

A Novel Oscillating-Rotating Power Toothbrush with SmartGuide™: Designed for Enhanced Performance & Compliance

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Introduction

Contemporary oral hygiene products have evolved dramatically from years ago. Dentifrice has transformed from a single benefit, cavity fighting product to formulations that control multiple conditions affecting both hard and soft tissues.^{1,2} Along with the expansion of benefits, a full range of flavor options is available today ranging from basic mint to exotic fruit flavors. A similar proliferation of products with additional benefits and new flavors has occurred with oral rinses and dental floss.³⁻⁵ Such advances in home care products were designed not only to improve the patient's oral health but also to drive compliance through a more enjoyable oral hygiene experience.

Perhaps the greatest advances in oral hygiene products have occurred with the evolution of the power toothbrush. Early power toothbrushes, introduced

commercially in the 1960's, were often designed based on the conventional manual toothbrush.⁶⁻⁷ Movement generally simulated hand-motion, back-and-forth or side-to-side, offering little cleaning advantage over manual toothbrushes. Dental professionals tended to recommend them for "special care" patients. In contrast, a variety of distinct designs and modes of action are available today.⁸⁻⁹ Certain models have been proven to offer significant benefits versus a manual toothbrush in removing plaque biofilm among the general population, and various features have been introduced to increase brushing time and improve cleaning efficiency.^{8,10}

Recently, a new power toothbrush has been introduced with oscillating-rotating motion and a novel compliance-enhancing technology, Oral-B® Triumph™ with SmartGuide™. The intent of this article is to:

- provide an overview of core power toothbrush technologies with a focus on the oscillating-rotating technology used by the novel power toothbrush;

- review compliance enhancing features of power toothbrushes and introduce the SmartGuide™ innovation; and
- provide practical recommendations to increase patient compliance to a power toothbrush regimen.

Power Toothbrush Technologies

Power toothbrush technologies can be grouped into four general categories: rotating, counter-rotational, side-to-side, and oscillating-rotating (Table 1.) With a rotating power toothbrush, the entire brushhead turns in a full circle, moving in one direction. In contrast, a counter-rotational brush has tufts that rotate in different directions.

Toothbrushes based on a sonic technology may have bristles that move side-to-side. With oscillating-rotating technology, the brushhead oscillates from the center point but does not rotate in a full circle. Recently a pulsating, or in-out movement, has been added to some oscillating-rotating power toothbrushes. Sonic and

Table 1: Common power toothbrush technologies. (Visit thejcdp.com to view a short video of the motion of each brush.)

Technology	Rotary	Counter Rotational	Sonic	Oscillating/Rotating
Description of Motion	Entire brush head turns in full circle.	Different tufts on brushhead rotate in different directions.	Side-to-side motion.	Entire brushhead oscillates from center point. Does not rotate in full circle.
Brush (Manufacturer)	Rotadent® (Professional Dental Technologies, Batesville, AR, USA)	Interplak® (Conair, East Windsor, NJ, USA)	Sonicare® Elite® (Phillips, Snoqualmie, WA, USA)	Oral-B® Vitality™ (Procter & Gamble, Cincinnati, OH, USA)

Technology	Studies		
Sonic	• Lobene 1964 • Glass 1965 • Walsh 1989	• Johnson 1994 • O'Beirne 1996 • Tritten 1996	• Ho 1997 • Yankell 1997
Counter-Rotational	• Baab 1989 • Khocht 1992	• Wilson 1993 • Yukna 1993	• Stabholz 1996
Rotary (Circular)	• McAllan 1976	• Khocht 1992	• Yankell 1996
Oscillating-Rotating¹	• Barnes 1993 • Van der Weijden 1994 • Stoltze 1994 • Ainamo 1997 • Yankell 1997 • Cronin 1998	• Clerehugh 1998 • Heasman 1999 • Sharma 2000 • Soparker 2000 • Sowinski 2000 • Warren 2001	• Haffajee 2001 • Garcia-Godoy 2001 • Dentino 2002 • Hickman 2002 • Lazarescu (unpublished) • Lapiere (unpublished)
Ionic²	• Galgut 1996	• Van Swol 1996	• Pucher 1999
Ultrasonic³	• Terezhalmay 1995	• Zimmer 2002	• Forgas Brockman 1998
Unknown⁴	• Soparker 1964	• Toto 1966	• Emling 1991 • Singh (unpublished)

¹ Includes oscillating-rotating with and without pulsation.
² Brush that aims to impart an electrical charge to the tooth surface with intent of disrupting the attachment of dental plaque.
³ Brush action where bristles vibrate at ultrasonic frequencies > 20 kHz.
⁴ Authors have been unable to establish brush action based on trial report or confirm with manufacturers.

Table 2: Studies included in 2005 Cochrane Report for all power toothbrush technologies.

oscillating-rotating technologies (with or without pulsation) are the most commonly used in power toothbrushes today.

With the large array of power toothbrush designs, dental professionals may find it challenging to determine which options will safely provide the most effective outcomes for their patients. To assist in decision making, the Cochrane Collaboration conducted a systematic review of manual versus powered toothbrushing for oral health (<http://www.cochrane.org/reviews/en/ab002281.html>).¹¹

The Cochrane Collaboration is an independent, non-profit, international organization that conducts systematic reviews of the effects of healthcare interventions with the goal of helping people make well-informed decisions.

The 2003 report represented the most comprehensive review of power toothbrush studies.¹¹ Data from 29 trials, representing over 2,500 participants, met the inclusion



A rotating power toothbrush. Image provided by P&G*.

criteria to be included in the meta-analysis. Findings from this report showed powered toothbrushes with a rotation-oscillation action removed plaque and reduced gingivitis more than manual toothbrushes in both the short- and long-term. Other

forms of powered toothbrushes demonstrated a less consistent benefit for plaque and gingivitis compared to manual toothbrushing. The report also confirmed powered toothbrushes are as safe to use as manual toothbrushes.

An updated report was issued in 2005 involving 42 trials and over 3,800 participants.¹² Table 2 lists the trials included in the most recent review and provides links to all abstracts indexed in Medline. Eighteen trials were included for oscillating-rotating; eight for sonic; five for counter-rotational; three for rotary; three for ionic; and three for ultrasonic brush motion. The power technology was unknown in four trials. Consistent with the 2003 findings, the report confirmed the benefits of oscillating-rotating technology for plaque and gingivitis. No other technologies were as consistently superior to manual.

Plaque Removal	Study 1		Study 2	
	Oral-B Triumph	Sonic Toothbrush ¹	Oral-B Triumph	Sonic Toothbrush ¹
Whole mouth	87%	70%	84%	79%
Marginal	83%	63%	75%	68%
Approximal	93%	77%	92%	89%

Between-treatment comparisons: Study 1 ANOVA, p<0.0001; Study 2 ANOVA, p<0.04. ¹Sonicare Elite; ²Oral-B Professional Care 7000

Table 3. Single-use plaque removal vs. baseline.¹⁵

Advances in Oscillating-Rotating Technology

The oscillating-rotating technology was first introduced commercially in 1990 in the Oral-B Braun Plaque Remover toothbrush.¹³ In 1998 the Oral-B 3D Plaque Remover (Procter & Gamble, Cincinnati, OH, USA) was launched that also incorporated a pulsating action.¹⁴ New brush head designs and filament technology have also been introduced, such as coextruded bifilaments that replaced crimped filaments to reduce axial stiffness and increase approximal penetration.⁸ In 2005 the Oral-B Triumph was developed combining the oscillating-rotating plus pulsation technology with Smart Technology in the handle. This onboard computer provides feedback to the patient regarding brushing time, brushing mode, battery charge status, & brush head replacement. Two unique brush head designs were introduced with this model. One has flexible MicroPulse™ bristles to enhance removal of plaque biofilm while the other has a polishing cup to facilitate stain removal.

Several clinical studies have been conducted to show the plaque removal benefits of the Triumph power toothbrush. In two independent clinical trials Triumph showed superior plaque removal relative to other power toothbrushes.¹⁵ Percent plaque removal results relative to baseline are listed in Table 3. Both trials followed a standard randomized, single-use plaque removal crossover

design. In one study Triumph removed statistically significantly more plaque than an Oral-B Professional Care 7000® [analysis of variance (ANOVA, p<0.04)]. In the second study Triumph was more effective than a sonic toothbrush (Sonicare® Elite®). The difference in all areas was statistically significant (ANOVA, p<0.0001). In both studies all power toothbrushes were found to be safe and significantly reduced plaque levels after a single brushing relative to baseline, t-test (p<0.0001). Long-term research has also shown significant benefits for Triumph in the prevention of plaque and gingivitis relative to a manual toothbrush with and without dental floss.¹⁶

Recently, further enhancements to the Triumph were revealed. A chip was added to the handle giving it the ability to send information wirelessly to a remote display, allowing patients to easily and continuously view brushing feedback. The latest Oral-B Triumph model delivers the same performance but with the unique SmartGuide feature.

Compliance Features

While a safe and clinically proven toothbrush is an essential element of a home care regimen, the toothbrush is irrelevant unless patients use it properly. Brushing frequency, time, and technique can affect the actual results realized by the patient relative to potential outcomes. In recent years features have been added to power toothbrushes to increase

brushing time, improve technique, and create a more pleasurable brushing experience. Examples of these features include:

- **Timers** – Research shows patients typically spend about forty-six seconds brushing their teeth, less than half the time recommended by dental professionals.¹⁷ To help patients meet the desired time, some models have a two-minute timer. In addition, many power toothbrushes are equipped with a professional timer that elicits a sound or vibration every thirty seconds. This signals the patient to move to the next quadrant to ensure more thorough plaque removal across the entire dentition.
- **Pressure Indicator** – In addition to providing feedback on brushing time, some power toothbrushes have pressure indicators. This feature provides reassurance patients will follow good brushing technique by alerting them if too much pressure is applied. Research shows patients actually use less pressure with a power brush than a manual brush.¹⁸
- **Brushing Modes** – Some power toothbrushes allow patients to customize their brushing mode. Examples of modes on various toothbrushes include clean, soft, massage, or polish. Patients can personalize their brushing experience based on their oral health needs and personal preferences.



Figure 1. Oral-B Triumph with SmartGuide™. Image courtesy of the Procter & Gamble Company.

Advances in Compliance Features: The SmartGuide Display

The new Oral-B Triumph with SmartGuide, an oscillating-rotating-pulsating brush, is equipped with the features listed above, but it also offers a unique remote display technology (Figure 1).

The display can be placed on the counter, or anywhere within 10-15 feet of the patient, so the two-minute timer, brushing mode, and quadrant timer can be easily viewed during brushing. In addition, it also has a visual pressure signal that lights up if too much pressure should be applied, at which time pulsations are interrupted. This is the first power toothbrush that allows patients to visually follow feedback mechanisms continuously during brushing. Research shows 75% of learning comes from visual stimulation, and this concept builds upon visual learning.¹⁹

A recent randomized, open label, parallel group clinical trial demonstrates the significant benefit of the SmartGuide remote display on brushing time. Forty healthy adult subjects were randomized to either the new Oral-B Triumph with SmartGuide or a manual toothbrush (Oral-B Advantage Plus® #40). Subjects were instructed to brush according to manufacturer's instructions with the power brush or use their usual

manner for two minutes with the manual toothbrush. For thirty days of at-home use, subjects recorded brushing time to the second on case report forms. Results showed subjects using the Oral-B Triumph with SmartGuide averaged 137.4 seconds per brushing versus 98.9 seconds for the manual brush group. This represents a 38.9% longer brushing time on average ($p=0.003$). Subjects using the Oral-B Triumph with SmartGuide were also 5.1 times more compliant with twice-a day, two-minute brushing than subjects using the manual brush. On average, subjects using the Oral-B Triumph with SmartGuide had both brushing episodes at least two minutes long on 67.8% of days, while subjects using the manual toothbrush had both brushing episodes at least two minutes on only 13.3% of days.

Practical Implications: Recommendations for Increasing Patient Adoption

Practice-based research in the US and Germany shows power toothbrushes are generally well accepted by professionals and patients.²⁰⁻²¹ The research also highlights the important role of the dental professional's recommendation in driving successful outcomes. When a dental professional determines a power toothbrush should be incorporated into a patient's home care regimen, the following recommendations may be helpful to increase patient compliance:

1. Customize the recommendation to meet the patient's health needs. Suggest the toothbrush, brush head, brushing mode, etc. based on the patient's oral status. Power brushes are available for virtually every age group, including children and teens, and unique brush heads have been designed to meet special oral care needs, such as special heads for orthodontic patients.
2. Take into account the patient's financial situation. Power toothbrushes are available at various price points. High end models, such as the Triumph with SmartGuide or Sonicare Elite, are typically priced over US\$100. However, there are safe and effective models available for less, such as the Oral-B Vitality™ (Procter & Gamble, Cincinnati, OH, USA). Series oscillating-rotating technology with a suggested retail price of less than US\$20 and Sonicare® Xtreme™ (Philips, Snoqualmie, WA, USA) brush for preteens and teens (US\$39). While the patient's income should be taken into account, it's important not to limit recommendations based solely on this factor. A highly-motivated patient with a small disposable income may be willing to invest in top of the line home care products whereas a less motivated patient with a large disposable income may prefer a less expensive toothbrush.
3. Motivate the patient based on his or her personal values. Healthy teeth and gingiva are the desired outcome for dental professionals. However, some patients may show greater interest in power tooth brushing if stain removal advantages are highlighted versus manual brushing. Employing patient centered, motivational interviewing techniques has been shown to be an effective tool to improve outcomes.²²⁻²³
4. Show the patient how to use a power toothbrush. The importance of experiential learning dates back to the days of Confucius, who in 450 BC reportedly said, "Tell me and I will forget; show me and I may remember; involve me and I will understand." Having demonstration models available will help familiarize



Figure 2: Visit thejcdp.com to view a short video of a person brushing with an oscillating/rotating brush.

patients with proper brushing techniques and key features of power toothbrushes. Short-term and long-term research has demonstrated an improvement in outcomes when patients receive individual instruction in proper power toothbrush usage.²⁴⁻²⁵

5. Give patients information to take home. Reinforce the message by supplying patient education materials and/or videos (Figure 2) for the patient to take home. A link to an educational or instructional website may also be helpful.

6. Set a goal for the patient and ask for a verbal commitment to achieve it. It's important to clearly state the desired goal, incorporating values of the patient and professional, and then ask the patient to commit to it. Here's an example script to illustrate this technique:

"Mrs. Lewis, I want to try to help you reduce the bleeding of your gums and keep the surface stains off your teeth. We took the first step today with your cleaning, but I'm going to need your help. Would you be willing to use this power toothbrush twice a day, two minutes each time using the technique we just reviewed? If so, we should see improvement at your next visit."²⁶

These suggestions can be altered to meet the dental professional's style and the personality of the patient.

Conclusion

Recently, an advanced oscillating-rotating toothbrush (Oral-B Triumph with SmartGuide) was introduced that uses the clinically proven oscillating-rotating technology and incorporates a unique remote display to drive good brushing technique and increase brushing time. This type of innovation in power toothbrush technology provides dental professionals and consumers with additional home care tools to help improve oral health. In recommending any power toothbrush, dental professionals should reinforce the benefits to patients in a way that addresses their values, use experiential learning tools to ensure they understand how to use the brush, explain the desired outcomes, and gain their commitment to comply with the recommendation.

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