Early intervention in the transverse dimension: Is it worth the effort?

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Participating in the International Symposium on Early Orthodontic Treatment allowed me to review our long-term studies of orthodontic and orthopedic intervention in patients in the mixed and early permanent dentition periods who present with tooth size-arch length discrepancies. I hope this brief synopsis of that research will spur the reader to examine our textbook,[1] a short conceptual article on maxillary transverse deficiency,[2] and the clinical studies summarized below for more detailed explanations of our overall approach to early treatment.

Much of the discussion concerning the efficacy and effectiveness of early treatment has centered on the timing of intervention in Class II malocclusion. In our practice, however, aggressive treatment of sagittal Class II problems in the early mixed dentition stage now involves relatively few patients, with intervention restricted to young patients with psychologically or physiologically handicapping malocclusions. Rather, we frequently encounter patients with discrepancies between tooth size and available arch space, typically manifested as crowding.

It is well known that there are only 3 ways to manage crowding problems in an adolescent: extraction, interproximal reduction, and expansion (both laterally and posteriorly). In contrast, by intervening during the mixed dentition period, the clinician can take advantage of the leeway space that exists during the transition to the permanent dentition. According to Ann Arbor standards,[3] 4 mm of space is typically available in the maxillary arch and 5 mm in the mandibular arch during the exchange of the second deciduous molars and the second premolars. We routinely place a transpalatal arch before the maxillary second deciduous molars are lost (>90% of patients), and we use a mandibular lingual arch if conservation of the leeway space is necessary in the mandible.

Tooth size-arch length discrepancies can be divided arbitrarily into 3 categories[4]: clear-cut extraction (mandibular crowding >6 mm), clear-cut nonextraction (crowding <3 mm), and borderline crowding problems. Patients with severe crowding in the mixed dentition are often best treated with a serial extraction protocol; large tooth size (eg, maxillary central incisors >10.0 mm wide[3]) is a primary indication for this treatment. Interproximal reduction can be used effectively to resolve mild-to-moderate crowding problems, but we use this procedure primarily during phase II treatment.

Orthopedic expansion of the maxilla often is indicated in patients with maxillary constriction (eg, when the maxillary intermolar width is ≤30 mm). Rapid maxillary expansion (RME) can be used effectively to correct transverse and sagittal crossbite problems and to provide sufficient arch space to resolve borderline crowding in some mixed dentition patients. (As with any treatment protocol, orthopedic expansion must be undertaken with a healthy dose of common sense. Just as all patients should not be treated with extraction, neither should all be treated with RME.) In addition, this procedure can be used to facilitate maxillary canine eruption, flatten the curve of Wilson, improve nasal airflow, and "broaden the smile," and for other purposes to be mentioned later.[2]

Although RME has been used routinely as a treatment modality for crossbite correction for over 3 decades, it only recently has come into regular use for patients without crossbites. In addition, there have been

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Presented at the International Symposium on Early Orthodontic Treatment, February 8-10, 2002; Phoenix, Ariz.
Am J Orthod Dentofacial Orthop 2002;121:572-4

0889-5406/2002/$35.00 + 0 **8/1/124167**
doi:10.1067/mod.2002.124167

surprisingly few studies of the long-term stability of this procedure, both in children and adolescents. Our group has been involved in these investigations, 4 of which are summarized below.

RME AND FIXED APPLIANCE THERAPY IN THE MIXED AND EARLY PERMANENT DENTITION

In the first study, we examined the treatment effects produced by a Haas-type RME followed by fixed appliance therapy.[5] An attempt was made to recall all patients treated during a specific time interval in a single private practice who had undergone RME followed by standard edgewise orthodontic treatment and who were 5 or more years posttreatment. Longitudinal dental casts from 70 late mixed dentition patients and 41 early permanent dentition patients were obtained and analyzed. On average, subjects were 11 years old at the time of initial records, 14 years old at the end of treatment, and 20 years old at the time of long-term records. For controls, the longitudinal dental casts from 19 untreated mixed dentition subjects and 24 untreated permanent dentition subjects were matched according to age and analyzed at the same time periods. When the normally occurring decreases in arch perimeter in the control group were considered, the residual increases in maxillary and mandibular arch perimeter were 5 to 6 mm and 6 mm, respectively, in the treated group at age 20 years; these are clinically relevant amounts.

Chang et al[6] analyzed a randomly chosen subgroup of patients from the previously described sample. The purpose of this study was to examine cephalometrically the long-term effects of RME on bite opening and on the anteroposterior position of the maxilla. The sample comprised 25 patients who had undergone RME with the Haas-type expander followed by treatment with standard edgewise appliances. This RME sample was compared with a group of 25 patients who had undergone single-phase edgewise treatment and an untreated control group of 23 subjects. The results indicated that RME therapy followed by treatment with fixed appliances had little long-term effect on either the vertical or the anteroposterior dimensions of the face (ie, no clinically significant side effects).

SCHWARZ APPLIANCE THERAPY AND RME IN THE MIXED DENTITION

The next group of studies involved the treatment of mixed dentition patients. Since 1981, we have gathered cephalometric and dental cast data on all young patients undergoing RME therapy, with or without prior dental decompensation with a Schwarz appliance, in our private practice and in the Graduate Orthodontic Clinic at the University of Michigan. This longitudinal prospective sample has been the basis of several publications[7,8] and master's theses.[9-12] For example, Geran[10] evaluated the serial study models of 51 patients who underwent early treatment with a bonded acrylic splint expander (customary expansion, 7 to 9 mm transpalatally) followed by a removable palatal plate as a retainer. About 50% of the patients had 4 brackets placed temporarily on the maxillary anterior teeth to achieve incisal alignment. Phase II treatment with fixed appliances was completed when the patients were about 14 years old, and follow-up records were obtained about age 20 years. Geran[10] found that the increases in transpalatal width at the end of active treatment were maintained at follow-up. In addition, the residual maxillary arch perimeter was 3.8 mm greater in the treated group than in the controls. Similarly, the residual mandibular arch perimeter was 2.6 mm greater in the RME group than in the controls, although no active expansion of the mandibular dental arch was attempted in phase I.

O'Grady[12] studied the long-term records of 35 patients who were treated with a Schwarz appliance followed by RME and later by phase II fixed appliance treatment. He compared the changes in dental arch dimensions of these patients with 31 patients treated with RME and fixed appliances and 31 matched controls. As in Geran's study,[10] patients began treatment at about 9 years of age, finished fixed appliance treatment at about 14 years of age, and were recalled at about 20 to 21 years of age. Preliminary analysis of these data indicated that the Schwarz-RME protocol resulted in about a 4-mm increase in both maxillary and mandibular arch perimeters compared with the control values.

The evaluation of the long-term data from this rather large study of patients treated primarily in a private practice is ongoing; however, the analysis of the data thus far is very promising regarding the long-term stability of those with borderline crowding problems managed with these treatment protocols. In addition, RME has been shown to have additional benefits, including facilitating the spontaneous correction of Class II and Class III malocclusion.[2] For example, we found that, after our initial efforts to expand the maxilla of Class II patients in the early mixed dentition period, a spontaneous correction of the Class II malocclusion sometimes occurred during the retention period. These patients had either an end-to-end or a full-cusp Class II molar relationship and reasonably well-balanced skeletal structures at the beginning of treatment. At the time of expander removal, they had a strong tendency toward a buccal crossbite, with only the lingual cusps of the maxillary posterior teeth contacting the buccal cusps of the mandibular posterior teeth. It was noted

several appointments later that, even though the patients were wearing maxillary stabilization plates full time, the tendency toward a buccal crossbite often disappeared; some patients displayed a solid Class I occlusal relationship. The shift in molar relationship in these patients occurred before the transition from the mandibular second deciduous molars to the second premolars, the point at which an improvement in Angle classification sometimes occurs in untreated subjects because of the forward movement of the mandibular first molar into the leeway space.

This phenomenon has led us to rethink our concept of Class II molar correction. Our experience with the post-RME correction of Class II problems in growing patients indicates that many Class II malocclusions have a strong transverse component. The overexpansion of the maxilla, which subsequently is stabilized with a removable palatal plate, disrupts the occlusion. It appears that the patient becomes more inclined to posture his or her jaw slightly forward, thus eliminating the tendency toward a buccal crossbite and improving the sagittal occlusal relationship. Presumably, subsequent mandibular growth makes this initial postural change permanent. If not, definitive orthopedic or orthodontic Class II correction can be undertaken as the first step of phase II treatment.

CONCLUSIONS

Of many adjunctive treatment modalities, the appliance I have used most effectively to treat young patients is the acrylic splint RME. This appliance produces many treatment effects that are not limited to correcting a crossbite or increasing arch perimeter. Thus, the cornerstone of our early treatment protocols is RME, a dentofacial orthopedic approach that, when used appropriately, is an efficient and effective option for treating the mixed dentition patient.

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