

Palatal expansion in adults: The nonsurgical approach

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The concept that nonsurgical maxillary expansion can be successful in adults has raised questions in the literature.¹⁻⁴ Overall, the consensus is that, once patients are out of their teens, that type of expansion is no longer feasible, and instead, surgically assisted rapid maxillary expansion is necessary. The purpose of this article is to challenge this commonly accepted orthodontic paradigm.

Let us assume that the first consult at your office is a 30-year-old woman with bilateral posterior and anterior crossbites with crowding of the maxillary left lateral incisor and edge-to-edge occlusion of the right lateral incisor. You estimate transarch deficiencies of 9 mm at the first premolars and 7.5 mm at the first molars. You suggest surgically assisted rapid maxillary expansion to correct the posterior occlusion and to gain arch length to correct the crossbite of the maxillary left lateral incisor. Surprised by the suggestion of surgery, the patient asks whether you can just correct the displaced lateral incisor. Obviously, she would much prefer that you treat her malocclusion without surgery.⁵

In 1997, I presented a series of 5 cases (including the one just described) on nonsurgical maxillary alveolar expansion in adults using the Haas expander.⁵ In a commentary on these 5 cases⁶ and in a letter to the editor,⁷ it was suggested that these 5 patients might have been selected for the excellence of the results and the lack of true skeletal deficiency.

To move beyond the anecdotal case series, I collected the records of every adult patient in my office who had nonsurgical expansion with the Haas expander from 1978 to 1995. To this group of 29 subjects, I added 18 patients from the office of Dr Andrew Haas. This combined group of 47 adults (mean age, 30 years) became the adult nonsurgical expansion group in our study.⁸ We also looked at 2 additional groups: 47

children (mean age, 9.5 years) who underwent nonsurgical rapid maxillary expansion and 52 adult orthodontic patients (mean age, 33 years) who did not require expansion and served as the controls. Lagravère et al,⁹ in their systematic review of long-term dental arch changes after rapid maxillary expansion, found only 4 articles that met their stringent evidence-based criteria, and ours was one of them.⁸

The Haas expansion screws were activated for both expansion groups once daily until the palatal cusps were almost in buccal crossbite. The expander was maintained for 12 weeks and then replaced with a removable retainer. (In adults, I now activate no more frequently than every other day and, often, every third to fifth day. Thus, for adult patients, the technique is better described as slow maxillary expansion rather than rapid maxillary expansion.) We studied the following phenomena: efficacy, long-term stability, and complications. The efficacy of adult nonsurgical maxillary expansion was excellent: averages of 4.6 mm at the first molars and 4.7 mm at the first premolars, with no statistical difference between the adult and child expansion groups.⁸ The adult nonsurgical expansion also compared favorably with the results of child and adolescent groups reported in the literature.^{2,10}

However, the nature of the expansion in adults is different. Trimming and then photocopying the backs of study models at the level of the first molar buccal groove allowed us to superimpose pretreatment and posttreatment contour tracings of the models.^{5,8} This analysis clearly showed that adult expansion was the result of displacement of the alveolar process, which carried the teeth buccally. The displacement generally started at the apical third to the midlevel of the palatal vault. In children, about 50% of the expansion occurred at the midpalatal suture and the remaining 50% by displacement of the dental alveolar complex.⁸ This finding challenges the assumption of many orthodontists that all or most of the expansion in children occurs at the midpalatal suture.

Interestingly, this assumption had previously been challenged in at least 2 other studies. Krebs,^{11,12} in the late 1950s and early 1960s, using metallic bone markers, estimated that only 50% of the expansion

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Am J Orthod Dentofacial Orthop 2011;140:462-9

0889-5406/\$36.00

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doi:10.1016/j.ajodo.2011.07.002

after rapid maxillary expansion was skeletal. More recently, Iseri and Özsoy¹³ also used metallic bone markers and confirmed these findings and noted that only 40% of maxillary expansion in adolescents (average age, 14.5 years) was in the maxillary bone. I quote these authors: "The above findings also indicated that the widening of the maxilla was mainly achieved with the expansion of the maxillary dentoalveolar structures."¹³ In our study, the adults were mostly in their 30s; therefore, almost all the correction was due to expansion of the dentoalveolar complex.⁸

Garrett et al¹⁴ used cone-beam computer tomography to the skeletal effects to the maxilla after rapid maxillary expansion on adolescents (average age, 13.8 years). They concluded that, at the level of the first premolars, 55% of the expansion was skeletal; and, at the level of the first molars, only 38% was skeletal; the remainder was dentoalveolar. Recently, Kartalian et al¹⁵ used cone-beam computerized tomography to evaluate the dentoskeletal complex before and after rapid maxillary expansion in growing subjects. They concluded that approximately 5 mm of the increase at the dental level was associated with the 2-mm increase at the skeletal level—ie, a 40% skeletal contribution.

For those who still doubt the possibility of significant nonsurgical maxillary expansion in adult patients, I would argue that the evidence that 50% to 60% of expansion in children and adolescents occurs in the alveolus and not at the midline suture is the basis for the success of nonsurgical adult maxillary expansion. If alveolar displacement did not occur, cases such as those I presented in my article who had 8 to 10 mm of expansion would have had perforation of the thin buccal plate of the posterior alveolus.⁵ The palatal acrylic bodies of the Haas expander are critical to the orthopedic displacement of the alveolus.

Data on long-term stability are difficult to obtain because patients must be recalled for records many years after the completion of their treatment. In our study, 21 subjects who had discontinued maxillary retention for a mean of 5.9 years after 5 years with nighttime retainer wear were reevaluated. Not 1 molar or premolar relapsed into crossbite. The posttreatment decreases in molar and premolar transarch widths were 0.5 to 0.6 mm, and some of these decreases can be accounted for by the overcorrection retained at the end of treatment. The literature does report cases

of relapse after expansion in children and adolescents.¹⁶⁻¹⁸ Possible explanations for such relapses are the use of dentally based expanders (hyrax) vs our use of the Haas expander with its palatal acrylic bodies, use of removable instead of fixed expanders, failure to significantly overexpand, and too short a retention period after expansion.

POTENTIAL COMPLICATIONS

The potential complications of adult nonsurgical expansion cited in the literature are that the posterior teeth will tip, the mandible will undergo opening rotation, there will be pain and tissue swelling, and the labial gingivae will recede. Let us examine these possible complications in detail.

Will the posterior teeth tip? The maxillary molars in our adult study inclined labially 3.1° per side, but the palatal alveolus inclined toward the buccal aspect about 4° per side as well. It appears that the molars, rather than tipping in a stable alveolus, incline with the alveolar bone, and this phenomenon can be observed in the contour tracings.^{5,8} Buccal tipping of the alveolus was also observed in cone-beam computed tomography scans of adolescents after rapid maxillary expansion.^{14,15}

Will the bite open? As the dental arch expands, cuspal interferences might temporarily open the bite. However,

by the end of treatment, the mandibular plane showed no opening rotation (37° both before and after treatment), and the facial heights were also unchanged.⁸ The mandibular plane was also stable in adolescents after rapid maxillary expansion with the Haas expander.¹⁹

How often should the expander be activated? In our series of 47 adults, we prescribed a quarter turn every day, but it became clear that this schedule was too rapid. Nine of these patients experienced pain or swelling and required turning back the screw and a rest period before completing expansion. We now turn no more frequently than 1 turn every other day and often turn every third to fifth day in older patients. Activation of the expansion screw at the rate appropriate for children will cause unacceptable palate swelling and pain in adults.²⁰ The expansion can be no faster than the palatal bones and soft tissues can adapt to the powerful forces generated by the Haas expander, because the palatal suture does not separate in these mature patients.²¹

The orthodontic specialty has been reluctant to accept expansion in most situations. However, when the evidenced-based literature demonstrates success in nonsurgical transarch expansion in adults, it is time for a paradigm shift.

Will the gingivae recede? Gingival recession, defined as exposure of root cementum, was rarely observed in our adult nonsurgical rapid maxillary expansion sample; it occurred in only 11 of 480 possible sites. The extent of the recession was limited, usually 0.25 to 1 mm. Crown lengthening due to buccal attachment loss (recession without cementum exposure), seen only in the women in our study, was moderate, only 0.5 mm greater than in our adult control group. This recession should be viewed in context, since attachment loss is a common finding in adults with high standards of oral hygiene.²²

BIOLOGIC BASIS OF ORTHOPEDIC ALVEOLAR EXPANSION

The forces generated by the Haas expander are quite high and would be sufficient to bend bone.²¹ Frost²³ and Epker and Frost²⁴ theorized that, when a bone surface bends, becoming more concave, as the buccal alveolar plate does during rapid maxillary expansion, bone apposition occurs. On the other hand, resorption will occur on the increasingly convex palatal surface. Recently, Williams and Murphy²⁵ biopsied the buccal sites of 2 adults after nonsurgical expansion, similar to our study. They observed woven bone, indicating new bone formation, which confirms Frost's theoretical construct. These authors proposed compensatory periosteal apposition on the labial alveolus to explain how the total alveolar bone can drift to the buccal aspect.

How does nonsurgical rapid maxillary expansion compare with surgically assisted rapid maxillary expansion in terms of specific outcome measures? Northway and Meade²⁶ compared 2 surgically assisted rapid maxillary expansion groups with an adult nonsurgical group similar to our study⁸ and found that "maxillary expansion in adults, both orthopedic as advocated by Haas and surgically assisted, are predicable and stable." The benefits of surgically assisted expansion were greater increases in palatal and nasal volumes and a smaller increase in crown length. The increase in crown length, observed only in women in our study, was minimal and clinically acceptable.⁸ In how many patients are the marginal increases in palatal and nasal volumes important? Perhaps in a limited number of sleep apnea patients, although to my knowledge none have been documented to have significantly reduced apneic episodes after surgically assisted rapid maxillary expansion, except when the facial bones are also surgically advanced.²⁷

In the 2 surgically assisted rapid maxillary expansion groups of Northway and Meade,²⁶ the average first molar expansion values were 3.4 and 5.5 mm. Magnusson

et al²⁸ also studied adults who underwent surgically assisted rapid maxillary expansion; the average first molar expansion was 4.5 mm. In our nonsurgical study,⁸ the average was 4.6 mm, which compared favorably with surgically assisted rapid maxillary expansion.^{26,28} The advocates of surgical expansion quote from the study of Betts et al²⁹ that up to 5 mm of transverse skeletal discrepancy might be treated with camouflage treatment. This should not be interpreted that wire expansion can achieve predictable and stable results similar to surgically assisted rapid maxillary expansion^{26,28} or orthopedic displacement of the alveolus with the Haas expander.⁸

INFORMED CONSENT

Surgical expansion has several problems, beginning with the fact that many patients refuse to undergo surgery. Surgically assisted rapid maxillary expansion adds to the cost of orthodontic treatment for patients requiring maxillary expansion. It is associated with significant morbidity—facial swelling, postoperative pain, work loss, and sinus infection. Surgically assisted rapid maxillary expansion produces a large unsightly midline gap, which unfortunately takes some time to close. I'm afraid that many orthodontists underestimate the difficulties our patients undergo during surgically assisted rapid maxillary expansion, especially if they are first seen after the initial healing.

The incidence of severe iatrogenic problems associated with surgically assisted rapid maxillary expansion relates to the extent of the surgery and the skill of the surgeon. According to Lanigan,³⁰ subtotal LeFort I procedures involving separation of the pterygoid plate might infrequently cause excessive hemorrhage, thrombosis, stroke, and arteriovenous fistula between the carotid sinus and the carotid artery. Even the more limited surgical procedures can cause uneven separation between the maxillary central incisors resulting in osseous defects and gingival recession.³¹ I personally have noted that the mesial aspect of the apex of the central incisors usually shows some root resorption.

Ultimately, every clinician must decide for each adult patient whether it is best to expand the maxilla with nonsurgical expansion or surgically assisted rapid maxillary expansion. The surgical approach might be advisable in patients with extreme maxillary hypoplasia requiring extensive expansion (especially if the posterior teeth incline buccally). It also might be the preferred choice for patients who have significant gingival recession with the probable dehiscences and fenestrations, and it might be beneficial for patients with sleep apnea.

However, the evidence presented here suggests that most patients requiring maxillary transarch expansion can be successfully treated without surgery. In view of the costs, morbidity, and surgical risks of surgically assisted rapid maxillary expansion, patients should be informed of the nonsurgical option before they are asked to consent to either mode of treatment.

The orthodontic specialty has been reluctant to accept expansion in most situations. However, when the evidenced-based literature demonstrates success in nonsurgical transarch expansion in adults, it is time for a paradigm shift.^{8,13}

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