Preoperative simulation and predictability for the facial asymmetry of Hemifacial microsomia Pruzansky grade I

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【Objectives】
Hemifacial microsomia is a congenital disorder in which hypoplasia of bones and soft tissues derived from the first and second branchial arches result in facial asymmetry. Recently, many congenital disorders that result in hypoplastic development of one side of the face, including the first branchial arch syndrome and the Goldenhar syndrome, are all included in this disorder.
Hemifacial microsomia is the second most frequent congenital facial disorder, the most common one being the cleft lip and palate, but it INDEED is a very complex disorder, and it does not have the standard treatment yet. Facial asymmetry tends to be more pronounced as children grow up so the treatment is best started early in the childhood.
When we treat these patients, we carefully take into consideration the degree of mandibular deformity in individual patients and postoperative control of the occlusal plane. Today, how we treat Pruzansky grade I patients at our institution, is presented.

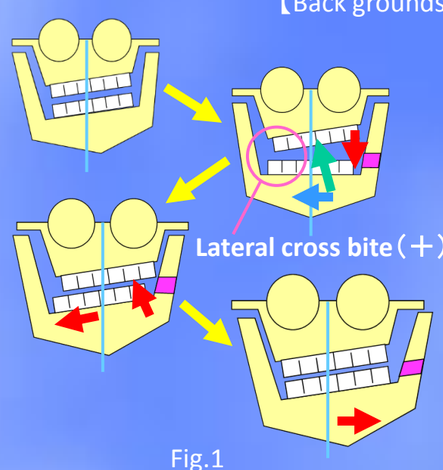


Fig.1

【Back grounds】Since McCarthy and his group reported in 1992, gradual distraction of the affected side has been carried out in just about everywhere, and we had been doing the same, but results often were not satisfactory because the breakdown of the occlusal plane often took place during the postoperative course.
Figure 1 presents this problem schematically. The ramus often moves into the space between upper and lower molar teeth made after elongation, and as a result, the ramus slides along the occlusal plane toward the normal side during the elongation process.

As a result, symphisis moves medially earlier than expected, so the tilting of the occlusal plane will not be corrected satisfactorily, and consequently, causes an unacceptable level of lateral cross bite. This not only makes the subsequent orthodontic treatments more difficult, but also, later improvement of the lateral cross bite often causes relapse of the deformity.

So, HERE is WHAT WE DO.
From our experience, elongation of the affected ramus needed is always less than 15mm. So we perform vertical osteotomy and a one-stage elongation.
This single-step procedure is what we think is the critically important point.
Then, using a bite block, we assure that the gap between the upper and lower molar teeth are kept intact. We then position the mandible so that the lateral cross bite will not occur.（fig.2）

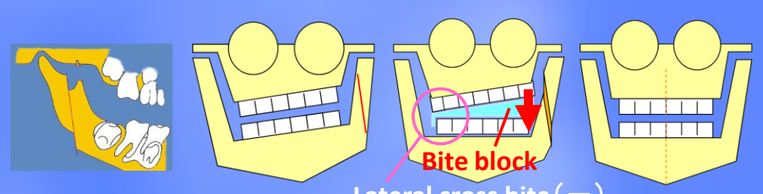
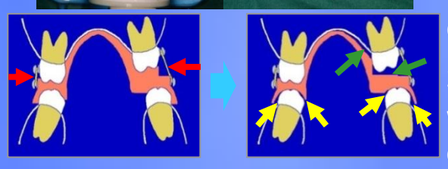


Fig.2

【Methods】
We retrospectively selected two cases with one-stage elongation procedure for mandibular hypoplasia.
In each case, we constructed a real-scale model using preoperative computed tomography three-dimensional reconstruction data and underwent preoperative simulation. Care was taken not to cause lateral cross bite of the normal side while lowering the underdeveloped side of the mandibular molars. A precisely fit bite block was then created for respective cases using an occlusion device, and applied to the maxilla after vertical osteotomy of the affected side of the mandible, just before its bone plate fixation. The mandibular position was then guided by the bite block. Lengthening of the mandible and bone fixation were carried out to the most three-dimensionally fit position for each case. One month after the operation, the bite block fixed to the maxilla was changed to a removable type and subsequently, underdeveloped side of the maxillary molars' downward traction was started.

HMVCB : Hemi-Maxilla Vertical Control Bite-block

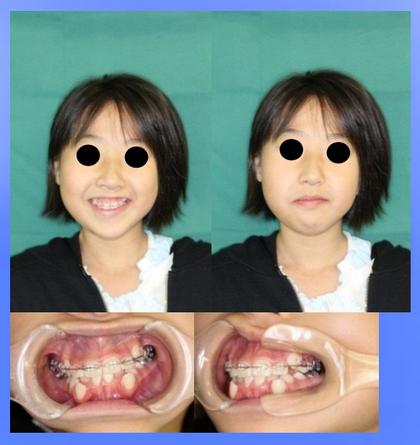


1. The wire stabilizing the bite block is removed after 4 weeks and is changed to an elastic module. **(red arrow)**
2. Then, the bite block is rather loosely placed so that it will not hinder opening of the mouth, allowing the patient to eat without any discomfort or trouble; and thus the patient can bear wearing the device 24 hours a day. **(yellow arrow)**
3. Positioning of the bite block is checked every 2-4 weeks. The resin material attached to the upper teeth of the affected side is gradually reduced. **(green arrow)**
4. The resin facing the hard palate of the affected side is deleted. **(green arrow)** This process is repeated several times as needed.

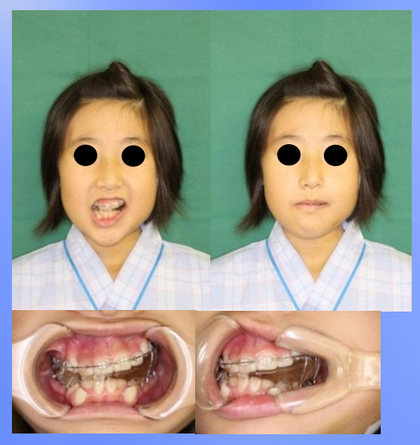
HMVCB should be worn for at least 6-10 months until the patient's upper jaw is satisfactorily rotated and the cross bite of the teeth are achieved. The device needs to be newly made each time as adjustments are needed. Even after the cross bite of the affected side is established to the satisfactory level, until all lateral teeth are completely replaced, patients need to keep using the device at night. In the meantime, otoplasty is usually performed . Once all of the patient's teeth have been replaced by the permanent teeth, multi-bracket system is worn to further achieve the cross bite of the permanent teeth.

CASE 1 : Female, Left Hemifacial microsomia

Preoperative views（11yrs 1mo old）

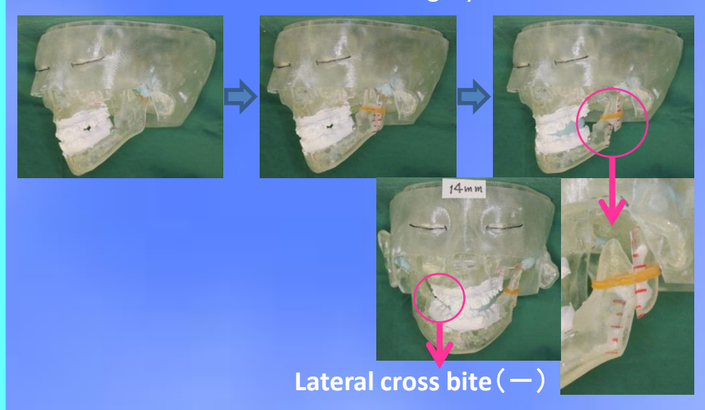


Postoperative views（11yrs 2mo old）

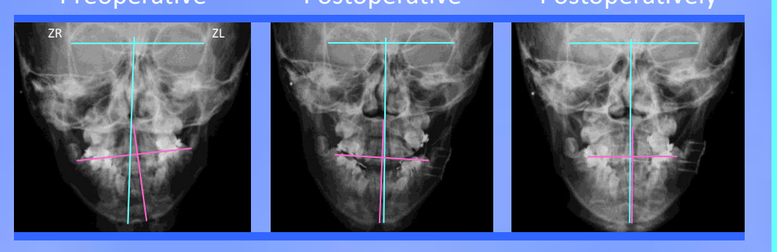


6 months postoperatively（11yrs 8mo old）

3D model simulation surgery



	Preoperative	Postoperative	6 months Postoperatively
Occlusal plane tilt	-8.0°, -8.0 mm	→	0°, 0 mm
Chin deviation	-7.0°, -7.5 mm	→	0°, -1.0 mm

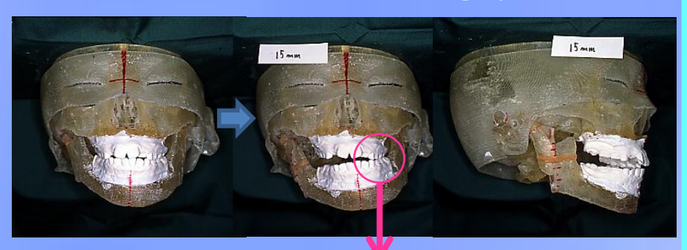


CASE 2 : Male, Right Hemifacial microsomia

Preoperative views（7yrs 7mo old）

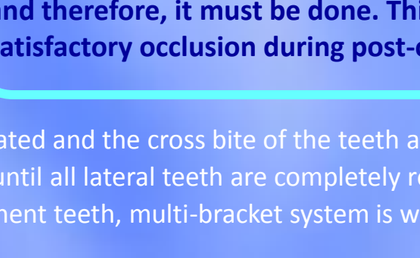
Postoperative views（7yrs 9mo old）

3D model simulation surgery

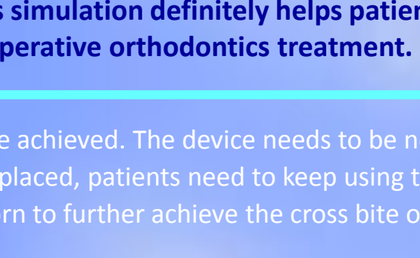


	Preoperative	→	Postoperative
Occlusal plane tilt	6.0°, 6.0 mm	→	0°, 0 mm
Chin deviation	5.0°, 5.5 mm	→	0°, 0 mm

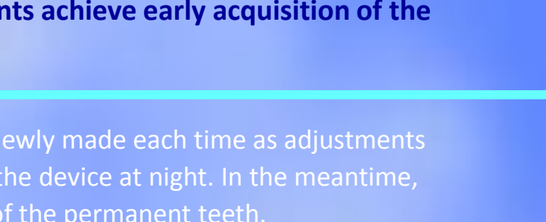
2years postoperatively（9yrs 9mo old）



8years postoperatively（15yrs 9mo old）



	Postoperative	→	8 years Postoperatively
Occlusal plane tilt	0°, 0 mm	→	0.5°, 0.5 mm
Chin deviation	0°, 0 mm	→	0°, 0 mm



【 Summary 】

We think the single most important point on the treatment of hemifacial microsomia is to prevent the breakdown of the occlusal plane. To successfully achieve that, we have to be sure that first, occlusal plane tilt is improved, and then, that lateral cross bite not to occur. The best way to achieve both of that, from our experience, is A ONE-STAGE ELONGATION of the mandibular ramus by vertical osteotomy.
When the operation is done on patients in their adolescent years, we need to stabilize occlusion as soon as possible in order to prevent early relapse. On the other hand, once recurrence of deformity due to growth spurt occurs, we certainly need to encourage occlusion exercise, additional traction and even operation if indicated to keep the occlusal plane intact. It is probably impossible to completely prevent the recurrence of deformity during the growth spurt, but we think we can keep it to the acceptable level with OUR TREATMENT METHODS.
Preoperative simulation performed using a precise 3D model has high predictability of the operative outcomes and therefore, it must be done. This simulation definitely helps patients achieve early acquisition of the satisfactory occlusion during post-operative orthodontics treatment.