Transverse, vertical, and anteroposterior changes from bone-anchored maxillary expansion vs traditional rapid maxillary expansion: A randomized clinical trial

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Introduction: The purpose of this study was to compare the transverse, vertical, and anteroposterior skeletal and dental changes in adolescents receiving expansion treatment with tooth-borne and bone-anchored expanders. Immediate and long-term changes were measured on cone-beam computed tomography (CBCT) images.

Methods: Sixty-two patients needing maxillary expansion were randomly allocated to 1 of 3 groups: traditional hyrax tooth-borne expander, bone-anchored expander, and control. CBCT images were taken at baseline, immediately after expansion, after removal of the appliance (6 months), and just before fixed bonding (12 months). Repeated measures multivariate analysis of variance (MANOVA) was applied to the distances and angles measured to determine the statistical significance in the immediate and long time periods. Bonferroni post-hoc tests were used to identify significant differences between the treatment groups.

Results: Immediately after expansion, the subjects in the tooth-borne expander group had significantly more expansion at the crown level of the maxillary first premolars (P = 0.003). Dental crown expansion was greater than apical expansion and skeletal expansion with both appliances. The control group showed little change (growth) over the 6-month interval. At 12 months, no group had a statistically significant difference in angle changes, suggesting symmetric expansion. Both treatment groups had significantly long-term expansion at the level of the maxillary first molar crown and root apex, first premolar crown and root, alveolus in the first molar and premolar regions, and central incisor root. Tooth-borne expansion resulted in significantly more long-term expansion at the maxillary premolar crown and root than did bone-borne expansion.

Conclusions: Both expanders showed similar results. The greatest changes were seen in the transverse dimension; changes in the vertical and anteroposterior dimensions were negligible. Dental expansion was also greater than skeletal expansion.

Read the full text online at: www.ajodo.org, pages 304.e1–304.e12.

EDITOR’S SUMMARY

With the growing popularity of CBCT imaging, it is tempting to try to determine once and for all whether we can increase the amount of skeletal expansion achieved with rapid palatal expansion procedures, with stable results. The purpose of this study was to use CBCT to determine the transverse, vertical, and anteroposterior skeletal and dental changes in adolescents receiving expansion with either tooth-anchored maxillary expansion (TAME) or bone-anchored maxillary expansion (BAME). Over an 18-month period, 62 patients who needed maxillary expansion were randomly allocated into 3 groups. One group received tooth-anchored expanders with bands on the first permanent molars and first premolars. The second group received bone-anchored devices, composed of 2 custom-milled stainless steel onplants, 2 miniscrews, and an expansion screw. The third group delayed treatment for 12 months to serve as the control group. Changes were measured on CBCT images taken at several stages: baseline, immediately after expansion, 6 months after placement of the appliance, and 12 months after placement of the appliance.

Midpalatal suture separation was seen on the CBCT images for both TAME and BAME groups. Approximately 4 mm (70%) of the expansion at the maxillary molars was maintained at 12 months with either appliance. Bone-borne expansion was developed to eliminate some of the negative effects (dental expansion, periodontal recession, and possible root resorption) of tooth-borne systems. However, based on the results of
both types of expansion led to similar outcomes. Force application at the teeth and on the roots is greater in the tooth-anchored method; in the bone-anchored method, pressure on the bone is greater. For this reason, the results are surprising. The authors discovered similar tipping of the molars with both appliances. Dental tipping was greater for the first premolars in the TAME group because the force application is on the molars and premolars; with the BAME method, it is at the level between the molars and second premolars. No difference between apical expansion of the molar apices was found between appliances; according to the authors, the rigidity of the tooth-anchored expander would result in buccal root movement, whereas, for bone-anchored expansion, the application of force at the bone surface near the molar root caused bone bending, with movement of the root apex toward the outer surface of the alveolus.

These findings indicate that bone-anchored maxillary expansion can be an alternate choice for achieving expansion when several teeth are missing or other complications limit the use of tooth-anchored devices.

**Q & A**

**Turpin:** Were you prepared for these unexpected findings?

**Lagravère:** We were not prepared for these findings. Our initial expectation was that BAME would cause more skeletal expansion and less dental tipping than TAME. Previous research in adults undergoing surgically assisted maxillary expansion showed more skeletal change with a bone-borne device than with a tooth-borne device. Surgical sectioning of the maxilla allowed unrestricted bone expansion. Based on our study of adolescents not having surgery, it appears that resistance to transverse bodily movement of the 2 halves of the maxilla is heavily influenced by the circummaxillary suture system.

**Turpin:** As a result of this outcome, will you consider redesigning the BAME appliance to achieve greater skeletal change?

**Lagravère:** This line of research is ongoing at our university. We are conducting a study using osseous integrated implants for palatal expansion. Future research is planned to investigate lower constant force levels with BAME devices. These new appliances are currently at the engineering design phase.

**Turpin:** Did you have any unexpected management problems in this randomized controlled trial? What was the response from the control-group subjects when asked to wait for 12 months, while those in the other groups started treatment immediately?

**Lagravère:** We experienced no resistance from the control (delayed treatment) group, even though we were strict in our randomized treatment allocation. Our Orthodontic Graduate Clinic has a waiting list for patients seeking treatment. Voluntary participation in this study did not reduce treatment fees but did assure patients that they would be accepted in a known time frame. Fortunately, there were no drop-outs from the control group.

**REFERENCE**