

Electric Toothbrushes— For Whom are They Designed?

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Abstract — Powered toothbrushes were first introduced on a large scale in the early 1960s. However, because of a clear lack of superiority compared with manual brushes, and problems with mechanical breakdowns, their sales decreased significantly. However, recommendation for their use continued in special populations with dexterity and cognition problems. The 1990s ushered in an era of new technology, and studies began to suggest superiority of some powered brushes, particularly those using oscillating-rotating or counter-rotational actions. Some studies have shown interproximal cleansing abilities superior to those of manual brushes and yielding results similar to those achieved with the use of a manual brush and floss. Both controlled and open-labeled studies have suggested that electric brushes improve gingival health with patients who routinely used manual brushes prior to using these new powered brushes, and safety has been clearly established. In recommending powered toothbrushes, practitioners should familiarize themselves with the products available, with the clinical studies supporting their benefits compared with manual brushes, their safety and ease of use, and the patient's economic status.

The first electric toothbrush is reported to have been introduced in 1938 but, due to technical problems, was withdrawn from the market place (Rosenthal, 1962).

Powered toothbrushes with an arcuate or reciprocal motion were first introduced in the early 1960s, but because of a clear lack of superiority and problems with mechanical breakdown, they were not widely available in the marketplace by the end of that decade (Frandsen, 1986; Bader, 1992). However, recommendation for their use continued for a limited population—mainly those with mental or physical impairments and for persons with reduced manual dexterity. Also, studies supported a recommendation for use in orthodontic patients (Kobayashi and Ash, 1954; Boyd *et al.*, 1989).

In 1986 an international workshop on oral hygiene concluded that powered toothbrushes were not as good as manual brushes (Frandsen, 1986). Because of this, these brushes remained limited to the same populations as occurred in the late '60s.

The 1990s ushered in an era of new technology for electric brushes, resulting in unique instruments that were of benefit in a broader population. A report by Brothwell *et al.* (1998) reviewed the various electric brushes available as of December, 1998, and evaluated the scientific evidence for these brushes and their value to the general population. They concluded that there is good evidence to recommend toothbrushing twice daily...and for using oscillating—rotating or counter-rotational action electric toothbrushes. The report also highlighted benefits in orthodontic patients. They went on to say that there is moderate evidence to recommend using a soft-bristled manual toothbrush, thus suggesting a benefit for the general population for using electric brushes compared with manual brushes.

An interesting part of their report went on to state that there is moderate evidence recommending against the use of vibrating, rotating, or sonic action brushes. They based this recommendation on a lack of superiority of these products compared with manual

brushes and stated that the added cost did not justify their use. Another population to consider for use of an electric brush is the patient who does not clean well interproximally. A 12-month study showed that a rotating brush gave results equal to those achieved with the use of a manual brush and interproximal cleaning aids (Glavind and Zeuner, 1986). Other powered brushes of various designs have also been shown to be superior to manual brushes in the removal of interproximal plaque (Yukna and Shaklee, 1993a,b; Ciancio *et al.*, 1994; Cronin *et al.*, 1998).

However, the practitioner must weigh his or her decision based on the literature relative to each product and on developments since 1998 on various product designs and improvements. Further, in reaching a decision, the practitioner must rely on claims supported by human clinical studies and not by animal or laboratory data.

A recent article by Barnes (1998) suggests that powered toothbrushes should be a primary recommendation, rather than a secondary alternative, for all patients (Barnes, 1998). This suggestion is good as long as the patient can afford the product. I say this for the following reasons: I was in a pharmacy a few weeks ago in my home town of 35,000 people and stood at the checkout counter and watched what happened to manual toothbrushes being sold for 3/\$1.00. Practically everyone bought one, with mothers buying multiples of 3. It should be noted that in this town the unemployment rate is high, wages are low, and there are many working poor, as in many other towns across America. Therefore, family economics must also be a factor in toothbrush recommendations.

In her review, Barnes goes on to say, "Since the size and design of some electric toothbrushes are not appropriate for some patients, dental hygienists should try one for feasibility and thoroughly familiarize themselves with exactly how each brush works in their hands." She also states that other features should be considered, such as warranty, cost, and availability of replacement heads.

Use in Children

Another important population to consider is children. In one early study, Lefkowitz *et al.* (1962) compared the use of an electric toothbrush with that of a manual brush in two groups of children, one group aged between 7 and 9 years, and another group between 10 and 12 years, and found that, in both groups, more plaque was removed by the electric brush. In contrast, a crossover study involving children with a mean age of 4.28 years compared use of an electric and a manual toothbrush; there were no statistically significant differences between the two groups with respect to plaque removal, although plaque reduction in the electric toothbrush group was somewhat greater than that with the manual brush (Owen, 1972). Other studies have shown that electric toothbrushes are valuable for children with mental handicaps (Kelner, 1963) and those with poor manual dexterity (Smith and Blankenship, 1964), while a more recent study in normal healthy children, 8-12 years of age, showed superiority of a reciprocating, oscillating brush over manual brushes in this population (Grossman and Proskin, 1997).

Key Words

Toothbrushes, powered, manual, clinical studies, safety.

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Practice-based Data

The majority of studies in the literature have been from university- or research-based centers and have been well-controlled. An interesting deviation from this design occurred when a practice-based survey of German dentists was conducted by the manufacturer of the most frequently sold electric brush in that country, a reciprocating, oscillating device (Braun Oral B Plaque Remover, Gillette Inc., Boston, MA, USA) (Warren *et al.*, 1998). Three hundred ninety-nine dentists were contacted. Many dentists in Germany (41%) thought that between half and 70% of their patients did not clean their teeth correctly, and that this is the result of either poor brushing technique or insufficient brushing time, coupled with insufficient visits to the dentist. Most dentists (61%) surveyed stated that they would recommend an electric toothbrush to their patients to improve oral hygiene control, and of these, 82% would recommend the reciprocating, oscillating brush. When these dentists were asked if there had been any change in tooth and gum condition among those patients who switched from using a manual toothbrush to the powered brush, 73% said that they had observed an improvement. None of the dentists interviewed had noted any deterioration in gingival health. This experience reflects exactly what happened in my practice. We recommend three electric brushes in our practice, each with a different action and all from reliable manufacturers. After switching several of our patients to electric brushes and blinding ourselves as to who they were, we noted a marked improvement, 3 months and 6 months later, in oral hygiene and gingival health in 85% of our patients (age range, 48-80 yrs).

A large practice-based study was conducted in the United States and published recently in the *Journal of the American Dental Association*. This study evaluated the effectiveness of a power toothbrush (again, the Braun Oral B Plaque Remover) in over 16,000 patients, the majority of whom were manual brush users before receiving the power brush (Warren *et al.*, 2000).

In summary, the authors concluded that "the power brush was considered by dental professionals to have had a positive effect on the oral health of 80.5% of their patients..." Most patients in the study (88.9%) reported that they would continue using the power brush after the study was completed.

When an electric brush is being recommended to a specific group of patients, compliance is a consideration. In the 1960s, compliance was less than 50% (Stalnacke *et al.*, 1995) after 6 months. However, two well-controlled recent studies showed compliance in the 70-80% range, particularly in periodontal patients who had been historically poorly compliant with oral hygiene instructions (Muhler, 1969; Hellstadius *et al.*, 1993).

Another point to consider is that some electric brushes reach certain areas of the mouth better than other areas. Therefore, in patients with selective plaque problems, this point should be considered in the selection of an electric brush for that area. Additionally, some electric brushes remove stain better than manual brushes, so heavy stainers (smokers, coffee and tea drinkers) may benefit from them.

Safety

Generally, the literature on safety falls into four categories (Fischman, 1998):

- (1) Studies that have measured the effect of the powered toothbrush on gingivitis. A positive effect on gingivitis, or the lack of a negative finding, would suggest that the device is not injurious to gingival health.
- (2) Safety studies that consist of an oral hard- and soft-tissue examination, performed at regular intervals during a clinical trial, and a subjective summary at the conclusion. These oral examination procedures generally follow the recommendations of the American Dental Association (American Dental Association Guidelines, 1996).
- (3) Patient satisfaction surveys. It can safely be assumed that patients would not prefer a product that they perceived as

injurious to their gingival health or that provoked gingival or dental pain.

- (4) Studies designed to assess tooth sensitivity. A lack of sensitivity would indicate minimal or no removal of tooth structure.

The major safety concerns expressed in the literature relative to both manual and powered brushes have been related to:

- Bristle hardness
- Force applied
- Methodology of the dentifrice
- Abrasiveness

The major clinical concerns of improper brushing with abrasives are:

- Soft-tissue abrasion
- Gingival recession
- Cervical wear
- Dentinal hypersensitivity

The American Dental Association's 1996 *Guidelines for Toothbrushes* state that it is generally accepted that powered toothbrushes "automatically confer on the user good brushing technique that most would never achieve with a manual toothbrush" (Fischman, 1998). Further, a leading European clinical investigator, Dr. Ainamo, has stated, "unfortunately, for a significant proportion of the general population the ideal situation does not exist and it is for these patients, plus those with poor manual dexterity, that the electric toothbrush may offer the greatest advantage" (Ainamo *et al.*, 1997).

In conclusion, it can be stated that, in the new century, electric brushes are of value for a variety of populations because (a) they generally provide a good brushing technique regardless of the ability of the user, and (b) they can improve patient motivation and encourage long-time compliance. However, not all electric brushes are better than manual brushes, and clinicians must be aware of this fact in recommending electric brushes.

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