Effects of surgically assisted rapid palatal expansion with and without pterygomaxillary disjunction on dental and skeletal structures: a retrospective review

Erdem Kilic, DDS, PhD,[a] Banu Kilic, DDS, PhD,[b] Gokmen Kurt, DDS, PhD,[c] Caglar Sakin, DDS,[d] and Alper Alkan, DDS, PhD[e]
Faculty of Dentistry, Erciyes University, Kayseri, Turkey

Objective. The aim of this study was to evaluate and compare dental and skeletal changes in surgically assisted rapid palatal expansion (SARPE) patients with (+PP) and without (−PP) pterygomaxillary disjunction.
Study Design. The study casts of 18 maxillary constriction patients indicated for SARPE formed the sample of this retrospective review. The sample was divided into 2 groups. Twenty linear and 2 angular measurements were performed on the study models.
Results. All transversal measurements increased after expansion in both the +PP and −PP groups. The −PP group showed greater expansion at the midpalatal and gingival levels, while the +PP group exhibited a greater increase of 0.78 mm at the apical base level and 11.25° less tipping in the molar teeth. A greater expansion of nearly 0.7 mm was measured in the premolar region of the +PP group.
Conclusions. Both SARPE techniques resulted in significant maxillary expansion. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;115:167-174)

Transverse maxillary discrepancy is one of the most common dentoskeletal problems encountered in clinical orthodontics. Maxillary expansion was first introduced by Angell[1] in 1860 to overcome maxillary constriction. Since then, it has been used for the correction of posterior crossbites. Skeletal expansion of the maxilla can easily be accomplished before closure of the midpalatal suture, but it is not feasible for adults owing to the increasing resistance of the midpalatal and lateral maxillary sutures.[2] The timing of midpalatal suture closure varies from age 16 to 35 years,[3] and relapse of rapid maxillary expansion has been shown in older patients.[4] Techniques of surgically assisted maxillary expansion (SARPE) with the use of bone cuts to reduce these resistances without completely freeing the maxillary segments have been developed to overcome such age limitations.[5] Various combinations of maxillary, pterygopalatine, lateral nasal, septal, and palatine osteotomies have been used based on the different theories regarding the locations of resistance to expansion.[6] Some of the initial reports indicated that the zygomatic buttress and pteryomaxillary junction are the main areas of resistance,[7,8] and some reports have recommended the sectioning of almost all articulating maxillary structures.[9-11] On the other hand, Glassman et al.[12] demonstrated minimal morbidity and postoperative complications without pterygomaxillary detachment. A number of reports avoided surgical separation of the pterygomaxillary junction, achieving a noninvasive surgical technique.[13-16] There is currently no consensus on pterygoid plate separation in SARPE; therefore, the aim of the present study was to evaluate and compare the dental and skeletal changes between SARPE patients with (+PP) and without (−PP) pterygomaxillary disjunction.

MATERIALS AND METHODS

This retrospective clinical study was based on the study casts of 18 patients (2 male, 16 female) treated with

Statement of Clinical Relevance

Surgically assisted rapid palatal expansion (SARPE) techniques resulted in significant maxillary expansion. Greater expansion was achieved at the premolar region with and at the molar region without pterygomaxillary disjunction. Maxillary expansion with SARPE is mainly a lateral rotation of the 2 maxillary halves.

[a]Assistant Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Erciyes University, Kayseri, Turkey.
[b]Orthodontist, Private Practice, Kayseri, Turkey.
[c]Associate Professor, Department of Orthodontics, Faculty of Dentistry, Erciyes University, Kayseri, Turkey.
[d]Resident, Department of Orthodontics, Faculty of Dentistry, Erciyes University, Kayseri, Turkey.
[e]Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Erciyes University, Kayseri, Turkey.
Received for publication Sep 4, 2011; returned for revision Jan 13, 2012; accepted for publication Feb 3, 2012.

2212-4403/$ - see front matter
http://dx.doi.org/10.1016/j.oooo.2012.02.026

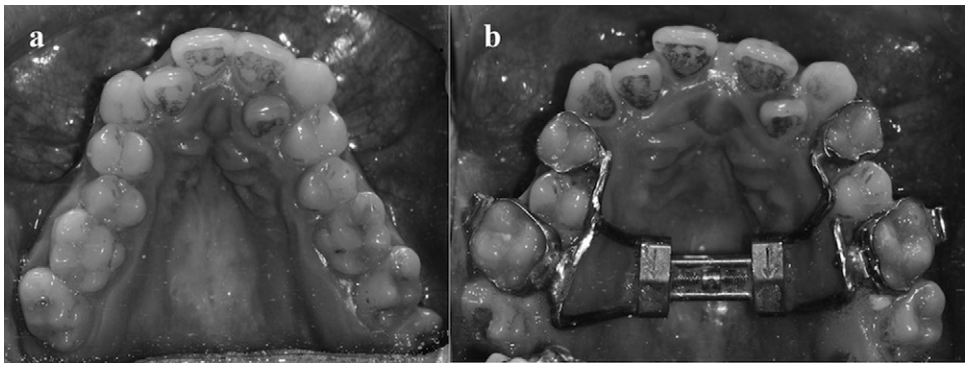

Fig. 1. Bonded SARPE appliance **(a)** before operation and **(b)** after activation.

SARPE from 2007 to 2010. The sample was divided into 2 groups. The first group consisted of 10 patients (−PP; mean age 20.1 ± 3.10 years, range 17-26 years; 2 male, 8 female) who underwent SARPE. The second group consisted of 8 patients (+PP; mean age 21.56 ± 3.43 years; range 17-24 years; 8 female). All of the patients were informed about the surgery protocols, and signed informed consent was obtained from the parents of the patients under 18 years of age.

Patient selection criteria were as follows: constricted maxilla with a maxillary-mandibular transversal difference of >5 mm; good oral hygiene and healthy periodontal structures; fused midpalatal suture as determined from occlusal films; good quality of dental casts available before and after expansion; no requirement for orthognathic surgery; and absence of craniofacial anomalies, such as cleft lip and palate.

To ensure standardization, the same interdisciplinary team treated all subjects included in this study. A tooth-borne fixed hyrax-type palatal expansion screw appliance (G&H Wire Co.) was used (Figure 1). The arms of the expansion screws were soldered to the bands of the first premolar and first molar teeth, and the appliance was cemented 1 or 2 days before the surgery.

All of the patients were also operated on by the same surgical team (A.A. and E.K.). The surgical protocol was performed with piezoosteotomy (Piezosurgery; Mectron Medical Technology) under local anesthesia. Bilateral incisions were made in the depth of the buccal vestibule from the region of the distal aspect of the canine to the mesial aspect of the first molar, and maxillary osteotomies were performed through the cortical bone from the pyriform rim to the pterygomaxillary fissure. After incising the mucosa between the apices of the central incisors, a sagittal osteotomy was performed interdentally between the roots of the upper central incisors through the posterior nasal spin with the use of a piezosurgical saw tip and subsequent posterior malleting of an osteotome. Unlike in the −PP group, in the +PP group the pterygoid fissures were separated on both sides with a curved osteotome to release the pterygoid plates. After activation of the appliance with a total widening of 1.5 mm, symmetric expansion was evaluated and the soft tissues closed. All of the patients were discharged from the hospital on the same day of their surgeries and were prescribed antibiotic, antiinflammatory, and analgesic drugs together with a chlorhexidine rinse and called back after 5 days for the initiation of expansion at a rate of 0.6 mm/d. When enough expansion was achieved, the hyrax screw was fixed with a ligature wire. The appliances remained in situ for 4 months. The study models were obtained before treatment (T0) and before fixed appliance treatment began (T1). Twenty linear and 2 angular measurements were taken.[17] Direct measurements on the study models were taken to the nearest 0.1 mm with Vernier calipers. All measurements were performed by 1 author (B.K.).

Measurements

The width of the maxillary dental arch was measured between the right and left vestibular and palatal cusp tips of the canine and first and second premolar teeth and between the right and left mesiobuccal and mesiopalatal cusp tips of the first molar teeth (Figure 2).

The clinical crown height of the first and second premolar and first molar teeth were measured on the vestibular side from the buccal cusp tip to the most apical point of the gingival margin. The change in crown height from T0 to T1 was used to measure the buccal attachment loss (Figure 3).

To measure the maxillary first molar axial angulation, the maxillary model base was trimmed to measure the angle between the intersecting lines drawn across the mesial buccal and mesial lingual cusp tips of both the right and left first molars (Figure 4).

The palatal vault angle was formed by the lines drawn tangential to the middle two-thirds of the right and left palatal surfaces (Figure 5, a). Palatal depth from the gingival height was measured as the shortest