The effects of orthodontic therapy on periodontal health: a systematic review of controlled evidence

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CRD summary
The authors concluded that there was a lack of reliable evidence about the effects of orthodontic treatment for malocclusions on periodontal health and that the existing evidence suggested that treatment had small detrimental effects. There were some limitations to this review, but overall the authors’ conclusions appear to reflect the data presented and are likely to be reliable.

Authors’ objectives
To evaluate the effect of contemporary orthodontic treatment on periodontal health.

Searching
MEDLINE, Web of Science, the Cochrane Library (including Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews, DARE, and HTA database) were searched from 1980 through to 2006 for studies published after 1980. Search terms were reported. ClinicalTrials.gov, NRR, ProQuest Digital Dissertation Abstracts, and six specified journals (1980 to June 2006) were also searched and reference lists were screened. No language restrictions were applied.

Study selection
Randomised controlled trials (RCTs), cohort studies, case-control and cross-sectional studies were eligible for inclusion if they compared the effects of fixed or removable orthodontic treatment versus no treatment, on a periodontal measure (other than root resorption), after removal of the orthodontic appliance. Patients could be of any age and have any type of occlusion. Studies restricted to patients with severe periodontal disease or craniofacial anomalies and studies that evaluated fully banded appliances, treatments that involved orthognathic surgery, and distraction osteogenesis were excluded.

Most of the included studies evaluated fixed orthodontic appliances including appliances with premolar extractions; other studies evaluated removable appliances, both fixed and removable appliances, or provided no details. Most studies evaluated treatments performed in adolescents or young adults (overall age range 12 to 47 years). Patients had varying types of malocclusions, such as anterior crowding and Class II. Malocclusion status in control groups was similar or different (i.e. controls with no or minor malocclusion) to the treatment group; some studies provided no details. Included studies assessed one or more of five surrogate markers for periodontal status. Where reported, post-treatment follow-up ranged from four weeks to 20 years.

Two reviewers screened identified studies and it was not clear if they did this independently or not.

Assessment of study quality
RCTs were assessed for random allocation; allocation concealment; baseline similarity of treatment groups; point estimates; measures of variability of primary outcome; blinding of outcome assessor, care provider and patients; and intention-to-treat analysis. Cohort and case-control studies were assessed using the Newcastle-Ottawa Quality Assessment Scale for patient selection, comparability of treatment groups, and outcome assessment. One additional item was also assessed: reporting of the number of observations, point estimates, and variability of primary outcome. Using these criteria, studies were classified as having a low, moderate, or high risk of bias.

Two reviewers independently assessed validity and resolved disagreements through consensus.

Data extraction
For each study, one reviewer extracted the means and standard deviations (SDs) of continuous outcomes or estimated...
them by pooling data for tooth surfaces or sites.

**Methods of synthesis**

The studies were grouped by study design and type of outcome. For continuous outcomes, pooled weighted mean differences (WMD) and 95% confidence intervals (CIs) were calculated using a fixed-effect model. Statistical heterogeneity was assessed using the $I^2$ statistic. Summary estimates were not presented where the $I^2$ for fixed-effect and random-effects models exceeded 70%. The authors stated that there were too few studies to assess publication bias or to employ sensitivity and subgroup analyses.

**Results of the review**

Twelve studies were included (n=1,670 patients, including 821 in treatment groups and 849 in control groups). These included one randomised controlled trial (RCT) with four weeks of follow-up after treatment (n=48 dental arch patients), three prospective cohort studies with follow-up of three, five, and 14 years, and eight cross-sectional studies.

All studies were classified as having a high risk of bias. Methodological flaws included lack of reporting of inclusion and exclusion criteria for intervention and control groups, lack of blinding, differences between treatment groups, lack of adjustment for differences, and absence of malocclusion in control groups. Validity scores were reported and validity was reported in full in supplementary tables (see [http://jada.ada.org/cgi/content/full/139/4/413](http://jada.ada.org/cgi/content/full/139/4/413) accessed June 2009).

**RCT:** The orthodontic treatment group had a mean pocket depth 0.3mm greater (SD not reported) and a similar number of bleeding sites (20 of 96 versus 18 of 96 sites) compared with the no treatment group.

**Cohort and cross-sectional studies:** Compared with no treatment, orthodontic treatment was associated with 0.03mm increase in gingival recession (95% CI 0.01 to 0.04; three studies), 0.13mm of alveolar bone loss (95% CI 0.07 to 0.20; three studies), and 0.23mm increase in pocket depth (95% CI 0.15 to 0.30; two studies). $I^2$ was less than 70% for all three analyses. Heterogeneity was high for attachment loss (three studies, $I^2=93\%$) and gingivitis (four studies, $I^2=97\%$) and these studies reported inconsistent results.

**Authors' conclusions**

There was a lack of reliable evidence about the effects of orthodontic treatment for malocclusions on periodontal health. The existing evidence suggested that orthodontic treatment had small detrimental effects on periodontal health.

**CRD commentary**

The review question was clearly stated. Inclusion criteria were specified for patients in treatment groups, interventions, and outcomes. Inclusion criteria for study design were appropriately broad. Several relevant sources were searched, including sources of grey literature, and no language restrictions were applied. Attempts were made to minimise reviewer error and bias during the assessment of validity, but only one author extracted data and the methods used to select studies were not described in full, so reviewer error and bias cannot be excluded. This limitation was acknowledged by the authors and the quality of the included studies was assessed and taken into account when drawing the conclusions. The studies were grouped by study design, data from statistically homogeneous studies were pooled, and heterogeneity was assessed.

There were limitations to this review, but overall the authors’ conclusions appear to reflect the data presented and are likely to be reliable.

**Implications of the review for practice and research**

The authors did not state any implications for practice or further research.

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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.