Rotational Distraction for the Treatment of Severe Mandibular Retrognathia

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Backgrounds: The main problem with intraoral distraction of the mandible is the inability to achieve the three-dimensional mandibular correction as planned preoperatively. We developed a technique that allows spontaneous changes in the direction of mandibular elongation using an intraoral distractor.

Methods: After mandibular osteotomy, the distractor is fixed to the distal segment of the mandible using a single bicortical screw, allowing anterior-posterior, vertical and limited lateromedial changes in the vector of distraction. Mandibular lengthening is performed while keeping the maxilla and mandible in class I occlusion with intermaxillary fixation.

Results: As the distraction device is activated allowing mandibular elongation, the proximal segment, guided by the surrounding soft tissues, moves and rotates posterosuperiorly. Mandibular lengthening is continued until the condylar head reaches an adequate position in the mandibular fossa as confirmed clinically and radiographically.

Conclusion: Thirty-three patients with mandibular retrognathia received this treatment and good results were obtained. (Plast Reconstr Surg Glob Open 2015;3:e467; doi: 10.1097/GOX.0000000000000437; Published online 22 July 2015.)

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ostectomy was completed. The distractor was applied again, and trial elongation was performed. The mandibular distal segment was fixed using a single bicortical screw, which was used as the rotational axis (Fig. 1). A surgical splint was applied between the maxillary and mandibular teeth, and the patient was put in intermaxillary fixation (IMF). After IMF, the distraction device was activated, and the wound was closed. After a latency period of 5–7 days, elongation was performed at a rate of 1 mm/d. Instructions were given to the patients who activated the device twice or more a day. Elongation was continued until the mandibular head was spontaneously seated in the mandibular fossa (Fig. 2). When elongation was complete, the IMF was replaced by elastics. During the consolidation period, the patients performed masticatory movements and passive range of motion exercises. After a consolidation period of more than 12 weeks, the distractor was removed. Intermaxillary elastics were continuously used after removal of the device. Passive range of motion exercises were continued until the patients recovered their presurgical maximum interincisal opening.

RESULTS

Intraoral rotational distraction was performed in 33 patients (6 males and 27 females) between 16 and 37 years (mean age 23 years). All patients had severe mandibular retrognathia (requiring advancement of 10 mm or more), associated to vertically short mandibular rami. In the 33 patients, 20 underwent isolated mandibular elongation and 13 underwent simultaneous maxillary and mandibular elongation. Every case had a successful rotational angular distraction result at the time of removal of the devices. At the long-term (2–5 years) follow-up, the average of relapse rates was less than 12% on 3D-computed tomography. Complications developed during distraction in 2 patients (1 breakage of the device and incomplete osteotomy in the other). These conditions were successfully treated with reoperation.

The patient was a 22-year-old woman. Class II dentofacial deformity was observed (Fig. 3). The maxillary anterior teeth showed marked labial inclination. On the profile, the lips were protruded, and lip closure insufficiency was observed. There was moderate crowding at her mandibular arch. After orthodontic preparation for 20 months, surgery was performed. After Le Fort I osteotomy in the maxilla, mandibular osteotomy was performed on the bilateral mandibular rami, and an intraoral distractor was applied. During operation, IMF in ideal occlusion was possible, and bilateral trial lengthening (2 mm each) was performed. After a 6-day latency period, self-lengthening was performed for 14 days. After distraction, the IMF was replaced by elastics, during a 10-week consolidation period. The amount of lengthening was 9 mm in the left and 11 mm in the right, and rotation angle was 10 degree in the
left and 8 degree in the right. The gonial angle was 128 degree before operation but improved to 138 degree after operation. The final facial condition and occlusal state after postoperative orthodontic treatment were well (Fig. 4).

**DISCUSSION**

In patients with severe mandibular retrognathia, sagittal splitting ramus osteotomies are the gold standard, but possible postoperative relapse and idiopathic condylar resorption have been reported as potential complications. Therefore, new techniques to prevent condylar resorption have been developed. Among them, intraoral vertical sagittal ramus osteotomy allows mandibular advancement using the principles of intraoral vertical ramus osteotomy with a wider contact area between the bone segments, but the advancement is limited to 5 mm, and the risk for relapse is still present. Thus, mandibular distraction was considered. Distraction technology has evolved from the large extraoral devices to intraoral miniaturized distractors used today, avoiding facial scars. However, there are limitations related to the inability to reconstruct the normal shape of the mandible and to obtain acceptable occlusions. Therefore, adequate preoperative planning and 3D control of the distraction vectors is necessary. To overcome this problem, simultaneous distraction of the maxilla and mandible, devices in the elongation method such as the floating bone concept, and curved surface distraction devices have been developed. Therefore, we developed a new method of applying miniaturized existing intraoral devices, so that a rotational vector would allow restoration of the normal shape of the mandible. The distractor was fixed at the distal bone segment using only a single bicortical screw, which was used as the rotation axis. Elongation was performed while keeping the patient in IMF and the proximal bone segment was rotated and seated in the mandibular joint. This method allowed mandibular advancement while keeping optimal occlusion. Condylar seating was guided by the masticatory muscles and temporomandibular joint ligaments. These soft tissue-guided condylar seatings allow physiologic positioning of the condylar head in the mandibular fossa. We think this simple method is more useful than existing methods for about 10-mm elongation of the mandibular angles.

**SUMMARY**

We developed a rotational technique that allows spontaneous changes in the direction of mandibu-
lar elongation using an intraoral distractor. After mandibular osteotomy, the distractor is fixed to the distal segment of the mandible using a single bicortical screw. Thirty-three mandibular lengthening cases had successful rotational angular distraction results.

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PATIENT CONSENT
The patient provided written consent for the use of her image.

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