

## Ask us\*

### Long-term stability of maxillary expansion

**Q** Is there evidence that maxillary expansion obtained with fixed or removable expansion appliances is stable in the long term (>1 year postretention from fixed appliances)?

**A** There is only second-level evidence that maxillary expansion obtained with fixed expansion appliances is stable in the long term. There is only weak indirect evidence of long-term expansion stability with the use of removable maxillary expansion appliances.

Maxillary expansion, with fixed or removable expansion appliances, is a common orthodontic treatment. It is primarily used for the correction of posterior crossbites as a result of reduced maxillary width.<sup>1</sup> Maxillary expansion is particularly important in eliminating mandibular functional shift, a finding commonly associated with deficient maxillary arch width in early dentition development that can have undesirable consequences on facial symmetry,<sup>2</sup> and possibly temporomandibular joint function,<sup>3</sup> if left untreated. Other applications suggested in the orthodontic literature include increasing arch perimeter in the absence of posterior crossbite to facilitate nonextraction edgewise treatment,<sup>4</sup> and improving Class II interarch relationships by a spontaneous mandibular growth or positioning response to maxillary expansion.<sup>5</sup>

The increase in the transverse dimension of the maxillary arch by using expansion appliances is indisputable.<sup>6</sup> The short-term treatment effects are both dental and skeletal, resulting in significant gains in maxillary intermolar width and maxillary perimeter arch width postexpansion. The long-term change in the maxillary transverse dimension posttreatment (ie, the amount of expansion remaining with time) is less well established, particularly in relation to expected transverse changes with growth in untreated persons with normal occlusion.<sup>7,8</sup>

Systematic reviews and meta-analyses are evidenced-based tools that use systematic literature searches, quality assessments and data extraction measures to summarize the literature for a particular treatment effect. They reduce bias in data interpretation. The Council on Scientific Affairs (COSA) used an evidence-based approach to the question of long-term stability of the maxillary transverse dimension changes associated with fixed or removable expansion appliances. A search of the literature for meta-analyses and systematic reviews via PubMed and Google Scholar, with the key words *palate expansion*, *maxillary expansion*, *rapid maxillary expansion*, and *slow maxillary expansion*, was conducted. Eight articles that surveyed the literature between 1979 and January 2005 were found.<sup>9-16</sup>

All 9 COSA members independently read and interpreted these 8 articles. Based on these systematic reviews and meta-analyses, all COSA members unanimously concluded that 6<sup>9-12,15,16</sup> of the 8 articles were equivocal or inconclusive or, at best, provided weak indirect evidence for long-term stability of maxillary expansion with either fixed or removable expansion appliances. Design and method flaws in the trials reviewed in these 6 articles include no long-term data, no control samples, small sample sizes, bias, confounding variables, no method or error analyses, no statistical analyses, and no retention protocol.

Of the 2 remaining articles, all 9 COSA members agreed that 1 systematic review (evaluating long-term stability by using skeletal landmarks on radiographs<sup>14</sup>) provided weak or secondary evidence of long-term skeletal expansion stability with fixed expansion appliances, mainly because only one study met the inclusion criteria for this systematic review. All 9 COSA members agreed that the final systematic review (evaluating the stability of dental-arch expansion with dental casts<sup>13</sup>) provided evidence of long-term stability of dental-arch expansion. Because the 2 qualifying studies in this systematic review were not randomized controlled clinical trials, the scientific evidence is not the highest level attainable.

In this final article, Lagravere et al<sup>13</sup> systematically reviewed the literature on the long-term dental-arch changes associated with rapid maxillary expansion treatment. They searched for controlled clinical trials that included long-term dental-arch evaluations from posteroanterior radiographs or dental casts. Long-term evaluation was defined as expansion remaining after more than 1 year postretention. Inclusion and exclusion criteria resulted in only 3 controlled clinical trials, each of which used Haas-type rapid maxillary expansion appliances. Two of these trials compared long-term changes on dental casts with untreated controls: a retrospective trial for an adult treatment sample and a prospective trial for an adolescent treatment sample. Based on the analyses of these data, the authors concluded that between 3.7 (adolescent treatment) and 4.8 mm (adult treatment) of expansion remained in the long term compared with the controls. The third study measured long-term changes on posteroanterior radiographs against untreated controls, but without statements of retention protocol. The authors commented, "Therefore, caution should be exercised in the interpretation of the long-term (expansion) effects according to cephalometric analysis. . . . Cephalometric measurements regarding inter-molar width change are subject to magnification effect and without knowledge of the magnification factor cannot be compared directly with model measurements."<sup>13</sup>

The question that COSA sought to specifically answer was whether maxillary expansion is stable in the long term. In the end, the evidence-based answer to this question comes from 1 retrospective controlled trial or adult subjects and 1

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prospective controlled trial of adolescent subjects. In the adolescent study, posterior crossbite was not an initial condition for any subject. In the adult study, 83% of the subjects began expansion therapy with a posterior crossbite. The evidenced-based answer pertains to these conditions. There remains a lack of evidence from controlled trials for long-term stability of maxillary expansion in adolescents when posterior crossbite is the pretreatment condition.

Does this mean that maxillary expansion with fixed or removable expanders is ineffective? Absolutely not! Rather, it means that additional controlled trials are needed to add to our knowledge of long-term expansion stability. Future trials should include well-defined retention protocols and untreated control groups to factor out normal transverse changes of growth. Randomized trials are desirable because they produce the highest level of scientific evidence for treatment evaluation. Yet they are used rarely in orthodontics.<sup>16</sup> The reasons for this might be ethical (denying patients the right to influence treatment choice) and practical (difficulty amassing large sample sizes and controls with similar malocclusions). For instance, designing a trial for long-term stability of posterior crossbite correction requires following a control group of untreated subjects with posterior crossbite. Thus, at present, orthodontists must accept that there are treatments which may be effective, but for which a high level of evidence may not be found.

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## REFERENCES

1. Marshall SD, Southard KA, Southard TE. Early transverse treatment. *Semin Orthod* 2005;11:130-9.
2. Hesse KL, Årtun J, Joondeph DR, Kennedy DB. Changes in condylar position and occlusion associated with maxillary expansion for correction of functional unilateral posterior crossbite. *Am J Orthod Dentofacial Orthop* 1997;111:410-8.
3. Pellizoni SEP, Salioni MAC, Juliano Y, Guimarães AS, Alonso LG. Temporomandibular joint disc position and configuration in children with functional unilateral posterior crossbite: a magnetic resonance imaging evaluation. *Am J Orthod Dentofacial Orthop* 2006;129:785-93.
4. Cameron CG, Franchi L, Baccetti T, McNamara JA Jr. Long-term effects of rapid maxillary expansion: a posteror anterior cephalometric evaluation. *Am J Orthod Dentofacial Orthop* 2002;121:129-35.
5. McNamara JA Jr. Early intervention in the transverse dimension: is it worth the effort? *Am J Orthod Dentofacial Orthop* 2002;121:572-4.
6. Lagravère MO, Heo G, Major PW, Flores-Mir C. Meta-analysis of immediate changes with rapid maxillary expansion treatment. *J Am Dent Assoc* 2006;137:44-53.
7. Hesby RM, Marshall SD, Dawson DV, Southard KA, Casco JS, Francisus RG, et al. Transverse skeletal and dentoalveolar changes during growth. *Am J Orthod Dentofacial Orthop* 2006;130:721-31.
8. Lux CJ, Conrad C, Burden D, Komposch G. Transverse development of the craniofacial skeleton and dentition between 7 and 15 years of age—a longitudinal postero-anterior cephalometric study. *Eur J Orthod* 2004;26:31-42.
9. Harrison JE, Ashby D. Orthodontic treatment for posterior crossbites. *Cochrane Database of Systematic Reviews* 2001, Issue 1. Article No. DC000979. doi: 10.1002/14651858.CD000979.
10. Schiffman PH, Tuncay OC. Maxillary expansion: a meta analysis. *Clin Orthod Res* 2001;4:86-96.
11. Ko CH, Lim SH, Yoon YJ, Kim KN. A meta-analysis of maxillary expansion: comparisons of intercanine/intermolar expansion and rapid/slow expansion. *Korean J Orthod* 2004;34:23-21.
12. Petren S, Bondemark L, Soderfeldt B. A systematic review concerning early orthodontic treatment of unilateral posterior crossbite. *Angle Orthod* 2003;73:588-96.
13. Lagravère MO, Major PW, Flores-Mir C. Long-term dental arch changes with rapid maxillary expansion: a systematic review. *Angle Orthod* 2005;75:155-61.
14. Lagravère MO, Major PW, Flores-Mir C. Long-term skeletal changes with rapid maxillary expansion: a systematic review. *Angle Orthod* 2005;75:1046-52.
15. Lagravère MO, Major PW, Flores-Mir C. Skeletal and dental changes with fixed slow maxillary expansion: a systematic review. *J Am Dent Assoc* 2005;136:194-9.
16. Bondemark L, Holm AK, Hansen K, Axelsson S, Mohlin B, Brattstrom V, et al. Long-term stability of orthodontic treatment and patient satisfaction. A systematic review. *Angle Orthod* 2007;77:181-91.