ORIGINAL ARTICLE

Long-term maxillary changes in patients with skeletal Class II malocclusion treated with slow and rapid palatal expansion

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Introduction: In this study, we evaluated the long-term maxillary changes in skeletal Class II patients who had slow and rapid palatal expansion. **Methods:** The sample consisted of 70 patients divided in 2 groups: 1 group was treated with cervical headgear with expanded inner bow (CHG) and the other with a Haas-type rapid palatal expansion appliance with cervical headgear (RPE-CHG). Data were collected in the molar and canine regions for basal width, alveolar width, and palatal depth at pretreatment (T1), posttreatment (T2), and postretention (T3). The Student paired *t* test was used to compare data and independent averages between phases. **Results:** In both groups, from T1 to T2, there were significant increases in basal width, alveolar width, and palatal depth for the molar region; in the canine region, there was a significant increase only in the alveolar width. From T2 to T3, no significant changes were found for basal and alveolar widths in both groups and regions, but a significant increase was seen in palatal depth in the molar region in the RPE-CHG group. **Conclusions:** Slow and rapid palatal expansion can expand the maxillae and the maxillary teeth in skeletal Class II patients. Rapid palatal expansion was efficient in the treatment of skeletal Class II patients with severe transverse maxillary discrepancy. Skeletal Class II correction with slow and rapid palatal expansion produced long-term stability (10 years after orthodontic treatment). (Am J Orthod Dentofacial Orthop 2008;134:383-8)

The role of the transverse dimension has been a topic of interest in the diagnosis and treatment of skeletal Class II patients because the maxillary arch is narrower than in adults with normal occlusion.[1-4] The skeletal Class II malocclusion can hide a transverse maxillary deficiency because the maxillary posterior teeth occlude a narrower portion of the mandible.[5] The palate is usually V-shaped, and the posterior teeth have improper buccolingual inclination; the maxillary teeth are inclined buccally, and the mandibular teeth are inclined lingually. By widening the maxillary dental arch and apical base in Class II patients through palatal expansion, it is possible to remove the functional interferences caused by maxillary constriction, thus allowing the mandible to move to a more comfortable anterior position, facilitating Class II correction.[6,7] There are many treatment options to expand the maxillary dental arch and apical base. Rapid and slow palatal expansions are 2 commonly used methods to correct transverse maxillary deficiencies.

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The advent of rapid palatal expansion (RPE) had a dramatic impact on the ability to treat transverse discrepancies. With greater forces, treatment objectives include maximizing skeletal expansion and minimizing dental expansion, since this is caused by buccal tipping and is therefore prone to relapse.[8-10] Slow palatal expansion (SPE) uses lower forces and takes months instead of weeks to accomplish the same amount of expansion. Slow expansion appliances have been shown in animal experiments to allow more physiologic adjustment to sutural separation with less relapse potential.[11] Kloehn cervical headgear with an expanded inner bow can promote growth at the midpalatal or intermaxillary suture in Class II correction. With the expanded inner bow of the headgear, marked widening of the dental arches can be achieved.[12]

Although there are many reports on maxillary expansion, no long-term studies on rapid and slow maxillary expansion changes in skeletal Class II patients were found in the literature. The purpose of this study was to evaluate long-term (10 years after orthodontic treatment) maxillary changes in skeletal Class II patients treated with SPE and RPE.

MATERIAL AND METHODS

The sample consisted of 70 patients divided into 2 groups: SPE with cervical headgear with expanded

Table I. Mean age and range (years and months) of all subjects at T1, T2, and T3

		CHG			*RPE-CHG*	
Phase	*n*	*CHG Mean*	*Range*	*n*	*RPE-CHG Mean*	*Range*
T1	40	10.6	8.10-13.2	30	10.4	7.1-15.0
T2	40	13.6	11.7-16.4	30	14.0	11.0-17.7
T3	40	23.6	17.6-33.5	30	24.6	17.1-36.3

inner bow (CHG), and RPE with a tissue-borne Haas-type appliance followed by cervical headgear (RPE-CHG). The patients were treated in the same clinic and selected consecutively from the records according to the following criteria: (1) skeletal Class II with ANB angle ≥5°, (2) treated with nonextraction, (3) the same fixed appliance therapy after obtaining Class I molar relationships, (4) no intermaxillary Class II elastics, and (5) the same retention protocol at the end of treatment.

The CHG group included 40 patients (18 male, 22 female), and the RPE-CHG group comprised 30 patients (14 male, 16 female). Their age characteristics are given in Table I.

The extraoral appliance used in this study was a Kloehn cervical headgear recommended to be worn for 12 to 14 hours per day. The force applied in both groups averaged 450 g. The patients were seen monthly, and attention was given to 3 areas of adjustment: (1) the inner bow was maintained at 4 to 8 mm of expansion, (2) the outer bow was maintained at 10° to 20° of elevation to prevent distal tipping of the molars, and (3) the ends of the inner bow were adjusted to rotate the molars. All palatal expanders were manufactured in the same clinic. The expansion rate was 2 quarter turns (0.5 mm) per day until adequate overexpansion was achieved as determined by clinical observation. The RPE appliance was left in place for 3 to 9 months while extraoral traction was applied against the maxilla. A loose removable acrylic plate was placed within 48 hours of removing the expander. Each patient wore the acrylic plate for a variable amount of time, usually 1 year.

A digital pantograph (Fig 1) was developed at the Robotics Laboratory in the Department of Mechanical Engineering at the Universidade Federal do Rio de Janeiro in Brazil for the analysis of the dental casts. Measurements were made directly on the maxillary dental casts with Excel 2000 software (Microsoft, Redmond, Wash).

Data were collected in the molar and canine regions at pretreatment (T1), posttreatment (T2), and postretention (T3) for the following measurements (Fig 2): (1) basal width (BW), measured 2 mm below the palatal suture to assess skeletal changes in the maxilla; (2) alveolar width (AW), measured at the lingual groove with the cervical gingival margin of the first permanent molars and for the canines at the cervical margins of the tooth from the point of greatest convexity bilaterally[13]; and (3) palatal depth (PD), a line drawn connecting the points on the gingival crest adjacent to the first molars, with the shortest distance from the midpalatal raphe to this line recorded.

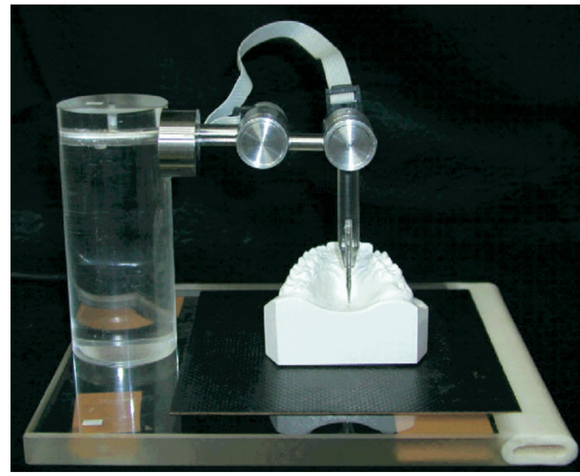

Fig 1. Digital pantograph used to measure dental casts.

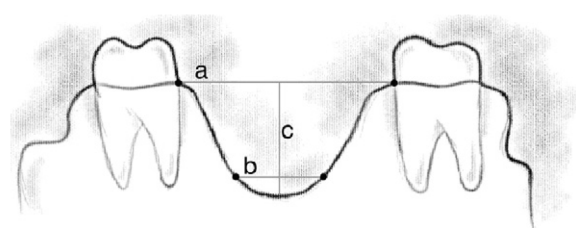

Fig 2. Illustration representing model cast measurements: *a,* AW; *b,* BW; and *c,* PD.

The data were statistically analyzed by using exploratory analyses for the variables studied in the T1, T2, and T3 phases. The Student paired *t* test was used to compare data and independent averages between phases. To evaluate the reproducibility of this research, 12 casts were randomly measured on 5 separate occasions. The error of the method was assessed by intraclass correlation coefficients (ICC):[14] ICC = MS (between) – MS (within)/MS (between) + MS (within), where *MS* = mean square. The ICC was calculated by using an ANOVA model. The ICC and the MS (between) and MS (within) values for all variables are shown in Table II.

RESULTS

The results of measurements at the T1, T2, and T3 assessments of all patients in both groups are given in