Brush Head Composition, Wear Profile, and Cleaning Efficacy: An Assessment of Three Electric Brush Heads Using In Vitro Methods

Eva Kaiser, PhD  Michael Meyners, PhD  Dirk Markgraf, MSc  Ulrich Stoerkel, PhD  Roxana von Koppenfels, PhD  Ralf Adam, PhD  Martin Soukup, MSc
Global Research and Development, Procter & Gamble Company
Kronberg, Germany

Heinrich Wehrbein, Prof. Dr. med. dent.  Christina Erbe, Dr. med. dent.
Department of Orthodontics, University Medical Center of the Johannes Gutenberg-University Mainz, Germany

Abstract

- **Objective:** The objective of this research was to evaluate a current store brand (SB) brush head for composition/physical characteristics, Wear Index (WI), and cleaning efficacy versus the previous SB brush head refill design (SB control) and the Oral-B® Precision Clean brush head (positive control, PC).

- **Methods:** This research consisted of three parts: 1) Analytical analysis using Fourier Transform Infrared (FT-IR) spectrometry to evaluate the chemical composition of the current SB brush head bristles relative to the SB control. In addition, physical parameters such as bristle count and diameter were determined. 2) Wear Index (WI) investigation to determine the Wear Index scores of in vitro-aged brush heads at four weeks (one month) and 13 weeks (three months) by a trained investigator. To “age” the brush heads, a robot system was used as a new alternative in vitro method to simulate aging by consumer use. 3) Robot testing to determine the cleaning performance of in vitro-aged brush heads, comparing one month-aged current SB brush heads with the SB control (one and three months-aged) and the PC brush heads (three months-aged) in a standardized fashion.

- **Results:** 1) FT-IR analysis revealed that the chemical composition of the current and control SB refill brush heads is identical. In terms of physical parameters, the current SB brush head has 12% more bristles and a slightly oval brush head compared to the round brush head of the SB control. 2) Wear Index analysis showed there was no difference in the one month-aged current SB brush head versus the one month-aged SB control (1.67 vs. 1.50, p = 0.65) or versus the three months-aged PC brush head (1.67 vs. 1.50, p = 0.65). The one month-aged current SB brush head demonstrated statistically significantly less wear than the three months-aged SB control (1.67 vs. 2.67, p = 0.01). 3) Analysis of cleaning efficacy shows that the one month-aged current SB brush head had improved cleaning performance over the one month-aged SB control brush head (p < 0.05), despite no statistically significant difference in wear. Both the one month-aged current and control SB brush heads showed statistically significantly lower cleaning performance compared to the three months-aged PC brush heads (p < 0.01).

- **Conclusion:** While the current SB brush head showed improved cleaning over the SB control, it demonstrated significantly lower durability and cleaning in comparison to the PC brush head. Dental professionals should be aware of these differences, both in durability and in cleaning performance, when recommending brush heads to their patients.