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## REVIEW

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### Treatment of developmental jaw deformity

#### —The osteotomy to aim at the improvement of the masticatory function—

Shigehito Wada, Isao Furuta

Department of Dentistry and Oral Surgery, Faculty of Medicine, Toyama Medical and Pharmaceutical University.

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#### 1 : jaw deformity

Jaw deformity can be classified as either acquired or developmental. Developmental deformities arise from abnormal growth of facial or skeletal system. Many of these deformities have a significant malocclusion and severe facial disharmony. Epidemiologic surveys in United States demonstrate that the approximately 10% of the population has a class II malocclusion (maxillary protrusion or mandibular retrusion), 1% of which require the surgical operation to correct the skeletal deficiency and, similarly, approximately 2.5% of the population has a class III malocclusion (mandibular protrusion or maxillary retrusion), 40% of which requires the surgical operation to correct the skeletal deficiency. Originally, treatment for these deformities has been aimed at the improvement of the masticatory function with little attention to the accompanying deformity of facial skeleton. The genetic factors play an important role in these deformities. For example, a familial tendency of a prognathic or deficient mandible is often seen in a patient with a jaw deformity. Many patients with these deformities have the masticatory dysfunction rather than the esthetic displeasure. Therefore the osteotomy to aim at the improvement of the masticatory function was performed on only patient with its indication. The facial profile is often secondarily improved by this operation, but the operation performed by oral surgeons is not the same as facio-plasty at all.

#### 2 : Diagnosis and preoperative treatment

Diagnosis is twofold, reflecting identification of the malocclusion and the dysgnathia. But in general there is conformity between the malocclusion and the dysgnathia. The occlusal disharmony is estimated by the clinical findings, x-ray, photogram, and study model, and then the most of diagnosis is easily made by oral surgeon and orthodontist. It is obvious that not all malocclusion require the surgical procedure. If the dysgnathia is slight, the orthodontic treatment alone may be the better treatment for this case. But in some cases, an ideal occlusal relationship cannot be achieved by only orthodontic treatment because of severe skeletal discrepancy. The operation combined with orthodontic treatment finally becomes indispensable in a certain kind of case.

Treatment of the adult case can be started without delay, but questions often arise about the growing child with these deformities. If the adequate growth potential remains, growth modification with functional appliances may be the preferred treatment. Surgery usually is applied to patients who do not respond to growth modification.

In many cases, the crowding of the anterior teeth occurs as a compensatory response to a developing deformity. Undesirable dental compensations for skeletal discrepancy must be corrected before the surgery by orthodontically teeth repositioning without considerations for the bite relationship to the opposing arch. The

important steps in the orthodontic preparation are to arrange the dental arch and establish the proper anteroposterior and vertical position of the incisors. The period of orthodontic preparation varies from several months to a few years due to symptom. When the patient is getting near to the end of orthodontic therapy for surgical operation, it is very useful to take impression and examine the hand-articulated models for occlusal assessment. Orthodontic device could be strong to withstand the forces resulting intermaxillary fixation with the wire and surgical manipulation. Moreover, it is necessary to treat dental caries, periodontitis, and pericoronitis, etc. completely before surgical operation.

### 3 : Typical cases

#### a) Mandibular deficiency (Figure 1)

The most remarkable feature of the mandibular deficiency is a retroursive mandible in the profile aspect. Other clinical features associated this jaw deformity are an excess labiomental fold with a procumbent appearance of lower lip, abnormal form of upper lip, and bird face. These cases usually have an abnormal occlusion as class II molar and cuspid relationships and an excessive overjet in the incisor relationship. For the most popular treatment, the bilateral sagittal split osteotomy is performed in order to extend the mandible. To improve the retruded position of the chin, the genioplasty is often performed together with this osteotomy. This technique can increase the lower facial height with intraoral incision and osteotomy.

#### b) Maxillary excess (Figure 2)

Maxillary excess occurs a convex facial profile associated with the incisor protrusion and the class II malocclusion. The clinical manifestation is marked by the prominence of the upper lip and the excessive exposure of the gingiva and the anterior teeth. The maxillary excessive growth can occur toward anteroposterior, vertical, or lateral directions. Until the early 1970s, the main treatment was the segmental

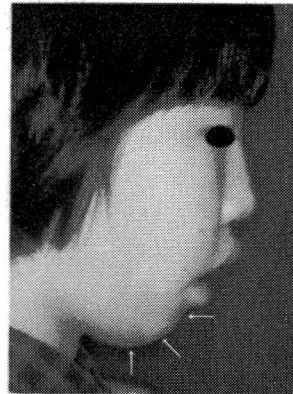


Figure 1

#### Figure 1

Mandibular deficiency:  
Abnormal appearance of the inferior face with mandibular deficiency. Arrows indicating the retrognathism of the mandible.

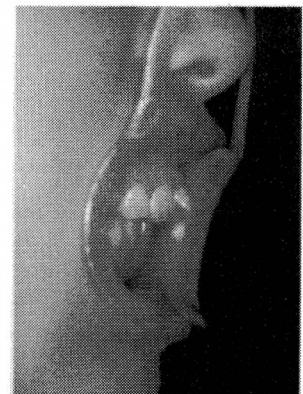


Figure 2

#### Figure 2

Maxillary excess:  
Severe class II malocclusion resulting from maxillary excess. The excessive overjet of about 10mm is admitted.

osteotomy. Now, the Le fort I total maxillary osteotomy is performed as a most popular treatment for this facial deformity.

#### c) Mandibular excess (Figure 3 A, B, C, and D)

Mandibular excess often involves the abnormal occlusion of class III, characterizing a reverse overjet in the incisor area and a facial deformity. Maxillofacial countenance associated with this deformity is characterized by a prominence of the lower third of face in the anteroposterior and vertical dimension. In serious cases, the close of lip is impossible without straining the orbicularis oris muscles. This jaw deformity is easily corrected by either the intraoral bilateral sagittal or vertical ramus osteotomy. The former is chiefly performed in our department for the reasons that the wide contact of excised bone aspect can be kept surely. The method of operation in our department is described later in detail. When the mental prominence remains after this ramus osteotomy, the genioplasty is occasionally used together with this operation. The main purpose of this operation is an improvement of not the aesthetic condition but the masticatory function.

#### d) Mandibular asymmetry (Figure 4 A and B)

In existences such as hemifacial microsomia,

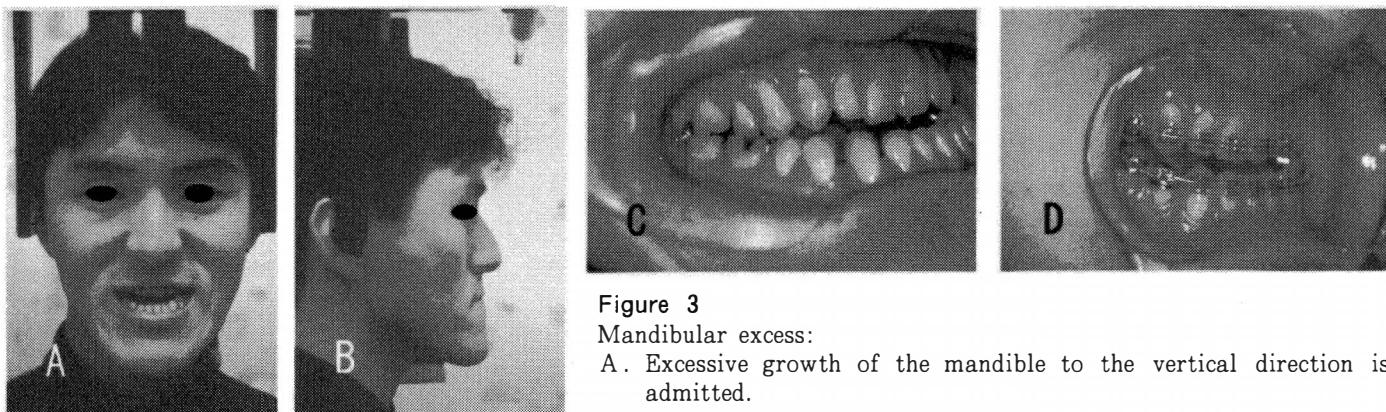


Figure 3 (A-D)

Figure 3

Mandibular excess:

- A. Excessive growth of the mandible to the vertical direction is admitted.
- B. Concave facial profile associated with the excessive mandibular growth.
- C. Abnormal occlusion of class III, characterizing a reverse overjet is admitted.
- D. Crowding teeth are properly arranged by orthodontic therapy before the osteotomy.

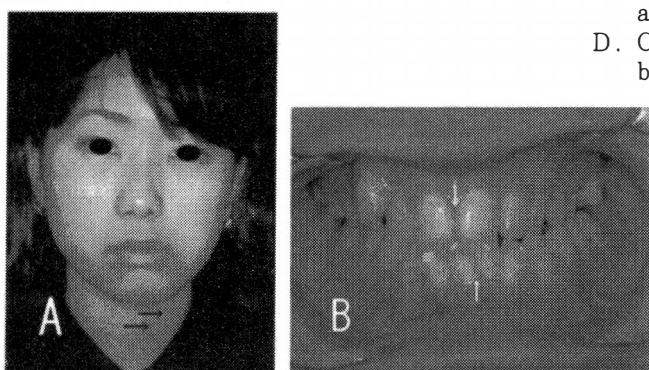


Figure 4

Figure 4

Mandibular asymmetry:

- A. Mental region has been displaced to the right side.
- B. Arrows indicating the discrepancy between upper jaw and lower jaw midline.

craniofacial microsomia, gigantism, fibrous dysplasia, or hemifacial atrophy, condylar hyperplasia as well as trauma may cause an asymmetric mandible and chin. If the displacement of facial midline is beyond the range of the allowance, the genioplasty should be intraorally performed to correct the asymmetries. The occlusion of this asymmetry is usually kept normal without masticatory dysfunction, and many patients satisfy the postoperative result by genioplasty alone.

#### 4 : Surgical technique

(sagittal ramus osteotomy: SRO)

The SRO is the most versatile operation and is able to be applied to various jaw deformities. This operation was originated by Obwegeser, and Dul-Pont added a useful modification that

extended the versatility of operation. The incision is performed in the buccal mucosa with the scalpel and the ablation is completed in the subperiosteal plane along the anterior border of the ramus and toward the coronoid process, escaping the outcrop of the buccal fat pad. Two-pronged periosteal ramus retractor makes the ramus dissection easy. The mandibular notch is clearly identified to protect the inferior alveolar neurovascular bundle before the osteotomy, otherwise the lower lip paresthesia or palsy happen at high frequency. To attain the sagittal division, the mucoperiosteal flap should be elevated laterally to disclose the inferior border until the antegonial notch. In the process of ramus osteotomy, only cortex is split by surgical engine bar, horizontally on the medial ramus surface above the inferior alveolar foramen and vertically on the lateral aspect in the premolar region (Figure 5 A, B, and C). The lateral, proximal segment bearing the condylar and coronoid processes is split from the distal, tooth-bearing segment by bone chisel and hammer. The inferior alveolar neurovascular bundle included in the distal segment is successfully preserved by this operation method. Once the osteotomy has been performed on each, the mandible is able to move into the desired position. In this new occlusal position, the intermaxillary fixation is conducted by

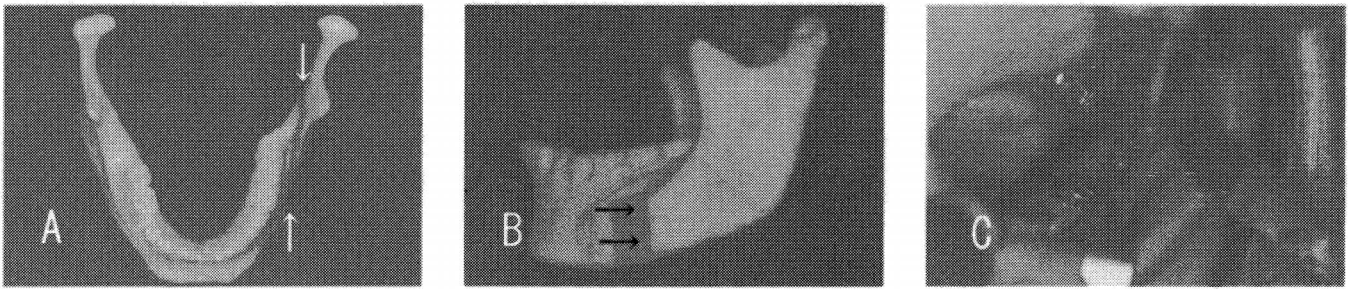


Figure 5 (A-C)

Figure 5

Osteotomy site of the mandible:

- A. In the axial view, the sagittal division of the mandibular ramus is presented. Note the distalsegment including the mandibular foramen.
- B. The sagittal view indicating the vertical cut of mandibular bone behind the mental foramen.
- C. Intraoperative finding showing the mandible divided into the proximal and distal segment.

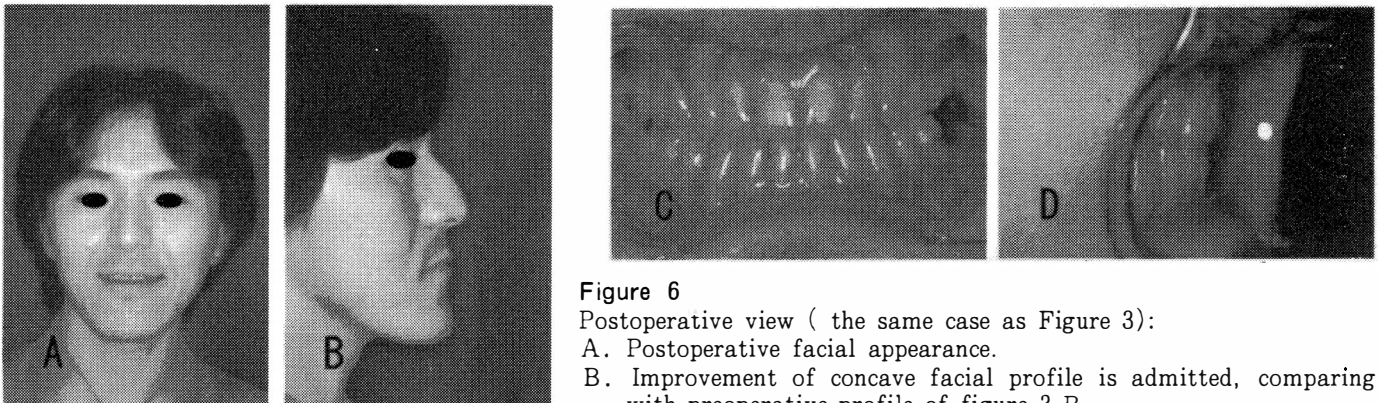


Figure 6 (A-D)

Figure 6

Postoperative view ( the same case as Figure 3):

- A. Postoperative facial appearance.
- B. Improvement of concave facial profile is admitted, comparing with preoperative profile of figure 3 B.
- C. deal occlusion is obtained without the postoperative orthodontic therapy.
- D. Overbite and overjet are extremely natural, and the masticatory function is successfully improved.

wiring. We prefer to use a titanium miniplate and screw to fix the proximal and distal segments. The intermaxillary fixation is maintained for about six weeks to obtain the normal bone union (Figure 6 A, B, C, and D). During the period of rehabilitation, the application of light training elastic may assist familiarization with newly acquired occlusion.

### 5 : Summary

Developmental jaw deformity is various from the slight case to the severe case on the masticatory dysfunction, but it is not rare to be accompanied by serious worry which originates in the cosmetic problem. It is important that the final purpose of the treatment of jaw deformity is to obtain a normal occlusion, and not to improve a cosmetic problem.

### 6 : References

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