Dentoalveolar changes after surgically assisted maxillary expansion: a three-dimensional evaluation

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Objectives. Surgically assisted rapid palatal expansion (SARPE) is a common procedure to correct maxillary transverse deficiency of >5 mm in patients with closed midpalatal suture. The aim of this study was to three-dimensionally analyze skeletal and dentoalveolar changes after SARPE.
Study design. Eighteen mature patients (mean age 26 years) with a palatal transverse deficiency underwent SARPE. The surgical procedure consisted of a lateral osteotomy combined with an interradicular osteotomy between the roots of the upper central incisors. Measuring points were defined on teeth as well as facial skeleton. Computerized tomography scans were performed preoperatively and immediately after the expansion period.
Results. Changes of the dentoalveolar and maxillofacial complex were analyzed.
Conclusions. Bilateral osteotomy combined with a sagittal osteotomy between the roots of the upper central incisors is a safe method of surgically assisted maxillary expansion. The amount of dentoalveolar tipping was smaller than reported in literature. The expansion was mostly achieved by maxillary expansion. **(Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:36-42)**

Surgically assisted rapid palatal expansion (SARPE) is a common procedure in correction of maxillary transversal deficiency. In younger patients conventional orthodontic rapid palatal expansion (RPE) before closure of the midpalatal suture is reported to be successful.[1-3] However, this technique is not indicated in skeletally mature individuals, because the sutural closure and the completion of transverse growth limitate the effect of maxillary expansion[4]: The expansion is primarily composed of alveolar or dental tipping with little or no basal skeletal movement.[5,6] Therefore, SARPE is a widely accepted technique in patients older than 15 years with isolated considerable (>5 mm) transverse maxillary deficiency.[6-8]

Brown[9] was the first to describe a midpalatal split for maxillary expansion. This technique suggests that the palatal suture offers the most resistance to maxillary expansion. Other authors find the pterygoid complex to be even more important.[10,11] Betts et al.[6] explain the need of a release of the pterygoid plates in the fact that, unlike the maxilla, which is composed of 2 bones, the sphenoid is a single bone with both pterygoid processes attached. Therefore, the pterygoid process has to be separated from the maxilla on both sides to allow posterior maxillary expansion. Evaluation of skeletal and dentoalveolar complex after SARPE demonstrated that real skeletal expansion through translation is only minimal. Tipping produced by the force exerted on the teeth by a palatal expander is also due to the lateral rotation of the 2 maxillary halves.[12] Most studies concerning RPE and SARPE use dental arch measurements from cephalometric radiographs and dental casts.[6,12] The aim of the present study was to analyze dentofacial structures before and after surgically assisted palatal expansion three-dimensionally using computerized tomography (CT) data. The hypothesis was that analyzing CT scans may allow a more exact evaluation of dental and alveolar movement compared with conventional 2-dimensional radiographs with interfering or overlapping structures.

MATERIALS AND METHODS

Eighteen patients (10 male, 8 female) were included in this prospective study. The average age of the participants was 26 years (range 17-42 years). All patients showed a cross-bite situation with a transverse deficiency of >5 mm and a closed midpalatal suture. Computerized tomography scans were performed to evaluate the preoperative anatomy and to exclude inflammation of the maxillary sinus. All patients underwent a similar treatment regime. A Haas-type expander[13] with bands on the first premolars and molars was mounted in all patients by their orthodontists. The surgical procedure, under general

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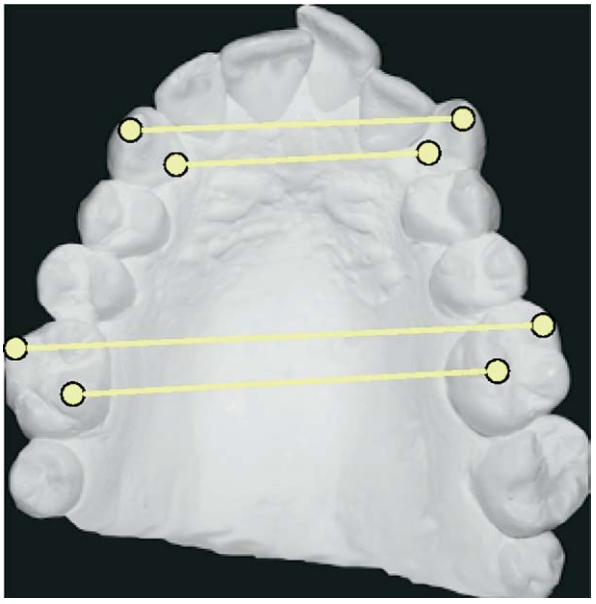

Fig. 1. Occlusal measuring points shown on a dental cast model.

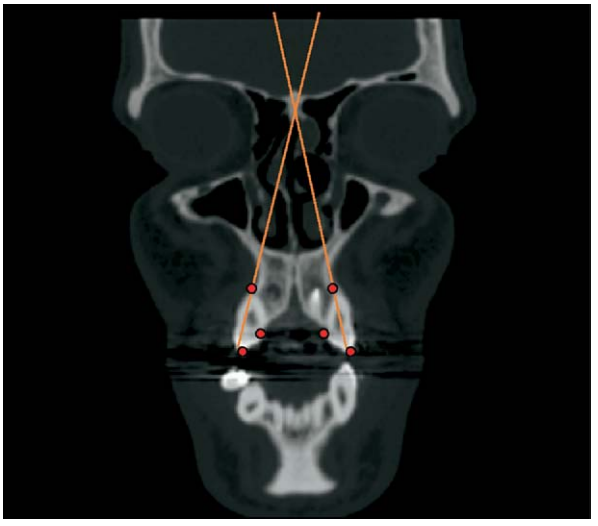

Fig. 2. Computerized tomography slide showing angulation of the canine teeth and the measuring points of the canine teeth.

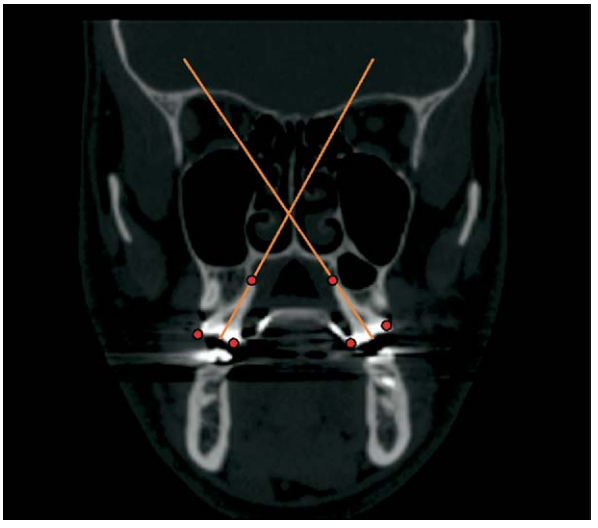

Fig. 3. Angulation of the palatal root of the first molar, measuring points of the the first molar.

anesthesia, consisted of a bilateral osteotomy reaching from the rims of the piriform aperture to the pterygomaxillary suture, which was osteotomized as well. Moreover, a sagittal osteotomy between the roots of the upper central incisors was performed in every patient. To verify an adequate osteotomy the expansion screw was activated intraoperatively until a diastema of 1 mm could be seen. On the second postoperative day the patients were instructed how to activate the Haas device. They were asked to open the screw twice a day until an overexpansion was achieved. In the follow-up period, the patients were seen once a week by the maxillofacial surgeon. After the expansion procedure was completed, orthodontic treatment was carried on by the patients' orthodontists. The expander was kept in place for a total of 6 months to minimize a possible relapse.

Six weeks after surgery, CT scans were performed in all patients. Measuring points were defined to analyze the amount of expansion and dentoalveolar tipping. The canine crown tip, tuberculum, and root apex were defined as anterior measuring points. The mesiobuccal and the distopalatal cusps were chosen as posterior measuring points, as well as the palatal root apex of the first molar. The angulation of the canine and palatal root of the first molar were evaluated. Measured points and angles are shown in Figs. 1-3. All measurements were performed by 2 authors (group 1: W.Z. and M.S.; group 2: M.F. and A.L.) and repeated after 1 week. The mean of the measurements was used for further investigations. Mean values and standard deviations were calculated for statistical analysis.

RESULT

All patients included in this study had received the same surgical intervention. Except for swelling and hematoma, no postoperative problems were noticed. Postoperative pain was minimal in all cases. The majority of patients reported pain only for ~30 min right after activation of the expander. The results of