Maxillary Expansion and Vertical Dimension -- 17 out of 84 hits

Lagravere MO, **Heo G**, **Major PW**, **Flores-Mir C**. **Meta-analysis of immediate changes with rapid maxillary expansion treatment.** J Am Dent Assoc. 2006 Jan;137(1):44-53.

BACKGROUND: The authors conducted a literature review to evaluate immediate transverse, anteroposterior, and vertical dental and skeletal changes produced by rapid maxillary expansion (RME). TYPES OF STUDIES REVIEWED: The authors reviewed clinical trials that assessed immediate dental and/or skeletal changes after RME using cephalometric analysis, model casts or both. No surgical or other simultaneous treatment was accepted during the evaluation period. RESULTS: The authors searched electronic databases and found 31 articles that met the initial inclusion criteria. The authors later rejected 12 of these articles because they did not report immediate changes, three because they lacked detailed descriptions of their results and two because of their nonconventional appliance designs. Fourteen articles satisfied th final inclusion criteria; however, they had methodological deficiencies. CLINICAL IMPLICATIONS: The greatest changes resulting from RME in the studies analyzed were dental and skeletal transverse changes. Few vertical and anteroposterior immediate changes were statistically significant, though they probably are not clinically important.

Chung CH, **Font B**. **Skeletal and dental changes in the sagittal, vertical, and transverse dimensions after rapid palatal expansion.** Am J Orthod Dentofacial Orthop. 2004 Nov;126(5):569-75.

The purpose of this study was to examine the maxillary and mandibular responses to rapid palatal expansion (RPE) in all 3 dimensions. Twenty children (average age, 11.7 years) who required RPE treatment were included in this study. Pre- (T1) and post-RPE (T2) lateral and posteroanterior (PA) cephalograms and study models were taken for all patients. For each patient, lateral and PA cephalograms at T1 and T2 were traced, and the sagittal, vertical, and transverse measurements were made. In addition, on the pre- and postexpansion models, the widths between the first premolars, the first molars, and the two acrylic halves of the Haas-type expander were measured. Results showed that from T1 to T2, the mean SNA increased 0.35 degrees ($P < .05$) and ANB increased 1.00 degrees ($P < .05$). Both the ANS and PNS moved downward (1.30 mm and 1.43 mm, respectively, $P < .05$), and the mandibular plane angle (MP-SN) increased 1.72 degrees ($P < .05$). The maxillary and mandibular incisors did not change significantly after RPE. After RPE, the mean increase of maxillary interpremolar width, maxillary intermolar width, maxillary width (J-J), nasal width, and interorbital width were found to be 110.7%, 104.5%, 30.1%, 23.1%, and 3.3% of the screw expansion, respectively. After RPE treatment in children, the maxilla displaced slightly forward and downward ($P < .05$); the mandible rotated downward and backward, and the anterior facial height increased

significantly (P < .05); and the widths of the maxilla and nasal cavity increased significantly (P < .05).

Jafari A, Shetty KS, Kumar M.
Study of stress distribution and displacement of various craniofacial structures following application of transverse orthopedic forces--a three-dimensional FEM study. Angle Orthod. 2003 Feb;73(1):12-20.

The purpose of this study was to analyze the stress distribution patterns within the craniofacial complex during rapid maxillary expansion. Therefore, a finite element model of a young human skull was generated using data from computerized tomographic scans of a dried skull. The model was then strained to a state of maxillary expansion simulating the clinical situation. The three-dimensional pattern of displacement and stress distribution was then analyzed. Maximum lateral displacement was 5.313 mm at the region of upper central incisors. The inferior parts of the pterygoid plates were also markedly displaced laterally. But there was minimum displacement of the pterygoid plates approximating the cranial base. Maximum forward displacement was 1.077 mm and was seen at the region of the anteroinferior border of the nasal septum. In the vertical plane, the midline structures experienced a downward displacement. Even the ANS and point A moved downward. The findings of this study provide some additional explanation of the concept of correlation between the areas of increased cellular activity and the areas of dissipation of heavy orthopedic forces. Therefore, the reason for the occurrence of sensation of pressure at various craniofacial regions, reported by the patients undergoing maxillary expansion could be correlated to areas of high concentration of stresses as seen in this study. Additionally, the expansive forces are not restricted to the intermaxillary suture alone but are also distributed to the sphenoid and zygomatic bones and other associated structures.

Cozza P, Giancotti A, Petrosino A. **Rapid palatal expansion in mixed dentition using a modified expander: a cephalometric investigation.** J Orthod. 2001 Jun;28(2):129-34.

The aims of this investigation were to cephalometrically study the short-term skeletal and dental modifications induced by rapid palatal expansion in a sample of 20 patients (10 male, 10 female), aged 6-10 years (mean age 8 years) in mixed dentition with a uni- or bilateral posterior crossbite, a mild skeletal Class II malocclusion, and an increased vertical dimension (FMA, SN/\GoGn), and to compare them with an untreated matched control group of 20 subjects (10 male and 10 female), mean age 8 years. Cephalometric analysis showed that the maxilla displayed a tendency to rotate downwards and backward, resulting in a statistically significant increase of the SN/\PP angle (T0 = 9*95 degrees, T1 = 11*60 degrees, P < 0*01) and the SN-ANS linear value (T0 = 49*50 mm,

T1 = 51*10 mm, P < 0*05). In addition, there was a statistically significant alteration of the anterior total facial height N-Me (T0 = 113*15mm, T1 = 114*15 mm, P < 0*05) and for the dental upper molar measurement U6-PP (T0 = 19*70 mm, T1 = 20*30 mm, P < 0*05). The small alterations found in the anterior total facial height and in the sagittal angles agree with previous studies, and suggest that RPE can be also used in subjects with a tendency to vertical growth and a skeletal Class II malocclusion.

Saadia M, **Torres E**. **Vertical changes in Class III patients after maxillary protraction with expansion in the primary and mixed dentitions.** Pediatr Dent. 2001 Mar-Apr;23(2):125-30.

PURPOSE: This study determined the vertical response of class III patients in the primary, mixed, and late mixed dentition phases fitted with a protraction mask and expansion. METHODS: The before and after cephalometric records of 112 patients divided by sex were analyzed at ages 3 to 6, > 6 to 9 and > 9 to 12 years to assess the vertical changes. Data was correlated by means of paired t tests and scheffe's multiple contrasts. The study showed: (1) descriptive statistics and the before and after results in males and females in the different age groups; (2) the changes in males and females disregarding age; and (3) the changes at the different ages disregarding gender. RESULTS: The main vertical changes in this study were seen in the FMA angle, GoGn to SN, Facial axis, and ANS-Me between the ages of 3 to 6 years. Between 6 to 9 years, a lesser significant opening existed and no significant change could be seen in the GoGn-SN angular measurement. Between 9 to 12 years all linear and angular measurements became non significant with the exception of ANS-Me. CONCLUSIONS: Class III corrections should be started as early as possible, once the diagnosis is made and cooperation allows it. Most of the changes were seen between the ages of 3 to 6 years. No significance was seen after the age of 9 years with the exception of ANS-Me in both males and females (P < 0.05). No differences were seen between males and females in all measurements at the different ages with the exception of occlusal plane to SN (P < 0.05) between 3 to 6 years. The vertical changes were mostly seen in the mandible with no direct benefit from the changes in the midfacial region.

Sankey WL, **Buschang PH**, **English J**, **Owen AH 3rd**. **Early treatment of vertical skeletal dysplasia: the hyperdivergent phenotype.** Am J Orthod Dentofacial Orthop. 2000 Sep;118(3):317-27.

This cephalometric study evaluated an early nonextraction treatment approach for patients with severe vertical skeletal dysplasia and maxillary transverse constriction. Thirty-eight patients, 8.2 years (+/- 1.2 years) of age, were treated for 1.3 years (+/- 0.3 years) with lip seal exercises, a bonded palatal expander appliance, and a banded lower Crozat/lip bumper. The bonded palatal expander functioned as a posterior bite-block and was fixed in place throughout treatment. Patients with poor masticatory muscle force

(79%) wore a high-pull chincup 12 to 14 hours per day. A control group was matched for age, sex, and mandibular plane angle. Treatment changes for chincup and other patients were not significantly different. Overall, treatment significantly enhanced condylar growth, altered it to a more anterosuperior direction, and produced "true" forward mandibular rotation 2.7 times greater than control values. Posterior facial height increased significantly more in patients than in controls, and the maxillary molars showed relative intrusion. In treated patients, articular angle increased, gonial angle decreased, and the chin moved anteriorly twice as much as in controls. Treatment also led to increased overbite and decreased overjet. Maxillary and mandibular expansion did not cause the mandibular plane angle to increase. The 16 patients with openbite malocclusions exhibited a 2.7 mm increase in overbite and inhibition of growth in anterior lower facial height. The aggregate of individual changes demonstrates a net improvement, indicating this treatment approach may be suited for hyperdivergent patients with skeletal discrepancies in all 3 planes of space.

Bertele G, **Mercanti M**, **Stella F**. **Structural dentofacial variations in maxilla expansion.** Minerva Stomatol. 1999 Apr;48(4):101-13. [Article in English, Italian]

BACKGROUND: The control of vertical dimension is important in those subjects who need a correction of the maxillary transversal diameters, in order to project a correct therapeutical plan and not to make worse an eventual contemporary long-face. This research intends to consider the vertical dimension changes of the cranio-facial middle third caused by palatal expansion, in relation to technique and patient's age. METHODS: We have compared orthodontic-orthopedic expansion both with elastic appliances ("w" expansion palatal arch), stiff ones (Hyrax-type appliance) and surgically assisted expansion which combines the action of Hyrax-type appliance with a bilateral corticotomy of zygomatic buttress. Among treatments of this kind which have been carried out in Odontological Clinic of University of Verona, we have selected three groups of subjects who have been treated with orthopedic expansion the first one in infantile age, the second one in adult age, and the third one with surgically assisted expansion. At the end of the treatment, we have evaluated dimension changes of the cranio-facial third middle caused by therapy, with the aid of a cephalometric analysis made on purpose. RESULTS: The results obtained are similar in the case of orthopedic expansion in young people and in surgically assisted expansion, while the increase of vertical dimension caused by the orthopedics expansion in grown-up people is more substantial. CONCLUSIONS: Considering these data, it appears that the surgically assisted expansion is more effectual and physiological for the correction of transversal deficiencies of maxilla in grown-up people.

Reed N, **Ghosh J**, **Nanda RS**. **Comparison of treatment outcomes with banded and bonded RPE appliances.** Am J Orthod Dentofacial Orthop. 1999, Jul;116(1), 31-40.

The purpose of this retrospective study was to compare the treatment outcomes with a banded (n = 38) versus a bonded (n = 55) rapid palatal expansion appliance followed by edgewise orthodontics. Both lateral cephalometric radiographs and orthodontic study casts were evaluated at pretreatment and posttreatment time periods. Overall, the banded rapid palatal expansion group had more vertical change than the bonded group. However, most of these changes were less than 1 degrees or 1 mm and may be considered clinically insignificant. This study could not establish superiority of one type of rapid palatal expansion technique over another.

Akkaya S, **Lorenzon S**, **Ucem TT**. **A comparison of sagittal and vertical effects between bonded rapid and slow maxillary expansion procedures.** Eur J Orthod. 1999 Apr;21(2):175-80.

The purpose of this study was to determine the vertical and sagittal effects of bonded rapid maxillary expansion (RME), and bonded slow maxillary expansion (SME) procedures, and to compare these effects between the groups. Subjects with maxillary bilateral crossbites were selected and two treatment groups with 12 patients in each were constructed. The Hyrax screw in the RME treatment group and the spring of the Minne-Expander in the SME treatment group were embedded in the posterior bite planes, which had a thickness of 1 mm. At the end of active treatment these appliances were worn for retention for an additional 3 months. Lateral cephalometric radiographs were taken at the beginning and end of treatment, and at the end of the retention period. The maxilla showed anterior displacement in both groups. The mandible significantly rotated downward and backward only in the RME group. The inter-incisal angle and overjet increased in both groups. No significant differences were observed for the net changes between the two groups.

Pearson LE, **Pearson BL**. **Rapid maxillary expansion with incisor intrusion: a study of vertical control.** Am J Orthod Dentofacial Orthop. 1999 May;115(5):576-82.

This is a prospective study of 20 consecutively treated patients needing maxillary expansion and incisor intrusion. The patients were treated with a bonded maxillary expansion appliance, intrusion of the incisors with either a one-piece or three-piece base arch and anchorage augmented by the use of vertical-pull chincup therapy. Because rapid palatal expansion and intrusion of maxillary incisors both produce extrusion of posterior teeth, this study was undertaken to determine if a combination of controlled forces could prevent undesirable increases in vertical dimension. The maxillae were widened approximately 8 mm, the incisors were intruded 3 mm, the maxillary molars stayed the same or were intruded slightly, and the mandibular plane angle stayed essentially the same. In addition, A-point was retracted slightly and the occlusal plane was rotated in a counter-clockwise direction.

Asanza S, **Cisneros GJ**, **Nieberg LG**. **Comparison of Hyrax and bonded expansion appliances.** Angle Orthod. 1997;67(1):15-22.

The majority of rapid maxillary expansion studies have reported the use of appliances with metal bands attached to the posterior teeth. Tooth extrusion, dental tipping, and an increase in the vertical dimension are often encountered, which may not coincide with treatment objectives. Bonded appliances using interocclusal acrylic may control the vertical dimension and expand the maxillary halves in a more bodily and symmetrical fashion. The purpose of this clinical trial was to determine, by radiographic analysis, the differences between a conventional banded expander (Hyrax) and a bonded acrylic expander. Fourteen patients who exhibited a need for expansion were enrolled in the study. The results suggest that the increase in the vertical dimension often seen with the more conventional Hyrax appliance may be minimized or negated with the bonded appliance. However, there appeared to be no significant difference between the amount of dental tipping or symmetrical expansion between the two appliances, as previously theorized.

Velazquez P, **Benito E**, **Bravo LA**. **Rapid maxillary expansion. A study of the long-term effects.** Am J Orthod Dentofacial Orthop. 1996 Apr;109(4):361-7.

A study was made to determine whether skeletal alterations usually produced by rapid maxillary expansion may be compensated for in time by growth and/or comprehensive orthodontic treatment. In 30 patients, orthodontic treatment was started with rapid maxillary expansion, followed by fixed appliances, not combined with any other form of orthopedic device. Mean treatment time was 3.1 years. Nine measurements from the Ricketts analysis were studied, based on lateral cephalometric radiographs. Records were taken before orthodontic treatment and after completion of active therapy. A statistical analysis was made of the nine variables used, reflecting the vertical and anteroposterior skeletal proportions of the face, contrasting the changes before and after treatment. Of all the variables studied, the four that change with age according to the Ricketts analysis (mandibular plane angle, maxillary height, facial depth and facial convexity), yielded statistically significant differences after treatment, indicative of normal growth. The five remaining variables that remain constant with age according to the Ricketts analysis (facial axis, lower facial height, total facial height, palatal plane inclination and maxillary depth) showed no significant changes after treatment, also indicative of normal growth.

Ladner PT, **Muhl ZF**. **Changes concurrent with orthodontic treatment when maxillary expansion is a primary goal.** Am J Orthod Dentofacial Orthop. 1995 Aug;108(2):184-93.

A retrospective study of dental and maxillary skeletal changes occurring during a period of orthodontic treatment was made from pretreatment and posttreatment dental casts. Sixty maxillary expansion cases were examined. Thirty cases had maxillary expansion

accomplished with a fixed rapid palatal expander and 30 were expanded with a quadhelix appliance. All cases were finished with full fixed edgewise appliances. Multiple linear regression analyses were completed for both groups with upper molar width change as the criterion and age, tipping of the upper molars, palatal width change and maxillary tipping as the predictors. All predictors were included in the analysis for the quadhelix group with a significant R2 value of 0.55. For the rapid expansion group, a significant R2 value of 0.33 was achieved with the inclusion of palatal width change and age only. The other variables did not meet the level of significance for entry into the model. Although both groups demonstrated similar amounts of maxillary dental expansion, the rapid expansion group demonstrated greater average skeletal expansion. In addition, there was a significant relationship between skeletal and dental expansion for the rapid expansion group, but not the quadhelix group. Palatal depth increased more on average in the rapid expansion group suggesting that there was greater dental eruption in that group. Expansion across the mandibular molars was greater on average in the quadhelix group. There was no difference in the degree of upper molar rotation or final upper and lower arch forms between the two groups.

Majourau A, **Nanda R**. **Biomechanical basis of vertical dimension control during rapid palatal expansion therapy.** Am J Orthod Dentofacial Orthop. 1994 Sep;106(3):322-8.

Rapid palatal expansion (RPE) is recognized as a very successful orthopedic therapy to correct maxillary transverse deficiencies in growing patients. However, the transverse forces delivered during RPE have been shown to create undesirable orthodontic and orthopedic side effects in patients exhibiting skeletal open bite tendency, large interlabial gap, or severe Class II skeletal patterns, with long lower facial height and increased facial convexity. The application of extraoral forces during RPE therapy by the concomitant use of a high-pull chincap is described and clinically illustrated as a method to control the vertical dimension.

da Silva Filho OG, **Boas MC**, **Capelozza Filho L**. **Rapid maxillary expansion in the primary and mixed dentitions: a cephalometric evaluation.** Am J Orthod Dentofacial Orthop. 1991 Aug;100(2):171-9.

The present study evaluated the skeletal alterations induced by rapid maxillary expansion procedures in 30 patients in the primary and mixed dentitions. The results were obtained with the use of lateral cephalometrics before and immediately after the active phase of expansion. The time span between these two cephalometric films ranged from 14 to 21 days; therefore the "growth factor" was not considered. Based on the differences in the cephalometric measurements studied on the first and second tracings, it seems that anterior displacement of the maxilla with significant changes in the SNA angle should not be expected, although point B was repositioned more posteriorly (SNB) because of

the mandibular downward and backward rotation, with subsequent increase of the inclination of the mandibular plane. The alterations in the A-P position of the mandible was reflected in the increase of ANB and NAP angles. The maxilla always dislocates downward, displaying a downward and backward rotation in the palatine plane, significantly altering the following measurements: N-ANS, PNS-PNS', A-A', SN.PP. The anchoring molars also follow the downward maxillary displacement (M-M') and, as a direct consequence of the vertical displacement of the maxilla and upper molars (N-ANS, A-A', ANS-Me, N-Me, PNS-PNS'), the facial heights increase.

Sarver DM, **Johnston MW**. **Skeletal changes in vertical and anterior displacement of the maxilla with bonded rapid palatal expansion appliances.** Am J Orthod Dentofacial Orthop. 1989 Jun;95(6):462-6.

The purpose of this study was to determine whether anterior and inferior displacement of the maxilla seen with rapid palatal expansion when done with a banded rapid palatal expansion appliance is significantly different from an occlusally bonded rapid palatal expansion appliance. It was hypothesized that the bonded appliance would limit unwanted displacement of the maxilla by producing vertical forces on both arches in a manner similar to a functional appliance. The study was conducted using the bonded appliance on 20 adolescents and comparing the results with those of a banded appliance population--namely, 60 cases from Wertz's study. Lateral cephalometric radiographs were taken before treatment and again after the expansion appliances were removed. The results of this study suggest that the downward and anterior displacement of the maxilla often associated with the banded rapid palatal expansion appliance may be negated or minimized with the more versatile bonded appliance.

Hartgerink DV, **Vig PS**.**Lower anterior face height and lip incompetence do not predict nasal airway obstruction.** Angle Orthod. 1989 Spring;59(1):17-23.

The controversy regarding nasal obstruction and malocclusion has been largely due to the inability to quantitate nasal airway function and hence objectively determine the mode of breathing. The purpose of this study was to measure the nasal airway resistance of patients before and after rapid maxillary expansion (RME), to compare them to a control group of subjects not receiving RME, and to measure oral/nasal airflow ratios (respiratory mode). An evaluation of the statistical associations between anterior facial height, lip posture, oral/nasal airflow ratios, and nasal resistance was undertaken. The effects of RME on nasal resistance have been reported elsewhere. We found that variation, for resistance values, was very high, and thus the median response for the group was not an adequate estimation of individual response. In this paper we describe associations between lip posture, lower anterior facial height, and nasal resistance. No significant correlations could be established between respiratory and morphologic

features. Lower anterior facial height was greater in the lips apart posture group. However, there was no significant correlation between percent nasality and lower anterior facial height. A small negative correlation ($r = -0.47$) existed between nasal resistance and percent nasality, but this relationship was not linear. Thus, it was not possible to predict percent nasality from nasal resistance data. Furthermore, no correlation was found between the amount of expansion and changes in nasal resistance. This paper was originally submitted June 1986, and revised October 1988.