Int. J. Oral Maxillofac. Surg. 2017; xxx: xxx–xxx
https://doi.org/10.1016/j.ijom.2017.10.017, available online at https://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Cleft Lip and Palate

Changes in maxillofacial morphology and velopharyngeal function with two-stage maxillary distraction–mandibular setback surgery in patients with cleft lip and palate

T. Susami[1], Y. Mori[2], K. Ohkubo[1], M. Takahashi[1], Y. Hirano[1], H. Saijo[1], T. Takato[1]

[1]Department of Oral and Maxillofacial Surgery, Dentistry and Orthodontics, University of Tokyo Hospital, Tokyo, Japan; [2]Department of Dentistry, Oral and Maxillofacial Surgery, Jichi Medical University, Shimotsuke, Tochigi, Japan

T. Susami, Y. Mori, K. Ohkubo, M. Takahashi, Y. Hirano, H. Saijo, T. Takato: Changes in maxillofacial morphology and velopharyngeal function with two-stage maxillary distraction–mandibular setback surgery in patients with cleft lip and palate. Int. J. Oral Maxillofac. Surg. 2017; xxx: xxx–xxx.

Abstract. Maxillary distraction is increasingly used for the correction of severe maxillary retrusion in patients with cleft lip and palate. However, control of the maxillary movement is difficult, and the need to wear visible distractors for a long period of time causes psychosocial problems. A two-stage surgical approach consisting of maxillary distraction and mandibular setback was developed to overcome these problems. In this study, changes in maxillofacial morphology and velopharyngeal function were examined in 22 patients with cleft lip and palate who underwent this two-stage approach. Lateral cephalograms taken just before the first surgery, immediately after the second surgery, and at completion of the active post-surgical orthodontic treatment were used to examine maxillofacial morphology. Velopharyngeal function was evaluated by speech therapists using a 4-point scale for hypernasality. The average forward movement of the maxilla with surgery at point A was 7.5 mm, and the average mandibular setback at pogonion was 8.6 mm. The average relapse rate during post-surgical orthodontic treatment was 25.2% for the maxilla and 11.2% for the mandible. After treatment, all patients had positive overjet, and skeletal relapse was covered by tooth movement during postoperative orthodontics. Velopharyngeal function was not changed by surgery. This method can shorten the period during which the distractors have to be worn and reduce the patient burden.

Key words: cleft lip and palate; maxillary distraction; bimaxillary osteotomy; maxillofacial morphology; velopharyngeal function.

Accepted for publication 27 October 2017

0901-5027/000001+09

Orthognathic surgery is required for the correction of severe maxillomandibular disharmony in patients with cleft lip and palate (CLP), and gradual maxillary advancement is increasingly used for this purpose[1]. A large amount of maxillary advancement can be performed with distraction[2], but a considerable amount of relapse has been reported[3].

Maxillary distraction may be performed using an external halo-type distractor system[4] or internal distractors[5–9]. Good control of the direction of distraction is important to obtain a successful treatment result. In this regard, a marionette method has been advocated for the halo-type distractor[10], and precise positioning is required for internal distractors. After distraction, the distractors are usually left in place for a consolidation period to ensure new bone formation and to prevent relapse[1,3]. However, control of the direction of distraction is difficult, and the need to wear visible distractors for a long period of time places a heavy burden on patients, leading to physical and psychosocial problems[11].

A two-stage surgical approach consisting of maxillary distraction and mandibular setback surgery was developed at the University of Tokyo Hospital to overcome these problems and has been reported previously[12]. This method can shorten the period during which the distractors have to be worn and reduce the patient burden. The aims of this study were to evaluate the stability of this two-stage surgery and to determine its effect on speech.

Materials and methods

Subjects

Twenty-two patients with CLP who underwent two-stage maxillary distraction–mandibular setback surgery and completed postoperative active orthodontic treatment were included in this study. Seventeen were male and five were female, and their average age at surgery was 18 years 8 months (range 14 years 10 months to 31 years 5 months). Thirteen patients had unilateral CLP and nine had bilateral CLP. The average duration of distractor wearing (interval between the first and second surgeries) was 22.5 days (range 9–33 days), and postoperative orthodontic treatment was performed for an average 1 year and 11 months (range 1 year 0 months to 3 years 10 months). The method used for mandibular setback surgery was the sagittal split ramus osteotomy (SSRO) in six cases and the intraoral vertical ramus osteotomy (IVRO) in 16 cases. RED system distractors (KLS Martin, Tuttlingen, Germany) were used in two patients[4,10], and the Zurich Pediatric Maxillary Distractor system (KLS Martin) in 20 patients[6]. Patients with associated craniofacial anomalies were not included in this study, and alveolar bone grafting had previously been performed in all patients.

Surgical method

The two-stage maxillary distraction–mandibular setback surgery was performed as reported previously[12] (Fig. 1). In the first surgery, a Le Fort I osteotomy was performed and the distractors were placed in the maxilla. After a short waiting period (normally 4 days), maxillary distraction was started. In certain cases, the first and second surgeries were scheduled with a short interval between them and distraction was started at the time of the first surgery. The rate of distraction was set at 1 mm/day. When there was remaining capacity in the distractors and the patient did not complain of pain, distraction of more than the required amount was attempted to achieve sufficient stretching of the surrounding soft tissues.

Immediately after distraction, following a short consolidation period (normally 7 days), the second surgery was performed. The distractors were first removed and the maxilla was then fixed precisely in the planned position using miniplates. The maxillary position was determined by cephalometric prediction before surgery. Four pits were created on the bone surface on both sides of the maxilla using a round bur in the first surgery (before Le Fort I osteotomy) as landmarks. Two were on the maxillary basal bone and two were on the Le Fort I segment. Distances between these pits were measured and recorded during the first surgery and used to decide on the maxillary position in the second surgery. The distances between the pupils and the midpoint of the maxillary anterior teeth were also measured to determine the vertical position of the maxilla and the position of the maxillary midline. An occlusal guide plate that indicated the maxillary occlusal plane was used to confirm the occlusal plane cant[13]. The maxilla was fixed with four titanium miniplates placed below the piriform aperture and in the molar region of the maxilla on both sides. Mandibular setback surgery (SSRO or IVRO) was performed simultaneously and the mandible was adapted to the maxilla. No intermediate splint was used to determine mandibular position. Intermaxillary elastics were placed routinely after the second surgery. A maxillary protractor was not used in any of the cases.

Examination of craniofacial morphology

Lateral cephalograms taken just before the first surgery (T0), immediately after the second surgery (T1), and at the completion of the active postoperative orthodontic

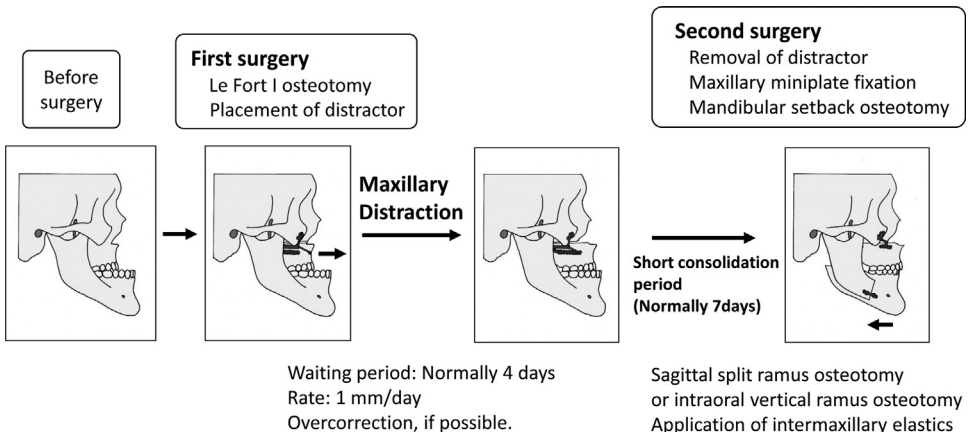

Fig. 1. Two-stage maxillary distraction–mandibular setback surgery (Mori et al.[12]).

Please cite this article in press as: Susami T, et al. Changes in maxillofacial morphology and velopharyngeal function with two-stage maxillary distraction–mandibular setback surgery in patients with cleft lip and palate, *Int J Oral Maxillofac Surg* (2017), https://doi.