Orthodontic anchorage: a systematic review
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CRD summary
This review assessed the effectiveness of orthodontic anchorage systems. There was insufficient evidence from the diverse and generally methodologically flawed studies identified to draw any conclusions; further research is required. The review was well conducted and the authors’ conclusions are likely to be reliable.

Authors' objectives
To determine the type of orthodontic anchorage systems or applications that have been evaluated and to assess their effectiveness.

Searching
PubMed and the Cochrane Oral Health Group's Trials Register were searched from January 1966 to December 2004 for articles published in the English language; the search terms were reported. The reference lists of retrieved studies were screened. Abstracts were excluded.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), prospective and retrospective controlled studies, and clinical trials that compared different anchorage systems were eligible for inclusion. Case series, case reports and reviews were excluded.

Specific interventions included in the review
Studies of orthodontic anchorage systems were eligible for inclusion. Studies that described surgical procedures or the treatment of cleft lips or palates were excluded. The most commonly evaluated systems were the anchorage of molars during space closure after premolar extractions and anchorage in the incisor and premolar region during distal movement of molars (based mainly on Nance appliances or modifications). The methods used for anchoring varied (details were reported). The duration of treatment, where reported, ranged from 10.7 weeks to 7.7 years.

Participants included in the review
Inclusion criteria were not specified in terms of the participants. The included studies were in male and female patients. The majority of studies reporting the mean age of the patients reported means of less than 15 years (i.e. patients who were still growing).

Outcomes assessed in the review
Studies that assessed effectiveness and reported quantitative data were eligible for inclusion. The review assessed anchorage loss. The included studies measured tooth positions using cephalometric analysis or study casts.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected the studies. Any disagreements were resolved by discussion to reach a consensus.

Assessment of study quality
The studies were assessed for study design, adequacy of sample size, adequate description of methods used to select study sample, use of valid methods to assess outcomes, use of method error analysis, blinded assessment of outcome, presentation of adequate statistics and analysis adjusted for confounders. The maximum possible validity score was 10 points. Studies were classified as low (0 to 5), medium (6 to 8) or high quality (9 or 10). Two reviewers independently assessed validity and resolved any disagreements by discussion to reach a consensus.
Data extraction
Two reviewers independently extracted data and resolved any disagreements by discussion to reach a consensus. Where possible, data were presented on the ratio between anchorage loss and active movements for each study.

Methods of synthesis
How were the studies combined?
The studies were grouped by the type of anchorage system and combined in a narrative.

How were differences between studies investigated?
Differences between the studies were discussed in the text of the review, or were apparent from the tables presented.

Results of the review
Fourteen studies (n=747) were included.

Anchorage of molars during space closure was evaluated in seven studies (n=346): two RCTs (n=97), one prospective split-mouth RCT (n=12), one prospective split-mouth comparative study (n=20) and three retrospective comparative studies (n=217).

Anchorage in the incisor and premolar region during distal movement of molars was evaluated in seven studies (n=401): one RCT (n=23), two prospective comparative studies (n=70), one retrospective controlled study (n=210) and three retrospective comparative studies (n=98).

Two studies were classified as high quality, three as medium and nine as low quality. However, most of the studies had methodological flaws: retrospective design, inadequate selection description, small sample size, lack of accounting for confounding variables, lack of method error analysis and lack of blinded outcome assessment.

Anchorage of molars during space closure after premolar extractions.

Two RCTs evaluated anchorage loss with and without laceback ligatures but reported different results: one reported a significantly larger anchorage loss with the ligatures, while the other reported no significant differences between treatments. The other five studies evaluated different anchorage systems, and the authors stated that this and the differences in study design made it impossible to compare systems.

Anchorage in the incisor and premolar region during distal movement of molars. The authors reported that anchorage loss of the incisors or premolars ranged from 0.2 to 2.2 mm, and the ratio of anchorage loss to distal movement ranged from 0.2 to 0.8 mm.

Authors’ conclusions
There was insufficient evidence from methodologically flawed studies to draw any conclusions. Further research is required.

CRD commentary
The review question was clear in terms of the study design and intervention. However, the inclusion criteria were very broad for outcomes and were not specified for participants. Only English language publications were included, which raises the possibility of language bias. Methods were used to minimise reviewer errors and bias in the study selection, validity assessment and data extraction processes. Validity was assessed using specified criteria and the results of this assessment were reported. In view of the differences between studies, the narrative synthesis was appropriate and study quality was taken into account when attempting to draw conclusions. Apart from the limited search, the review was well conducted and the authors’ conclusions are likely to be reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that adequately powered RCTs are required to determine the effectiveness of different anchorage systems (including implant systems) and to evaluate patient acceptability and compliance, adverse effects and costs.

**Funding**
Centre for Research and Development, Uppsala University/ County Council of Gavleborg; Swedish Dental Society.

**Bibliographic details**

**PubMedID**
16637733

**DOI**

**Original Paper URL**
http://www.angle.org/anglonline/?request=get-document& amp;issn=0003-3219& amp;volume=076&issue=03&page=0493

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Bicuspid /pathology /surgery; Humans; Incisor /pathology; Molar /pathology; Orthodontic Anchorage Procedures /instrumentation /methods; Orthodontic Space Closure; Research Design; Serial Extraction; Tooth Movement

**AccessionNumber**
12006003550

**Date bibliographic record published**
30/06/2007

**Date abstract record published**
30/06/2007

**Record Status**
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.