Dental and skeletal changes following surgically assisted rapid maxillary expansion

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CRD summary
This review cautiously concluded that surgically assisted rapid maxillary expansion resulted in greater expansion at the molars, which progressively decreased towards the anterior part of the dental arch, with little or no clinically significant skeletal changes and a relapse of 0.5 to 1 mm after 1 year of orthodontic treatment. These conclusions appear to follow from the poor-quality data presented.

Authors' objectives
To assess intermediate and long-term skeletal and dental changes after surgically assisted rapid maxillary expansion (SARME).

Searching
MEDLINE (1966 to May 2005), MEDLINE In-Process and Other Non-Indexed Citations (May 2005 to June 2005), LILACS (1982 to May 2004), PubMed (1966 to May 2005), EMBASE (1988 to 2005), Web of Science (1945 to 2005) and all Evidence-based Medicine Reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, DARE, Cochrane Controlled Trials Register; to second quarter of 2005) were searched; the search terms were reported. In addition, the reference lists of retrieved articles were checked for further studies.

Study selection
Study designs of evaluations included in the review
Clinical trials were eligible for inclusion. The authors did not specify what types of study design were eligible for inclusion, nor did they report details of those employed by the included studies.

Specific interventions included in the review
Studies of SARME were eligible for inclusion. All of the included studies evaluated a tooth-anchored device.

Participants included in the review
Studies of individuals requiring maxillary expansion were eligible for inclusion. The included participants were adolescents and adults, with mean ages ranging from 19.6 to 36 years.

Outcomes assessed in the review
Eligible studies had to report outcomes using measurements made from cephalograms, computer tomograms and/or dental casts. The outcomes reported in the review included skeletal changes, dental changes, and volumetric and area changes assessed over an intermediate period, after expansion retention, after orthodontic treatment, or over a longer term period. The majority of the studies used dental casts to monitor changes.

How were decisions on the relevance of primary studies made?
Two reviewers assessed the titles and abstracts and full papers for eligibility; any disagreements were resolved through discussion.

Assessment of study quality
Study validity was assessed according to the following criteria: study objective, population, selection criteria, sample size, comparable baseline characteristics, prospective design, randomisation, objective measurement method, blinding of examiner and/or statistician, reliability of the data, drop-outs included, appropriate statistical methods, confounders included in the analysis, and reporting of significance levels. Each study was given a quality score up to a maximum of 20 points. The authors did not state how many reviewers carried out the assessment.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.
The original study authors were contacted for missing data where relevant. Mean expansion distances (with ranges) for molars, maxillary molars, pre-molars and/or canine teeth were reported in millimetres (mm) for each study. Skeletal changes were reported as means (with ranges) for skeletal maxillary expansion or nasal expansion. Where relevant, volumetric changes were reported as changes in nasal or palatal vault volume (cm$^3$); area changes (cm$^2$) were also reported.

**Methods of synthesis**

How were the studies combined?
The studies were combined in a narrative.

How were differences between studies investigated?
A limited number of differences between the studies were evident from the review text and data tables.

**Results of the review**

Twelve studies ($n=163$ reported in 11 studies; one study did not report numbers of participants) were included in the review. The types of study designs were not reported.

The quality scores ranged from 1 to 7 points. One study scored 7 points, one scored 6 points, one scored 5 points, one scored 4 points and seven scored 2 to 3 points, and one scored 1 point.

Immediate changes.

Dental changes (8 studies): all of the studies reported a greater immediate expansion at the molar level after SARME, which progressively reduced to the cuspid level. Reported mean expansions were from 7.1 to 8.7 mm in the first molars (5 studies), 5.5 and 7.1 mm in the second molars (2 studies), 4.9 to 5.2 mm in the canines (2 studies), and 7.8 and 8.1 mm in the first bicuspids (2 studies).

Skeletal changes (5 studies): all of the studies reported immediate significant transverse expansion after SARME. In addition, one found neither vertical nor sagittal changes, while another study reported a significant change in palatal plane inclination (1.5 degrees) and a sagittal decrease in the SNB (not defined) angle of 1.78 degrees.

Volumetric and area changes (1 study): the study reported a total increased nasal volume of 4.7 cm$^3$ immediately after SARME, which increased the nasal dimensions and resulted in an improvement in nasal patency.

Changes after expansion retention.

Dental and skeletal changes (1 study): the study reported relapses in dental and skeletal changes during the retention phase immediately after expansion, but the reported changes were considered clinically insignificant.

Changes after orthodontic treatment.

Dental changes (4 studies) all 4 studies reported increased molar expansion with progressive concomitant anterior reduction up to the cuspids with SARME at the end or orthodontic treatment. The mean maxillary molar expansion ranged from 3.8 to 7.2 mm (3 studies) and the mean canine expansion was 4.1 and 4.2 mm (2 studies).

Long-term changes.

Dental changes (6 studies): 4 studies reported greater molar expansion compared with cuspid expansion from at least 1 year after orthodontic post-expansion treatment; mean molar expansions varied from 5.6 to 7.3 mm (4 studies). Two studies reported minor mean maxillary molar expansion relapses of 0.88 and 2.6 mm.

Skeletal changes (1 study): the study reported a minor mean relapse at the maxillary posterior alveolar level of 0.3 mm.
Authors' conclusions
Caution is advised when interpreting the review conclusions as all of the studies suffered from methodological flaws. A greater expansion at the molars, which progressively decreased towards the anterior part of the dental arch, was reported in all of the studies. There were little or no clinically significant vertical and sagittal skeletal changes, and nasal patency was improved through the increase in the nasal portion of the maxillary complex. After 1 year of orthodontic treatment an overall dental relapse of 0.5 to 1 mm was reported.

CRD commentary
This review was based on a clear research question, defined in terms of the intervention, population and outcome; no criteria were reported for study design and the designs used by the included studies were not reported. The authors searched a number of electronic databases and there were no obvious indications to suggest a risk of publication or language bias. The authors also took precautions to reduce reviewer error and bias when selecting studies, but it is unclear whether these approaches were also applied when extracting the data and assessing study quality. The authors did, however, assess the quality of the studies using an extensive checklist, and the findings of the review were discussed in relation to the quality of the data, which was poor. It is difficult to assess how similar the studies were in terms of their design, populations and outcomes, given the limited study details provided, but the authors’ use of a narrative synthesis appears appropriate. Overall, the authors are very cautious in their conclusions, which appear to follow from the poor-quality data provided.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that a randomised clinical trial is needed to evaluate dental and skeletal changes immediately after SARME and to assess the risk of relapse in the long term.

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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.