A systematic review of the effects of bone-borne surgical assisted rapid maxillary expansion
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CRD summary
The review assessed the effectiveness and safety of bone borne surgically assisted rapid maxillary expansion in adults and adolescents. There was weak evidence of less buccal tipping of teeth used as anchor teeth in tooth-borne expansion. The conclusion was based on the results of a very small case series with no direct comparison. The reliability of the conclusion is unclear.

Authors' objectives
To assess the effectiveness and safety of bone borne surgically assisted rapid maxillary expansion (SARME).

Searching
MEDLINE (from 1966), EMBASE (from 1980), CINAHL (from 1982) and Cochrane Central Register of Controlled Trials (CENTRAL) were searched to first quarter or June 2008 and Biological Abstracts was searched (from 1991 to 2001). Search terms were reported. There were no language restrictions. Reference lists of retrieved articles were searched.

Study selection
Eligible studies were randomised controlled trials (RCTs), controlled clinical trials (CCTs) and case series with a sample size of at least five. Eligible participants were adolescents or adults who had undergone a SARME with a bone-borne palatal distractor. Inclusion criteria for outcomes were not specified.

Median age of participants ranged from 13.9 to 26.4 years (the youngest was 11 and the oldest 43 years). Most studies had participants with developmental deformity; a few participants had cleft lip palate, other congenital deformity or unknown diagnosis. Five different distractors were used: Trans Palatal Distractor (TPD); Rotterdam Palatal Distractor (RPD); Madeburg Distractor (MD); Dresden Distractor (DD); and Maxillary Widening Device (MWD). An average latency period of 5.6 days (range one to seven) before the start of activation was reported. The average rate of distraction was 0.66mm/day (range 0.33 to 1mm/day). Outcomes measured included assessment of expansion in terms of changes in dental and skeletal structures, assessment of orthodontic side effects in terms of tipping of teeth, treatment related difficulties, dental and periodontic side effects and assessment of pain.

Two reviewers independently undertook selection of studies. Differences were resolved by consensus.

Assessment of study quality
Methodological quality of the included studies was assessed independently by two reviewers; criteria included assessment of follow-up, recording of patient numbers and details of the technique. The method of validity assessment was not reported.

Data extraction
Data were extracted on assessment of expansion, orthodontic side-effects, treatment related difficulties, dental and periodontic side effects and pain on special extraction forms.

Two reviewers independently performed data extraction. Differences were resolved by consensus.

Methods of synthesis
Studies were synthesized in narrative format.

Results of the review
Ten case series (n=159 patients, range eight to 57) were included in the review. One study was prospective and nine were retrospective. Three studies from the same research group had overlapping samples and only the largest study was
included. Three studies reported qualitative clinical experience. Seven studies performed quantitative measurements. All studies had a minimal follow up until the removal of the distractor.

Sixty-one episodes of treatment-related difficulties were found in 147 patients; 33 episodes were appliance related, mostly distractor loosening. Average tipping for first maxillary premolars and first maxillary molars was 0.9° buccal tip and 8.3° palatal tip (one study of 20 patients).

**Authors' conclusions**

There was very weak evidence that when bone-borne SARME is compared with tooth-borne SARME, there was less buccal tipping of the teeth used as anchor teeth in tooth-borne expansion.

**CRD commentary**

The review addressed a clear research question. Inclusion criteria appeared appropriate. No eligibility criteria for outcomes were reported. Five electronic databases were searched without language restrictions. Attempts made to find other relevant studies by searching reference lists. The authors did not report whether they searched for unpublished studies, so publication bias could not be ruled out. Methods used to minimise reviewer error and bias during study selection, data extraction and validity assessment were appropriate. The authors did not report what tool they used for quality assessment. The included studies were all small case series. The methodological quality data reported by the authors appeared to be data describing follow-up and comparative data on the nature of the interventions used. Given the variation in the included studies, the decision not to pool was appropriate.

The authors' conclusion was based on the results of one small case study with 20 participants. The conclusion was an implicit indirect comparison with tooth-borne SARME based on data from other studies not included in the review. These concerns and the heterogeneity and low quality from a small evidence base made the reliability of the conclusion unclear.

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

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that further research was required. This should comprise RCTs with a control group of tooth-anchored SARME, 3-dimensional volumetric analysis of bony and soft tissue changes, standardised surgical and distraction protocol, standardised reporting of treatment difficulties, interim follow-up of three months after removal of the distractor and follow-up of at least one year after the completion of the surgical treatment.

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