A systematic review of efficacy of machine-driven and manual subgingival debridement in the treatment of chronic periodontitis

Tunkel J, Heinecke A, Flemming T F

Authors' objectives
To compare machine-driven debridement with manual debridement for the treatment of periodontitis.

Searching
MEDLINE (from 1966), the Cochrane Controlled Trials Register (from 1966) BIOSIS Previews (from 1970), EMBASE (from 1974), Health Devices Alerts (from 1983), MEDITEC (from 1968), RUSSMED ARTICLES (from 1988), and SciSearch (from 1974) were searched to April 2001 for reports published in the English language; the search terms were stated. The reference lists from identified studies were also checked.

Study selection
Study designs of evaluations included in the review
In the 'Methods' section of the review, the authors stated that the review was of randomised controlled trials (RCTs), but the review also included non-randomised controlled clinical trials. Initially, studies presenting data on clinical outcomes had to have at least 6 months' follow-up and had to present data on a per patient basis. However, studies presenting the time required for treatment and adverse effects were not restricted by the duration of follow-up, and could present data by site or by patient. A decision was later taken to include studies of clinical outcomes that reported data by site. All the included RCTs were split-mouth RCTs.

Specific interventions included in the review
Studies that compared supra and subgingival debridement using machine-driven debridement plus no concomitant therapy with manual debridement using hand-operated instruments were eligible for inclusion. Studies in which time restrictions were placed on the treatment were excluded, as were studies of surgical treatment. The included studies used ultrasonic or sonic scalers (oscillating motion perpendicular to the long axis of the working tip), an air-turbine driven six-sided rotary instrument and a vibratory air-driven handpiece. The studies were of initial and supportive periodontal treatment. In the included studies, the operators included third and fourth year students, dental hygienists and dentists.

Participants included in the review
Studies of patients with chronic periodontitis were eligible for inclusion. The review defined periodontitis as loss of clinical attachment or alveolar bone of 1 mm or more; pocket probing depth of 4 mm or more; and gingival inflammation assessed by bleeding on probing or by a gingival index. Studies that did not define periodontitis were also included. Studies of patients with aggressive periodontitis, periodontitis as part of a systemic disease or associated with endodontic lesions, acquired or developmental abnormalities, necrotising periodontal disease, or periodontal abscesses, were excluded.

Outcomes assessed in the review
The inclusion criteria were not explicitly defined in terms of the outcomes. The intention in the review was to assess prevention of tooth loss as the primary outcome, but in the case where few studies reported this outcome, secondary outcomes were defined. The review therefore assessed the following secondary outcomes: the loss of 2 mm or more in clinical attachment level or alveolar bone; a gain in clinical attachment level (mCAL-G) or reduction in pocket probing depth (mPPD-R); reduction in bleeding on probing (mBOP-R) or by gingival index; periodontal abscess. The review also assessed the mean time to treat one tooth and adverse effects (i.e. gingival recession, soft tissue trauma, and root damage, roughness and hypersensitivity).

How were decisions on the relevance of primary studies made?
Two reviewers independently screened titles and abstracts, and resolved any disagreements on relevance through discussion. Two reviewers independently made the final selection of studies to be included in the review, using the full...
text of identified publications. Inter-reviewer agreement for both stages of the selection process was assessed using the kappa statistic.

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 completeness of follow-up. Two reviewers independently assessed validity, and agreement was assessed using the kappa statistic.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. Tables presented in the review showed the following outcomes for individual studies for each treatment group: mCAL-G, mPPD-R, mBOP-R and the mean time to treat one tooth.

Methods of synthesis
How were the studies combined?
The quality of the studies was summarised. The intention was to pool studies in a meta-analysis, but this could only be done for treatment time per tooth. In this analysis, the standardised weighted mean difference between treatments was calculated, along with the 95% confidence interval (CI), using a fixed-effect model in the absence of significant heterogeneity. For clinical outcomes, the authors reported that a meta-analysis could not be performed because of the lack of adequate data and differences in the study designs.

How were differences between studies investigated?
Statistical heterogeneity in the meta-analysis was tested using the chi-squared statistic (a P-value of less than 0.1 indicated significant heterogeneity). Differences in mBOP-R and mCAL-G between studies were discussed with reference to study design.

Results of the review
The review included 13 studies: 6 RCTs (91 patients) and 7 non-randomised controlled trials (the numbers were presented as a mix of teeth and individual patients).

None of the included RCTs adequately described the method of randomisation, or described adequate allocation concealment. In 9 studies, the outcome assessor was blinded to the treatment. Only one study described withdrawals and drop-outs.

Clinical outcomes (3 RCTs with 40 patients and 1 non-randomised controlled trial with 10 patients): all of the studies used ultrasonic or sonic scalers. The studies showed no significant difference between power-driven ultrasonic or sonic debridement and manual debridement in mCAL-G, mPPD-R and mBOP-R. Three studies were of single-rooted teeth; one study gave no details on the teeth.

Treatment time (2 studies): for initial therapy, ultrasonic or sonic debridement was 36.7% (95% CI: 0.39, 1.13) faster than manual debridement. No significant heterogeneity was detected (P=0.77). For supportive periodontal treatment, the studies suggested that ultrasonic or sonic debridement was faster than manual debridement.

Adverse effects (9 studies).
No studies reported on root sensitivity. Five studies found mixed results for root damage: 3 studies showed machine-driven treatment increased adverse effects, one study showed that manual treatment increased adverse effects, and one study found no difference between treatments. Four studies found mixed results for soft tissue trauma: one study showed manual treatment increased adverse effects, while 3 studies found no difference between treatments.

Authors' conclusions
There was weak evidence for no difference in clinical outcomes between machine-driven debridement and manual debridement.

CRD commentary
The review question was clear in terms of the intervention, participants and outcomes. The inclusion criteria were not clearly defined in terms of study design, with some sections of the review reporting that only RCTs were included when non-randomised controlled trials as well as RCTs were actually included. Several relevant sources were searched and the search terms were stated. Limiting the included studies to those in English might have resulted in the omission of some relevant studies. No attempt was made to locate unpublished studies, thus raising the possibility of publication bias. Two reviewers independently selected the studies and assessed validity, and this reduced the potential for bias and errors. The methods used to extract the data were not described; hence, any efforts made to reduce errors and bias cannot be judged. Validity was assessed using criteria generally used for RCTs, but since some of the included studies were not RCTs these criteria were not appropriate for such studies.

Data on the time to treat one tooth were combined from both RCTs and non-randomised trials in a meta-analysis. Combining studies of different designs may not be appropriate, and stratification by study design was not examined. The mean values for clinical outcomes were reported for each study for each treatment group, but there were no data to support the authors’ statement that there was no significant difference between treatments. The review identified a few very small studies, but did not discuss the possibility of the studies being underpowered to detect a difference. A more appropriate conclusion would be that there was insufficient evidence to assess the relative effectiveness of power-driven and manual debridement.

Implications of the review for practice and research
Practice: The authors stated that there appeared to be no difference in efficacy, and no major differences in adverse effects, between ultrasonic or sonic debridement and manual debridement in single-rooted teeth with chronic periodontitis. They also stated that ultrasonic or sonic debridement is faster than manual debridement.

Research: The authors stated that well-conducted RCTs are required to compare power-driven and manual subgingival debridement. They stated that future research should assess periodontal disease progression using tooth survival; include multi-rooted teeth; assess biopsychological outcomes, adverse effects, health and safety of the operator, and cost-effectiveness; and adhere to CONSORT guidelines (accessed 23/06/2005; see Web Address at end of abstract).

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.