A systematic review of powered vs. manual toothbrushes in periodontal cause-related therapy

Sicilia A, Arregui I, Gallego M, Cabezas B, Cuesta S

Authors' objectives
To compare the effect of power-driven toothbrushes with manual toothbrushes on gingival bleeding and inflammation in patients with gingivitis and chronic periodontitis.

Searching
MEDLINE and the Cochrane Oral Health Group's Trials Register were searched to June 2001 for reports published in the English language; the search terms were stated. The Journal of Clinical Periodontology, Journal of Periodontal Research and Journal of Periodontology were handsearched to June 2001, and editors of these journals were asked for details of any in press reports or reports that had been accepted for publication. Reviews and letters were excluded. Reference lists in reviews, texts and workshops were also checked.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for inclusion. The included RCTs allocated patients into parallel treatment groups, or allocated sides or quadrants of mouths to treatments.

Specific interventions included in the review
Studies that compared electric toothbrushes with conventional manual toothbrushes were eligible for inclusion. The included studies were grouped into four models of care according to the intensity of the intervention:

- the over-the-counter (OTC) model, in which toothbrushes were used with standard instructions, but without any professional input into change to oral hygiene;
- the oral hygiene instruction (OHI) model, which included professional input into education, motivation and change to oral hygiene habits, with or without encouragement using telephone calls or cards;
- the prophylaxis and oral hygiene instruction (POHI) model, which included instruction in oral hygiene and administration of a prophylaxis after the first examination, with or without encouragement to comply; and
- the supportive periodontal treatment (SPT) model, in which long-term studies included treatment for periodontal disease with prophylaxis and scaling every 3 months.

The included studies used oscillating-rotating, counter-rotational, sonic, ultrasonic and other types of electric toothbrushes. The duration of treatment in long-term studies ranged from 6 to 24 months.

Participants included in the review
Studies of adult patients (older than 15 years old at enrolment) with gingivitis or periodontitis, who had no handicap, implants, extensive prosthetic restoration, or orthodontic treatment, were eligible for inclusion. Most of the participants in the included studies were from the general population, enrolled in periodontal treatment programmes, or were non-dental university students.

Outcomes assessed in the review
Studies that assessed gingival bleeding or inflammation were eligible for inclusion. The review also assessed plaque, gingival recessions and abrasions. The included studies used a variety of indices (at least 23 different indices) to assess the outcomes. The most commonly used plaque index was the Turesky, while the most common gingival bleeding index was bleeding on probing.
How were decisions on the relevance of primary studies made?
Two groups of reviewers screened titles and abstracts, and resolved any disagreements on relevance through discussion. The full texts of studies that appeared relevant, but did not meet all of the inclusion criteria, were obtained. Two reviewers independently made the final selection of studies to be included using the full-text versions of publications.

Assessment of study quality
Validity was assessed on the basis of adequacy of the method of randomisation, allocation concealment, blinding of the outcome assessors, and the handling of withdrawals. Two reviewers independently assessed validity and agreement was assessed using the kappa statistic.

Data extraction
Two reviewers independently extracted the data and agreement was assessed using the kappa statistic. Data on the study design, participants, interventions, outcomes (bleeding and gingivitis) and cause-related therapy were extracted and tabulated.

Methods of synthesis
How were the studies combined?
The quality of the included studies was summarised with respect to validity criteria, statistical errors and the adequacy of description of patient characteristics. It was not possible to combine the data using a meta-analysis because of heterogeneity among the studies. The studies were grouped according to the four models of intervention (OTC, OHI, POHI and SPT) and combined in a narrative.

How were differences between studies investigated?
Differences between the studies were discussed with respect to duration of follow-up (short term appeared to be 3 months or less and long term from 6 to 24 months), characteristics of the participants, intervention (OTC studies compared with OHI studies), type of powered toothbrush, and the use of different indices to score gingival bleeding, inflammation and plaque.

Results of the review
Twenty-one RCTs (1,501 patients) were included.

In terms of study quality, 7 RCTs described the method of randomisation, 6 studies used adequate allocation concealment, and only 2 RCTs did not clearly describe the methods of blinding. The drop-out rates ranged from 1 to 28% across 11 RCTs that did not take account of drop-outs in the analysis. Statistical errors in the analysis were found in 6 RCTs.

OTC model (4 RCTs): the results were mixed. Two short-term RCTs showed electric toothbrushes significantly reduced gingival bleeding and inflammation, and one showed a reduction in plaque. One RCT showed deterioration with both treatments. One long-term RCT showed no significant difference between treatments.

OHI model (8 RCTs): the results were mixed. Four short-term RCTs showed electric toothbrushes reduced gingival bleeding or inflammation, and four studies showed no significant difference between treatments or greater reductions with the manual toothbrushes.

POHI model (5 RCTs): the results were mixed. Three short-term RCTs showed no marked difference between treatments. Two long-term RCTs showed that oscillating-rotating electric toothbrushes significantly reduced gingival bleeding, but only one RCT showed a significant reduction in plaque.

SPT model (3 RCTs): all three RCTs showed that electric toothbrushes (2 counter-rotation) significantly reduced gingival bleeding and plaque.

Gingival recession (2 RCTs): neither RCT showed any significant difference between treatments in recessions.
Abrasions (8 RCTs): 6 RCTs showed no significant difference between treatments.

Comparisons of different models: the OTC intervention appeared to show different results to the OHI model. Only one OTC study showed a marked reduction in plaque compared with 3 OHI studies. Fifty per cent of RCTs of each model showed significant reductions in gingival bleeding with electric toothbrushes.

The results for POHI differed according to the duration of follow-up.

Four out of 5 RCTs showed that oscillating-rotating brushes improved gingival bleeding and inflammation compared with manual brushes.

Four out of 6 RCTs showed that counter-rotational brushes improved gingival bleeding and inflammation compared with manual brushes.

Two out of 3 RCTs showed that sonic brushes improved gingival bleeding and inflammation compared with manual brushes, while the other showed the opposite.

One out of 2 RCTs showed that ultrasonic brushes improved gingival bleeding and inflammation compared with manual brushes.

Authors' conclusions
Power-driven toothbrushes (particularly counter-rotational and oscillating-rotating) can reduce gingival bleeding or inflammation, but further good-quality research is required.

CRD commentary
The review question was clear in terms of the study design, intervention, participants and outcomes. Several relevant sources were searched and the search terms were stated. However, no attempt to locate unpublished studies was made, thus raising the possibility of publication bias. By limiting the literature search to studies published in the English language, some relevant studies might have been omitted. Two reviewers independently selected the studies, assessed validity and extracted the data, which reduces the potential for bias and errors. Validity was assessed using defined criteria, and methodological limitations of the included studies were discussed in the text of the review.

Relevant information on the included studies was presented in tabular format. Given the heterogeneity between the different studies, a narrative synthesis was appropriate. The potential influence of various factors on the results was discussed. The evidence presented appears to support the authors' conclusions.

Implications of the review for practice and research
Practice: The authors stated that there is limited evidence for the benefit of electric over manual toothbrushes, there is limited evidence supporting oscillating-rotating and counter-rotational brushes over manual brushes, and there is insufficient evidence about ultrasonic and sonic brushes.

Research: The authors stated that reports of future research assessing the efficacy of electric toothbrushes should adhere to the CONSORT guidelines (see Web Address at end of abstract) and present global outcomes for all patients at baseline and follow-up. They stated that future studies should use similar methods, include adequate information on the participants, use common indices to measure the outcomes, and investigate ultrasonic and sonic models.

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