HEADLINES

- For healthy subjects, electric powered toothbrushes are more effective than manual toothbrushes in plaque removal and reduction of gingival inflammation.
- Electric powered toothbrushes are more effective than manual for children, and for a- dolescents with fixed orthodontics.
- For persons with physical or intellectual disabilities powered and manual toothbrushes are equally effective.
- For patients with periodontitis, implants, and caries there are few studies comparing the efficacy of electric powered versus manual toothbrushes.

AUTHORS

Elina Väyrynen, PhD student, DDS. Research Unit of Population Health, Faculty of Medicine, University of Oulu, Finland
Christian Damgaard, PhD, DDS. Associate professor. Research Area Periodontology, Section for Oral Biology and almmunopathology, Department of Odontology, Faculty of Health and Medical Sciences, University of Copenhagen, Denmark
Annica Almståhl, PhD, RDH, associate professor. Department of Oral Microbiology and Immunology, Institute of Odontology, Sahlgrenska Academy, University of Gothenburg, Sweden and Department of Oral Health, Faculty of Odontology, Malmö University, Sweden

Corresponding author: Annica Almståhl , Department of Oral Microbiology and Immunology, Institute of Odontology, Sahlgrenska Academy, University of Gothenburg, Sweden. E-mail: annica.almstahl@odontologi.gu.se

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Electric powered toothbrush vs manual – which is more efficient?

Elina Väyrynen, Christian Damgaard og Annica Almståhl

Background: Toothbrushing twice a day is important to maintain oral health. The aim of this review was to determine the efficacy of manual versus electric powered toothbrushes for plaque removal and reduction of gingival inflammation.

Material and methods: PubMed was used in the search for relevant articles with limitations that the articles should be published in English in peer-reviewed scientific journals and available in full-text.

Results: For healthy subjects, electric powered toothbrushes are more effective than manual toothbrushes in plaque removal and reduction of gingival inflammation. Electric powered toothbrushes were more effective than manual for children. For persons undergoing treatment with fixed orthodontics, and persons with physical or intellectual disabilities powered and manual toothbrushes are equally effective. For patients with periodontitis and caries there are few studies comparing the efficacy of powered versus manual toothbrushes.

Conclusion: The efficacy of electric powered toothbrushes versus manual varies. The better efficacy for some groups should be put in relation to the higher cost of an electric powered toothbrush compared to a manual, but also the much higher cost of dental and periodontal treatment versus patient performed preventive measures such as toothbrushing.

Good oral hygiene is important for everybody. Toothbrushes are available in many shapes and brands and can be either manual or

electric powered. Toothbrushing is a complex sequential task that requires manual dexterity (1), but at the same time it is also considered a daily prerequisite to maintain oral health (2,3). The aim of this review was to determine the efficacy of manual versus electric powered toothbrushes for plaque removal and reduction of gingival inflammation.

Material and methods

The primary objective was to answer the clinical research question "Do patients (population) using electric powered toothbrushes (intervention) compared with manual toothbrushes (comparison) exhibit better oral health conditions (outcome)?" PubMed.gov was used to identify relevant articles published before January 1st 2024. MeSH terms used in the search included: "electric toothbrush" OR "powered toothbrush" AND "manual toothbrush". Limitations used were that the articles should be published in English in peer-reviewed scientific journals and available in full-text. Systematic reviews were the first-hand choice.

Results and discussion

Healthy individuals

In one systematic review including healthy subjects of all ages with no disabilities, it was shown that electric powered toothbrushes were more efficient than manual toothbrushes in plaque removal and in reducing gingival inflammation (Table 1) (4). However, the authors concluded that it could be argued if differences in reduction of plaque and gingival inflammation was clinically relevant. In another systematic review including only studies with participants with 15 or more teeth electric powered toothbrushes were found more effective in reducing dental plaque, gingivitis, and bleeding index than the manual toothbrush (Table 1) (5).

Children and adolescents

A recent systematic review and meta-analysis of the relative effect on plaque index among children 2-17 years old using electric powered toothbrushes versus manual toothbrushes revealed a marked reduction in plaque in favor of the electric powered toothbrushes (6) (Table 1). The results suggest that children as young as two years old benefit from the use of electric powered toothbrushes and it can provide significant reduction in dental plaque. These results provide strong clinical evidence for recommending electric powered toothbrushing to obtain good oral hygiene in children (6). Design with popular animated characters and the use of bright colors, lights and timer may increase the child's motivation, leading to increased toothbrushing duration and frequency (7,8).

Adolescents undergoing orthodontic treatment

Fixed appliances enhance the accumulation of dental plaque, which can lead to gingival inflammation, gingival edema (9) and dental caries (10). A recent meta-analysis demonstrated comparative reductions in plaque with an electric powered toothbrush versus a manual toothbrush among adolescents aged 10-17.9 years old with fixed orthodontic appliances (6). This finding may indicate that the professional instruction plays a more important role than the choice of toothbrush for patients with fixed orthodontic appliances.

Older adults

Electric powered toothbrushes were more effective than manual toothbrushes in removing plaque and controlling periodontal inflammation in persons aged 68-85 years with periodontal inflammation (11) (Table 1).

Persons in vulnerable situations

In a recent systematic review, it was shown that an electric powered toothbrush and a manual toothbrush was equally effective irrespective of physical or intellectual disability and applies both to people brushing their own teeth and to those whose teeth are brushed by a caregiver (12) (Table 1).

Patients with periodontal diseases

Only one study was found which compared electric powered toothbrushes with manual for patients with periodontal disease (13) (Table 1). The participants were given instruction in toothbrushing technique. The results showed no statistically significant difference in plaque reduction, but a lower bleeding index for those who had used a manual toothbrush. Low levels of plaque are of great importance for patients with periodontitis and the quality of oral hygiene should be monitored by dental professionals and instrumentation performed when needed.

Patients with dental caries

Few studies have examined the effect of manual and electric powered toothbrushes for persons with dental caries. Persons with insufficient oral hygiene practices exhibit a 2-fold increased risk of developing dental caries (14). Papas et al (15) reported a significant reduction of root caries among persons with drug-induced xerostomia using an electric powered toothbrush compared with a manual. Also, subjects using an electric powered toothbrush had a somewhat lower incidence of coronal caries than subjects using manual toothbrushes. The effect of toothbrush type seems to be most important for effective plaque removal and managing periodontal in-

Table 1. Studies comparing the efficacy of manual toothbrushes (MTB) and powered toothbrushes (PTB) for plaque removal and reduction of gingival inflammation.

Author, year, country	Study design	Sample size and age and group studied	Purpose	Key findings	Conflict of interest
Graves et al, 2023 USA	Systematic review and meta-analysis	27 non-orthodontic (n=1626) 11 orthodontic studies (n=500) Age 2-17 y	Evaluate the Relative Effect on Plaque Index among Pediatric Patients Using PTB versus MTB.	Reduction in plaque index scores was 17.2% higher for PTB compared with MTB for non-orthodontic patients and 13.9% for orthodontic patients.	None
Kalf-Scholte et al, 2023 The Nether-lands	Systematic review	16 studies including persons with physical or intellectual disabilities. Totally 25 comparisons: 12 self-brushing, 13 care-giver brushing. The age-span varied between studies; subjects 4-79 years were included	Compare effectiveness of a PTB and an MTB in the hands of people with physical or intellectual disabilities or in the hands of a caregiver on parameters of plaque and gingival inflammation	For people with disabilities a PTB compared to a MTB results in no significant difference in plaque removal or reduction of gingival inflam-mation (low level of evidence). This was found irrespective of whether the person had a physical or intellectual disability and if the person brushed his/her own teeth or got hem brushed by a caregiver.	None
McCracken et al, 2004 UK	Single-blind, two-group, randomized, parallel group clinical trial	N=32 Persons with periodontitis Mean plaque index of <2.0 modified Quigley and Hein index	Compare the relative efficacy of and oscillating/rotating PTB to that of a conventional MTB in a group of periodontal patients over a 16-month period with respect to plaque control.	No significant differences in plaque index or probing depths at month 3, 6, 10 or 16. A statistically significant difference of 0.2 for Bleeding index in favor of the group brushing with the MTB.	Supported by a grant from Philips Oral Healthcare
Papas et al, 2007 USA	RCT	N=80 adults	Evaluate whether the use of a Sonicare toothbrush could be beneficial in reducing coronal and/or root caries among patients with medication-indu-ced xerostomia	After one year of use, the numbers of incipient and frank root caries were significantly lower among subjects using Sonicare compared to subjects using MTB.	Study was funded by Philips Oral Healthcare, Inc.
Verma and Bhat, 2004 India	Cross-over clinical trial	N=15 68-85 years old, having moderate gingival inflammati-on	Evaluate the usefulness of PTB (Colgate Actibrush) in elderly individuals regarding removal of plaque and reduction of gingivitis in comparison to MTB (Colgate Zig Zag)	After 2 and 3 months use, there was a significant reduction in both plaque (24% and 27% lower score) and gingival inflammation (52% and 64% lower score) in favor of the PTB.	None
Wang et al, 2020 China	Systematic review and meta-analysis	21 RCTs, 2296 healthy subjects	Evaluate efficacy of PTB compared with MTB in terms of plaque, gingivitis and bleeding reduction.	PTBs were significantly more effective in reducing plaque, gingival index, and bleeding index. Plaque index: Standard Mean Difference (SMD): 0.86 Gingival index: SMD 0.47 Bleeding index: SMD 0.92	None
Yaacob et al, 2014 UK	Systematic review and meta-analysis	RCTs with ≥ 4 weeks of unsupervised brushing by subjects (children and adults) with no disabilities. 40 short-term trials (1-3 months), n=2871, 14 long-term trials (> 3 months), n=978.	To compare MTB and PTB in everyday use, by people of any age, in relation to the removal of plaque, the health of the gingivae, staining and calculus, dependability, adverse effects and cost.	PTBs were more efficient than MTBs in reducing plaque: 11% in the short-term and 21% in the long-term, and gingival inflammation: 6% in the short-term and 11% in the long-term.	None

flammation, while the addition of fluoride toothpaste at daily brushing is important for preventing dental caries (16).

Conclusions

Dental care professionals should focus on supporting their patients' dental awareness and improved oral hygiene, along with professional prophylaxis and other oral hygiene aids, independently of the toothbrush used. However, when improvements in plaque control are required, evidence suggest that electric powered toothbrushes should be recommended. The use of electric powered toothbrushes may need repeated training from dental care professionals to help subjects taking full advantage of the electric powered toothbrushes. Adjunctive use of interdental cleaning in patients with periodontal inflammation and history of interdental caries lesions is important.

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