight filaments to provide stability of the filament design. The brush head also has a novel high-low trim for better contour adaptation, as well as high bristle density for effective, yet gentle cleaning.

The purpose of this study was to compare the efficacy of an oscillating-rotating power toothbrush with the novel brush head with angled CrissCross bristles versus an advanced sonic toothbrush for plaque and gingivitis reduction over a six-week period.

Materials and Methods

This was a six-week, randomized, two-treatment, examiner-blind, parallel group study. The study protocol was approved by an Institutional Review Board (BRCL). One-hundred and thirty-one subjects were recruited and asked to sign a written informed consent prior to their participation in the study. At the baseline visit, subjects were given an oral soft tissue examination, followed by assessment of gingivitis using the Modified Gingival Index (MGI) and the Gingival Bleeding Index (GBI), and plaque using the Rustogi Modified Plaque Index (RMPI).14-16

To qualify for the study, subjects were required to have a baseline plaque score greater than 0.5 and a gingivitis score (MGI) greater than or equal to 1.75 and less than 2.3. In addition, subjects had to be at least 18 years of age, in good general health, and have a minimum of 16 natural teeth with facial and lingual scorab surfaces. Subjects had to agree not to participate in any other clinical study during their enrollment in this study, and were required to delay any elective dentistry, including dental prophylaxis, until study completion. Subjects also had to agree to refrain from using non-study oral hygiene products for the duration of the study, to refrain from brushing their teeth and performing any other oral hygiene procedures for 12 hours prior to each visit, and to refrain from eating, chewing gum, drinking, and tobacco use for four hours prior to each visit, except for small sips of water up until 45 minutes prior to each visit. Subjects were advised that they would be excluded from the study if there was evidence of existing poor oral hygiene (e.g., severe periodontal disease, grossly carious or extensively restored teeth), or if antibiotics or chlorhexidine mouthrinse had been used within two weeks prior to the start of the study. Subjects were also excluded if there was evidence of any disease or condition that may interfere with study procedures.

Qualifying subjects were then stratified based on their baseline MGI scores, whole mouth mean RMPI scores, tobacco use, and typical toothbrush used at home (manual brush or power brush), and then randomly assigned to one of two treatment groups (Figure 1):

- The oscillating-rotating brush with the novel brush head incorporating angled CrissCross bristles (Oral-B Triumph with SmartGuide with Oral-B CrossAction brush head, D34/EB50, Procter & Gamble, Cincinnati, OH, USA); or
- The marketed sonic toothbrush (Sonicare DiamondClean fitted with the Standard brush head, Snoqualmie, WA, USA).

Subjects were supplied with their assigned toothbrush and a standard anticavity dentifrice in an area separate from the examination room to ensure the examiner was blinded to treatment assignment. Under supervision by a member of the research staff not associated with the clinical assessments, subjects then received oral hygiene and product usage instructions (per manufacturers’ usage instructions), in front of a mirror for on-site practice. Subjects were then instructed to brush with their assigned products for two minutes twice daily at home for six weeks. The on-site supervised brushing at the baseline visit was considered one of the subject’s twice-daily brushings.

Subjects were scheduled to return to the research center with

Figure 1. (a) Sonic brush and oscillating-rotating brush (b) sonic standard brush head and oscillating-rotating novel brush head with angled bristles (c) SmartGuide (with oscillating-rotating brush).
their study product for their Week 6 (± 2 days) visit. They were reminded prior to this visit that they should refrain from brushing their teeth for 12 hours prior to their appointment time, and that for four hours before the visit they were to refrain from eating, chewing, drinking, or smoking.

At the Week 6 visit, subjects received an oral soft tissue examination, MGI, GBI, and RMNPI plaque assessments as conducted at the baseline visit. Following the safety and clinical assessments at the Week 6 visit, subjects completed an electronic consumer perception questionnaire.

Safety and Efficacy Clinical Assessments

An experienced examiner carried out the safety assessment, as well as the three clinical assessments for each subject. The examiner was blinded to the subject’s assigned treatment group.

The safety assessment involved both the hard and soft tissues of the oral cavity. The structures examined included the free and attached gingiva, hard and soft palate, tongue, floor of the mouth, buccal mucosa, labial mucosa, mucobuccal/mucolabial folds, oropharynx/uvula, lips, and perioral area. Any abnormal findings or voluntarily reported adverse events were recorded.

The MGI gingivitis evaluation scored inflammation on six gingival areas (distobuccal, buccal, mesiobuccal, mesiolingual, lingual, and distolingual) of all scorable teeth using a scale of 0–4 as follows: 0 = normal (absence of inflammation); 1 = mild inflammation (slight change of color, little change in texture) of any portion of, but not the entire marginal or papillary gingival unit; 2 = mild inflammation of the entire gingival unit; 3 = moderate inflammation (moderate glazing, redness, edema, and/or hypertrophy) of the marginal or papillary gingival unit; and 4 = severe inflammation (marked redness and edema/hypertrophy, spontaneous bleeding, or ulceration) of the marginal or papillary gingival unit. Whole mouth MGI scores were computed by summing all scores and dividing by the number of scored sites examined.

The GBI assessment immediately followed; the gingiva was lightly air-dried and a periodontal probe with a 0.5 mm tip was inserted into the gingival crevice to a depth of 2 mm or until slight resistance was felt. The probe was then run gently around the tooth at an angle of approximately 60° and in contact with the sulcular epithelium. Minimum axial force was used to avoid undue penetration into the tissue, and the probe was moved around the crevice, gently stretching the epithelium. Each of six gingival areas as described above of the scored teeth was probed in a likewise manner, waiting approximately 30 seconds before recording the number of gingival units which bled, according to the following scale: 0 = absence of bleeding after 30 seconds; 1 = bleeding observed after 30 seconds; and 2 = immediate bleeding observed. GBI score was characterized as 0, 1, or 2 to determine total number of bleeding sites.

The RMNPI was then used to score plaque biofilm on the teeth. Plaque was scored as either present (score = 1) or absent (score = 0) on each of nine tooth areas (A–I) on both buccal and lingual surfaces. This gives a total of 504 sites for all 28 teeth (excluding third molars, crowns, and surfaces with cervical restorations). Mean RMNPI scores (total number of tooth areas with plaque present/total number of tooth areas scored) were calculated for each subject at both the baseline and Week 6 examination as follows: for the whole mouth (areas A–I), along the gingival margin (gumline, Areas A, B, C), and for approximal surfaces (areas D and F).

Consumer Perception Assessment

The questionnaire was designed to assess subjects’ opinions of their respective test toothbrushes. Questions focused on attributes such as overall usage experience, perception of cleaning, gentleness, and feel during brushing.

Data Analysis

Power analysis based on whole mouth MGI variability of 0.0472 estimated that a sample size of 65 subjects per treatment group would provide 90% power to detect a difference of about 0.027 MGI units between measurements. Power analysis based on whole mouth RMNPI variability of 0.043 estimated a similar sample size to provide the same power to detect a group treatment difference of about 0.024 RMNPI units.

Age was compared for group differences using a two-sample t-test, and gender and race were compared using a Chi-Square test and Fisher’s Exact test, respectively. Mean treatment group MGI score and number of bleeding sites, and whole mouth, gumline, and approximal RMNPI scores were calculated separately for both visits (Baseline and Week 6). Analysis for gingivitis efficacy was based on average MGI and number of bleeding site changes from baseline at Week 6, with MGI changes as the primary endpoint. Analyses for plaque efficacy were based on average RMNPI changes from baseline at Week 6. Within-brush differences from Baseline at six weeks for MGI, number of bleeding sites, whole mouth RMNPI, and approximal RMNPI were tested versus zero using an ANCOVA model, with the respective baseline value as the covariate. For gingival margin RMNPI, an ANOVA model was utilized to test baseline differences significant from zero. An ANCOVA was used to determine treatment differences, with baseline scores as covariates. The consumer study results were analyzed with t-tests. All statistical tests were two-sided and a significance level of α = 0.05 was used.

Results

A total of 130 subjects were enrolled in the study and randomized to treatment (65 to oscillating-rotating group, 65 to sonic group); 128 subjects completed the study (64 per group). Subjects’ ages ranged from 19 to 69 years, with a mean age of 42.9 years in the oscillating-rotating group and 45.2 years in the sonic group. Sixty-nine percent of all subjects were female and 62% were Caucasian. In addition, 94% of participants were non-smokers. The groups were well-balanced in terms of age, gender, and ethnicity (p ≥ 0.254; Table I).

MGI and GBI Scores

Subjects enrolled in this study presented with mild-to-moderate gingivitis (Baseline MGI score of 1.75 to 2.3). Mean Baseline and Week 6 MGI scores, GBI scores, and number of bleeding sites are shown in Table II. There was no significant difference between groups at Baseline for MGI; however, the sonic group had statistically higher scores at Baseline for GBI and number of bleeding sites. Both groups showed significant (p < 0.001) reductions from
Baseline in MGI scores, GBI scores, and number of bleeding sites at Week 6. Gingivitis reductions at Week 6 versus Baseline were 13.8% for the oscillating-rotating group and 10.4% for the sonic group as assessed by MGI.

### Table I

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Oscillating-Rotating (N = 65)</th>
<th>Sonic (N = 65)</th>
<th>Total (N = 130)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years) &lt;sup&gt;a&lt;/sup&gt;</td>
<td>42.9</td>
<td>45.2</td>
<td>44.1</td>
</tr>
<tr>
<td>SD</td>
<td>12.21</td>
<td>11.69</td>
<td>11.97</td>
</tr>
<tr>
<td>Minimum</td>
<td>19</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Maximum</td>
<td>66</td>
<td>69</td>
<td>69</td>
</tr>
<tr>
<td>Sex &lt;sup&gt;b,c&lt;/sup&gt;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>42 (64.6%)</td>
<td>48 (73.9%)</td>
<td>90 (69.2%)</td>
</tr>
<tr>
<td>Male</td>
<td>23 (35.4%)</td>
<td>17 (26.1%)</td>
<td>40 (30.8%)</td>
</tr>
<tr>
<td>Race &lt;sup&gt;b,d&lt;/sup&gt;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Asian Indian</td>
<td>13 (20.0%)</td>
<td>13 (20.0%)</td>
<td>26 (20.0%)</td>
</tr>
<tr>
<td>Asian Oriental</td>
<td>3 (4.6%)</td>
<td>4 (6.2%)</td>
<td>7 (5.4%)</td>
</tr>
<tr>
<td>Black</td>
<td>12 (18.5%)</td>
<td>3 (4.6%)</td>
<td>15 (11.5%)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>36 (55.4%)</td>
<td>45 (69.2%)</td>
<td>81 (62.3%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (1.5%)</td>
<td>0 (0%)</td>
<td>1 (0.8%)</td>
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<tr>
<td>Smoke &lt;sup&gt;b,d&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5 (7.7%)</td>
<td>3 (4.6%)</td>
<td>8 (6.1%)</td>
</tr>
<tr>
<td>No</td>
<td>60 (92.3%)</td>
<td>62 (95.4%)</td>
<td>122 (93.9%)</td>
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<tr>
<td>Brush Type &lt;sup&gt;b,c&lt;/sup&gt;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td>65 (76.9%)</td>
<td>65 (76.9%)</td>
<td>100 (76.9%)</td>
</tr>
<tr>
<td>Power</td>
<td>15 (23.1%)</td>
<td>15 (23.1%)</td>
<td>30 (23.1%)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Two sample t-test was used to compare mean age between the two treatment groups (p = 0.587).

<sup>b</sup> Number and percent of subjects in each category.

<sup>c</sup> Chi-Square test was used to assess gender and brush type balance between the two groups (p = 0.254 and p = 1.000, respectively).

<sup>d</sup> Fisher’s Exact test was used to assess race and smoking status balance (p = 0.085 and p = 0.718, respectively) between the two groups.

Bleeding (GBI) was reduced by 63.1% for the oscillating-rotating group and 38.1% for the sonic group at Week 6 relative to Baseline. The number of bleeding sites was reduced by 63.9% for the oscillating-rotating group and 38.9% for the sonic group (Figure 2).

The oscillating-rotating brush with the novel brush head demonstrated statistically significantly greater reductions in all gingivitis measures compared to the sonic toothbrush. The benefits for the oscillating-rotating brush were 32.6% for gingivitis (MGI), 35.4% for gingival bleeding (GBI), and 32% for number of bleeding sites (p < 0.001 for all measures).

### Plaque

Subjects presented with evidence of plaque accumulation at study entry (Baseline whole mouth RMNPI score > 0.50). Mean Baseline and Week 6 whole mouth, gingival margin, and approximal RMNPI scores for both groups, and mean changes in scores from Baseline, are shown in Table III. There were no significant differences between groups at Baseline for the three plaque measurements. Both groups showed significant (p < 0.001) reductions from Baseline in whole mouth, gingival margin, and approximal plaque scores at Week 6. Whole mouth plaque reductions versus Baseline were 20.3% for the oscillating-rotating group and 16.3% for the sonic group; gingival margin plaque reductions were 7.7% for the oscillating-rotating group and 6.2% for the sonic group; and approximal plaque was reduced by 28.4% for the oscillating-rotating group and 21.3% for the sonic group (Figure 3). The analysis of group differences showed the oscillating-rotating brush had statistically significantly greater reductions in whole mouth plaque (22.0%), gingival margin plaque (24.2%), and approximal plaque (33.3%) after 6 weeks of brushing compared to the sonic brush.

### Table II

Mean Baseline and Week 6 MGI, GBI, and Bleeding Site Reductions from Baseline at Week 6

<table>
<thead>
<tr>
<th>Visit/Group</th>
<th>Baseline Mean (SD)</th>
<th>6-Wk Adj. Mean Reduction from Baseline (SE): % Change</th>
<th>% Difference Between Brushes</th>
<th>p-value*</th>
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<tbody>
<tr>
<td>Modified Gingival Index</td>
<td></td>
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<td></td>
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<tr>
<td>Oscillating-Rotating</td>
<td>2.060 (0.0806)</td>
<td>0.285 (0.0087);13.8</td>
<td>32.6</td>
<td>&lt; 0.001</td>
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<tr>
<td>Sonic</td>
<td>2.075 (0.0998)</td>
<td>0.215 (0.0087);10.4</td>
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<tr>
<td>Gingival Bleeding Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oscillating-Rotating</td>
<td>0.103 (0.0522)</td>
<td>0.065 (0.0024);63.1</td>
<td>35.4</td>
<td>&lt; 0.001</td>
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<tr>
<td>Sonic</td>
<td>0.126 (0.0737)</td>
<td>0.084 (0.0024);38.1</td>
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<tr>
<td>Number of Bleeding Sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Oscillating-Rotating</td>
<td>15.5 (7.73)</td>
<td>9.9 (0.34);63.9</td>
<td>32.0</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sonic</td>
<td>19.3 (10.71)</td>
<td>7.5 (0.34);38.9</td>
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</tr>
</tbody>
</table>

*Between-group differences

### Table III

Mean Baseline and Week 6 Plaque Reductions from Baseline at Week 6

<table>
<thead>
<tr>
<th>Visit/Group</th>
<th>Baseline Mean (SD)</th>
<th>6-Wk Adj. Mean Reduction from Baseline (SE): % Change</th>
<th>% Difference Between Brushes</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Mouth Plaque</td>
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<tr>
<td>Oscillating-Rotating</td>
<td>0.606 (0.0393)</td>
<td>0.123 (0.0046);20.3</td>
<td>22.0</td>
<td>0.001</td>
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<tr>
<td>Sonic</td>
<td>0.614 (0.0498)</td>
<td>0.100 (0.0046);16.3</td>
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<tr>
<td>Gingival Margin Plaque</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Oscillating-Rotating</td>
<td>0.999 (0.0058)</td>
<td>0.077 (0.0044);7.7</td>
<td>24.2</td>
<td>0.018</td>
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<tr>
<td>Sonic</td>
<td>0.999 (0.0031)</td>
<td>0.062 (0.0044);6.2</td>
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<tr>
<td>Approximal Plaque</td>
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<td></td>
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<tr>
<td>Oscillating-Rotating</td>
<td>0.987 (0.0414)</td>
<td>0.280 (0.0130);28.4</td>
<td>33.3</td>
<td>&lt; 0.001</td>
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<tr>
<td>Sonic</td>
<td>0.686 (0.0396)</td>
<td>0.210 (0.0130);21.3</td>
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</tbody>
</table>

*Between-group differences
Consumer Perception Survey

Subjects in the oscillating-rotating group rated their brush significantly higher than those in the sonic brush group for overall rating, cleaning, gentleness, brush-head shape/size, and use experience attributes (Figure 4). Scores were not significantly different for the other attributes (not shown), although the majority numerically favored the oscillating-rotating brush.

No product-related adverse events or safety concerns were observed or reported in either group.

Discussion

Inadequate oral hygiene is the most common factor associated with the occurrence of gingivitis. Therefore, efficient removal of plaque biofilm from the teeth and gingiva represents a significant step toward preventing the condition and thereby reducing the potential for progression to a more advanced disease state, i.e., periodontitis. Effective plaque control can be achieved by brushing twice daily using an efficient technique and brushing for an appropriate length of time (recommended two minutes). Since individual brushing techniques have been found
to be less than adequate for optimal plaque control, brush manufacturers have addressed this ongoing need by modifying the design of both toothbrush handles and brush heads to assist the patient in achieving this goal.

One pivotal manual toothbrush innovation was the Oral-B CrossAction, which incorporated filament tufts arranged in a unique CrissCross design with filaments inclined at 16° angles. Numerous laboratory and clinical investigations have proven CrossAction's efficacy in maximizing plaque removal. A recent systematic review supports the effectiveness of the angled manual toothbrush design relative to brushes with flat-trim or multi-level bristle designs. After evaluating 59 papers with 212 brushing exercises as separate legs of the experiments, Slot and colleagues found the angled bristle design numerically showed the highest mean plaque reduction. Studies using the Quigley and Hein Plaque Index showed the angled brush had a mean plaque removal of 39% compared to 24% for flat trim and 33% for multi-level brushes. Mean plaque removal based on the Navy Plaque Index was 61% for brushes with angled bristles compared to 47% for flat trim and 54% for multilevel brushes. This evidence indicates that bristle tuft arrangement, i.e., flat trim, multilevel, or angled, is an important factor in plaque removal efficacy.

The objective of this six-week study was to assess the relative gingivitis and plaque reduction effectiveness of an oscillating-rotating power brush with a novel brush head (Oral-B CrossAction), which was designed based on the angled bristle configuration introduced with the CrossAction manual toothbrush. The comparison brush in this study was an advanced sonic toothbrush with a side-to-side mode of action and straight filament brush head. This brush provides up to 31,000 brush strokes per minute. The brush is reported to remove up to 45% more plaque versus the Sonicare FlexCare power toothbrush, and showed a significant reduction in gingivitis and bleeding sites after two weeks when compared to a manual toothbrush.

Results of this trial showed the oscillating-rotating brush with the novel brush head provided statistically significant advantages (p ≤ 0.001 unless otherwise noted) over the sonic brush: 32.6% for gingivitis; 35.4% for gingival bleeding; 32% for number of bleeding sites; 22% for whole mouth plaque; 24.2% for gingival margin plaque (p = 0.018); and 33.3% for approximal plaque. These results are consistent with a recent clinical trial reported by Klukowska, et al., which showed an oscillating-rotating power brush provided significantly greater reductions in plaque and gingivitis compared to the Sonicare DiamondClean after six and 12 weeks of use.

Numerous other publications corroborate these findings. A systematic review by Deacon, et al. in 2011 compared different power toothbrush technologies for plaque and gingivitis control. Brushes with a rotation-oscillation action were found to reduce plaque and gingivitis more than those with a side-to-side (sonic) action in the short term (four to 12 weeks). In addition to the therapeutic benefits offered by the new brush head with angled bristles, the consumer perception questionnaire indicated it is well-accepted by users. The brush was rated significantly higher than the sonic brush overall, as well as for attributes related to cleaning (e.g., clean feel between teeth, at gumline), gentleness (e.g., gentle on gums), and brush-head shape/size (e.g., how bristles wrap around tooth, reach all areas).

In view of the need to help patients attain optimal oral health, combining an effective power toothbrush handle with the new brush head design based on angled CrissCross bristles is a significant advancement; it not only reaches hard-to-clean surfaces of the tooth, but also provides the shear force necessary to remove plaque biofilm. This study provides the dental professional with further evidence for differentiating between power toothbrush products, and assists them in offering an effective option for plaque removal and gingivitis reduction for their patients.

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