A systematic review concerning early orthodontic treatment of unilateral posterior crossbite

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CRD summary
This review examined orthodontic treatment effects on unilateral posterior crossbite in primary and early mixed dentition. The authors concluded that there is no scientific evidence to show which of the treatment modalities, grinding, Quad-helix, expansion plates, or rapid maxillary expansion, is the most effective. The authors' conclusions are appropriate given the methodological limitations of the evidence base reviewed.

Authors' objectives
To examine the orthodontic treatment effects on unilateral posterior crossbite in primary and early mixed dentition.

Searching
MEDLINE was searched from January 1966 to October 2002 to identify studies published in English, German, French, or Scandinavian languages. In addition, the Cochrane Controlled Trials Register was searched and the references of all retrieved articles were checked for additional studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), prospective and retrospective studies with concurrent untreated or normal controls, and clinical trials comparing at least two treatments without any untreated or normal control group were included. Case reports and case series were excluded, as were reviews and abstracts.

Specific interventions included in the review
Studies that compared at least two treatment strategies were included. The review compared Quad-helix (QH), expansion plates, rapid maxillary expansion (RME) and grinding, either with each other or with no intervention. Studies in which treatment was combined with extractions, full-fixed appliances, or surgery were excluded.

Participants included in the review
Children under the age of 10 years with posterior unilateral crossbite, who were in the stage of primary or early mixed dentition, were eligible. The participants included in the review were aged from 4.0 to 9.7 years. Studies that included treatment in adults, in late mixed and permanent dentition, or for anterior crossbite (Angle Class III) were excluded, as were participants with cleft lip and/or palate or other craniofacial syndrome diagnoses. The studies were conducted in Sweden (n=7), Finland (n=1), Turkey (n=2), Denmark (n=1) and the USA (n=1).

Outcomes assessed in the review
No inclusion criteria for the outcomes were specified. The outcomes assessed included the treatment time or retention time, success rate, mean expansion (immediate and at follow-up), side-effects and costs.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for thereview, or how many reviewers performed the selection.

Assessment of study quality
Studies were assessed on the basis of the following: study design; sample size and prior estimate of required sample size; participant selection description; withdrawals and drop-outs; valid methods; whether confounding factors were considered; blinding; and the adequacy of the statistical methods. All studies were categorised as low, medium, or high. Two independent reviewers assessed study quality, with any disagreements being resolved through discussion. A third reviewer assessed the validity of the statistical techniques employed.
Data extraction
Two reviewers extracted the data independently, and any disagreements were resolved by discussion. Data were extracted on the study design, materials, drop-outs, measurements, treatment time, outcomes, side-effects, costs and the authors' conclusions.

Methods of synthesis
How were the studies combined?
The studies were combined in a narrative discussion.

How were differences between studies investigated?
Differences between the studies were discussed with reference to the study design, treatment modality and methodological quality.

Results of the review
Twelve studies were included: 2 RCTs and 10 controlled clinical trials, five of which were prospective and five of which were retrospective. The total number of participants was 725.

Five studies compared treatment with QH versus expansion plates, and one study compared QH, expansion plates and RME. A further 4 studies assessed the effects of grinding compared with no treatment, and one additional study compared QH and grinding. The remaining study evaluated QH treatment in primary dentition versus treatment in early mixed dentition.

Success rate: the success rate was reported to be close to 100% for treatment with QH and RME. The success rate for expansion plates was between 51 and 100%, and for grinding between 27 and 90%. Spontaneous correction was found to occur among 16 to 50% of the participants in the untreated control groups.

Treatment time: the treatment time varied between 1 and 7.7 months for QH, and between 4 and 14 months for expansion plate; the treatment time for RME was 19 days.

Expansion effects: the mean expansion obtained immediately post-treatment varied. The values ranged from 3.3 to 6.4 mm in the molar region and from 1.3 to 5.2 mm in the canine region for treatment with QH; from 2.6 to 4.7 mm and from 0.7 to 4.1 mm, respectively, with expansion plate treatment; and were 5.5 and 3.2 mm, respectively, with RME. When grinding was performed, minor expansion effects were found in the molar region and up to 3 mm in the canine region. In the majority of studies the expansion effects were followed up for between 3 months and 7 years. The remaining expansion at follow-up varied: for QH, from 3.6 to 5.1 mm in the molar region and from 2.2 to 3.3 mm in the canine region; for expansion plates, from 3.1 to 3.7 mm and from 2.5 to 3.7 mm, respectively; and for RME, the values were 5.4 mm in the molar region and 3.3 mm in the canine region.

Three studies found there to be no significant differences between QH and expansion plates, while 2 studies found significantly more expansion with QH. One study found the expansion effect of RME, QH and expansion plates to be equivalent, but with more skeletal effects with QH and RME. In the one study that compared treatment with QH versus grinding, no significant differences were shown between the two treatment modalities at the long term follow-up. In the remaining 4 studies that assessed the treatment effect between grinding and spontaneous correction, 2 studies found the effect of spontaneous correction almost equalled that of grinding. However, the other 2 studies found grinding to be superior to spontaneous correction in primary dentition.

Side-effects: based on the results from 4 studies, the most commonly reported side-effects were loose bands for QH, and poor fit and broken appliances for expansion plates.

Cost information
Two studies included a cost analysis. In both of these, the costs of QH and expansion plates were compared. Both studies found that there were lower costs with QH treatment.
Authors' conclusions
The treatment strategies of QH, expansion plates and RME are effective in early mixed dentition and have a high success rate. However, there is no scientific evidence showing which of the treatment modalities is the most effective. Consequently, no conclusions can be drawn regarding stability in the long term, especially since the follow-up time varied substantially among the studies.

CRD commentary
The review question was clear in terms of the interventions, participants and study design. However, it appears as though some study designs may have been inappropriately classified, thus the actual design of some studies was not entirely clear. An adequate search was conducted, but no attempts were made to minimise publication bias. The methods used to select the studies were not described, so it is not known whether any efforts were made to reduce errors and bias. Methods were, however, employed to minimise bias in the validity assessment and data extraction. The studies were combined appropriately in a narrative discussion and limitations of the primary studies were adequately discussed. Given the limitations of the evidence base reviewed, the authors' conclusions are appropriate.

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

Research: The authors stated that RCTs with sufficient sample sizes are needed to determine which treatment is the most effective for early correction of unilateral posterior crossbite. Future studies should also include assessments of long-term stability, as well as an analysis of the costs and side-effects of the interventions.

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