Plaque removal efficacy of an advanced rotation-oscillation power toothbrush versus a new sonic toothbrush

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ABSTRACT: Purpose: To evaluate the plaque removal efficacy and safety of an advanced rotation-oscillation power toothbrush relative to a newly-introduced sonic toothbrush. Methods: This study used a randomized, examiner-blind, two-treatment, four-period, four-sequence crossover design. Subjects received both toothbrushes (Oral-B Triumph and Sonicare FlexCare) and a standard dentifrice from the study site and used each toothbrush at home during an acclimation phase prior to their plaque measurement visits. After abstaining from all oral hygiene for 24 hours, subjects returned to the study site and were assessed with the Rustogi Modified Navy Plaque Index. They then brushed for 2 minutes with their first randomly-assigned toothbrush and post-brushing plaque scores were recorded. This procedure was followed for three additional study visits, with subjects using their normal at-home toothbrush and dentifrice for the 2- to 5-day washout periods between visits. Subjects always abstained from all oral hygiene for 24 hours prior to their visits. Results: 45 subjects completed the study. Both brushes were found to be safe and both significantly reduced plaque after a single brushing. Oral-B Triumph was statistically significantly (P< 0.0001) more effective in plaque removal than Sonicare FlexCare for whole mouth plaque scores, gingival marginal plaque scores and interproximal plaque scores. Compared to Sonicare FlexCare, the adjusted mean plaque reduction scores for Oral-B Triumph were 21%, 23% and 22% greater for whole mouth, marginal and interproximal areas, respectively. (Am J Dent 2008;21:185-188).

CLINICAL SIGNIFICANCE: The Oral-B Triumph oscillating/rotating/pulsating toothbrush was significantly more effective in plaque removal after a single 2-minute brushing than the new Sonicare FlexCare toothbrush. This advantage was clear not only for whole-mouth plaque but also for tooth surfaces along the gingival margin and interproximal surfaces.

Introduction

Effective control of dental plaque is critical for the prevention of dental caries, gingivitis and periodontal disease.1,4 The toothbrush is the primary instrument for removing dental plaque from teeth. Unfortunately a large proportion of the general population does not brush effectively, resulting in a high incidence of plaque-induced gingivitis.5 Powered toothbrushes were introduced commercially in the early 1960’s as a replacement for manual toothbrushes.5,6 Over the past 40 years, a number of powered toothbrushes have been developed. In recent literature, they have been classified based on mode of action into five groups: side to side action, counter-oscillation, rotation-oscillation, circular, and ultrasonic.10,11

All of these classes of powered toothbrushes have been advanced forward into the marketplace on the premise that they help control plaque better than manual toothbrushes. A comprehensive evidence based meta-analysis involving 29 studies and 2,547 subjects compared plaque removal with power toothbrushing versus manual toothbrushing and concluded that there is a general lack of evidence regarding power toothbrush superiority to manual toothbrushes, with the notable exception of rotation-oscillation powered toothbrushes.10 The conclusions from the research were that powered toothbrushes with rotation-oscillation action achieved larger reductions in plaque and gingivitis relative to manual toothbrushes. None of the other power toothbrush types (side to side action, circular, counter oscillation, or ultrasonic) were found to be superior to manual toothbrushing in the reduction of plaque and gingivitis.

Oral-B developed the rotation-oscillation action powered toothbrush which had a small circular brush head in the 1990s. Short and long-term studies have shown that this brush is significantly more effective than manual brushing.12,13 A further technical advance was the introduction of a high frequency pulsating movement in the direction of the long axis of the filaments; this was combined with the oscillating/rotating action of the brush head in the Oral-B 3D models, now known as the Oral-B ProfessionalCare Series.a,14,15 These rotation-oscillation toothbrushes have repeatedly been shown to be superior for plaque removal relative to sonic toothbrushes. Three independent studies have confirmed that Oral-B Professional Care toothbrushes remove statistically significantly more plaque than Sonicare Plus in both single use and 4-week studies.16-18 Furthermore, superior reductions in gingivitis and bleeding were observed in the Oral-B Professional Care treatment group as compared to the Sonicare Plus treatment group in the 4-week studies.17,18

The most recent model to be introduced in the Oral-B ProfessionalCare Series is Oral-B Triumph ProfessionalCare 9000 which incorporates advances over some earlier models within the series, including increased oscillating and pulsating frequency.19 It has recently been tested in a pair of single brushing plaque removal clinical studies versus Sonicare Elite, where Oral-B Triumph was statistically significantly more effective than Sonicare Elite with respect to plaque removal.20
Plaque removal in the hard-to-reach approximal (interproximal) regions for Oral-B Triumph was 21% better than Sonicare Elite with the standard head and 12% better than Sonicare Elite with the compact head. In contrast, a recent single brushing study found that Sonicare Flexcare, an upgraded version of Sonicare Elite, removed statistically significantly more plaque than Oral-B Triumph ProfessionalCare 9000. The present study reported herein was undertaken to assess the plaque removal efficacy of Oral-B Triumph with the FlossAction brush head, designed with soft, flexible MicroPulse bristles to increase approximal penetration and improve plaque removal, versus a new sonic power toothbrush with side-to-side action (Sonicare Flexcare).

Materials and Methods

This was a two-treatment, randomized, examiner-blind, four-period crossover, single-center study conducted at BioSci Research Canada Ltd, Mississauga, Ontario, Canada. The study protocol and written informed consent were reviewed and approved by an institutional review board prior to study initiation. The toothbrushes used in the study were:

- Oral-B Triumph power brush with a round brush head and a three-dimensional motion (oscillating/rotating/pulsating). It operates at 8,800 oscillations/40,000 pulsations per minute. The toothbrush was fitted with a FlossAction brush head.
- Sonicare FlexCare, a newly-released power brush with a conventionally shaped brush head and a side-to-side motion. It operates at a frequency of 260 Hz. The Easy-Start feature was deactivated prior to use and the brush was used in “Clean” mode. This toothbrush was fitted with a ProResults brush head.

Forty-eight subjects between the ages of 18-70 and in general good health were enrolled in this study. Subjects were required to have at least 16 natural teeth with facial and lingual surfaces which were gradable using the Rustogi Modified Navy Plaque Index (RMNPI) (Fig. 1). Subjects were excluded from the study if they had orthodontic appliances or removable partial dentures or if they had evidence of severe periodontal disease, were under treatment for periodontal disease or had evidence of severe periodontal disease, were under treatment for periodontal disease or had evidence of severe periodontal disease.

Subjects were given both study toothbrushes and were provided with written acclimation phase instructions. The site staff ensured that the subjects read and understood the brushing instructions. Subjects were provided with a standard dentifrice and instructed, each subject was given instructions on how to use the brushes for approximately 5-6 days at home in the following manner: use the Oral-B Triumph toothbrush for two uses, and then switch to the Sonicare FlexCare toothbrush.

At study Visit 1, subjects completed an informed consent form and were reviewed for study inclusion/exclusion criteria. Subjects were given both study toothbrushes and were provided with written acclimation phase instructions. The site staff ensured that the subjects read and understood the brushing instructions. Subjects were provided with a standard dentifrice (Crest Cavity Protection) to use at home. Subjects were asked to use the brushes for approximately 5-6 days at home in the following manner: use the Oral-B Triumph toothbrush for two uses, then switch to the Sonicare FlexCare toothbrush. Continue using the Sonicare FlexCare toothbrush until approximately 24 hours prior to the subject’s return to the site for the start of the first study period. Included with the usage instructions, each subject was given instructions on how to use each brush after being shown how to use them at the site by study staff. Subjects were instructed not to use any other oral hygiene products during the acclimation period.

At study Visit 2, subjects were reviewed for continuance criteria, swished with disclosing solution in order to disclose their plaque and then received a baseline plaque examination by a single examiner. They were then instructed to brush for 2 minutes with their assigned toothbrush (one of the brushes used ...
were performed using all subjects. Within-treatment analyses of RMNPI reductions. ANCOVA was not used for these supplemental average gingival margin scores and for average interproximal scores (the primary efficacy variable), supplemental analyses are presented in Table 2. These results show that statistically significantly (P= 0.0001) more plaque was removed relative to Sonicare FlexCare following 2 minutes of brushing for the whole mouth, along the gingival margin and in interproximal areas.

Subjects had plaque data recorded at Visit 2, however this single-visit data was not included in the statistical analysis. Table 1 displays the demographic information for the 45 subjects included in the statistical analysis.

The treatment groups were well balanced and there were no significant differences in pre-brushing RMNPI scores. Both toothbrushes showed statistically significant reductions in RMNPI scores from pre-brushing to post-brushing (all P < 0.0001).

A preliminary analysis of RMNPI reductions was performed to test for differential carryover effects between the two treatment groups. No statistically significant differential carryover effect was detected for whole mouth (P = 0.526), gingival marginal (P = 0.679) or interproximal (P = 0.259) reductions in RMNPI scores. The comparison of treatments was performed using an ANCOVA or ANOVA with the carryover term deleted from the model.

Comparisons between treatment groups of the adjusted mean plaque reduction scores (changes from pre to post-brushing RMPI scores) from the ANCOVA and ANOVA analyses are presented in Table 2. These results show that statistically significantly (P= 0.0001) more plaque was removed with Oral-B Triumph than with Sonicare FlexCare following 2 minutes of brushing for the whole mouth, along the gingival margin and in interproximal areas.

Relative to Sonicare FlexCare, adjusted mean plaque reduction scores for Oral-B Triumph were 21%, 23% and 22% greater for whole mouth, marginal and interproximal areas respectively. The adjusted mean plaque reduction scores are displayed graphically in Fig. 2. There were no adverse effects reported in the study.

**Discussion**

Plaque removal benefits have been reported for rotation-oscillation power brushes and sonic toothbrushes. However, results of this study are consistent with the existing literature regarding the superiority of rotation-oscillation toothbrushes to sonic toothbrushes. The results show that statistically significantly (P= 0.0001) more plaque was removed with Oral-B Triumph than with Sonicare FlexCare following 2 minutes of brushing for the whole mouth, along the gingival margin and in interproximal areas. Relative to Sonicare Flex-
Care, adjusted mean plaque reduction scores for Oral-B Triumph were 21%, 23% and 22% greater for whole mouth, marginal and interproximal areas respectively. In a report of two independent studies, Oral-B Triumph was statistically significantly more effective than Sonicare Elite with respect to the whole mouth, along the gingival margin and in interproximal areas. In particular, plaque removal in the hard-to-reach approximal regions was 21% better than for Sonicare Elite with the standard head and 12% better than for Sonicare Elite with the compact head. Previous comparisons of Oral-B power toothbrushes with rotation-oscillation action and the Sonicare range of toothbrushes with high-frequency, side-to-side bristle action have found similar advantages for the Oral-B brushes.16-18

In contrast to this study, a recent publication by Schaeken et al19 reported that Sonicare Flexcare was superior to Oral-B Triumph for single-brushing plaque removal. The different results between these studies may be a result of the incomplete nature of the brush acclimation phase in the Schaeken et al study, where subjects acclimated to either the sonic or rotation-oscillation brush, as opposed to both brushes prior to single brushing efficacy measurements. This potentially confounded the subject brushing experience. Furthermore, there was not a washout period between the two periods in that cross-over study, where subjects acclimated to either the sonic or rotation-oscillation brush, as opposed to both brushes prior to single brushing for efficacy in supragingival plaque removal and reduction of gingivitis. J Clin Periodontol 1998;23:641-648.

In conclusion, the Oral-B Triumph rotation-oscillation toothbrush was significantly more effective in plaque removal after a single 2 minutes of use than the new Sonicare FlexCare toothbrush. This advantage was clear not only for whole-mouth plaque but also for tooth surfaces along the gingival margin and interproximal surfaces.

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References