Refresher Course

Orthodontic Treatment in Craniofacial Microsomia

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Craniofacial microsomia previously known as hemifacial microsomia (HFM) is an asymmetric craniofacial anomaly that involves skeletal, soft tissue and neuromuscular components of the first and second branchial arches. It is the second most common congenital facial anomaly after cleft lip and palate. Facial asymmetry due to asymmetric growth of mandible is the earliest skeletal manifestation and plays an important role in secondary distortion of the related facial skeletons including maxilla and zygoma[1].

Pathogenesis of Craniofacial Microsomia

Regarding the animal study of Poswillo[2], hematoma formation from hemorrhage of the stapedial artery that supplies the first and second branchial arches is the etiologic factor for the deformity of these areas. Severity of deformity depends upon the amount of vascular damage.

Typical Charateristics of Craniofacial Microsomia

Remarkable deformities that can be detected by clinical examination in the typical case comprises deviation of the chin toward the affected side, macrostomia and auricular malformation of the affected side. Anyhow, this anomaly can manifest in wide variants from minimal to severe deformities. Therefore, accurate classification of craniofacial microsomia is necessary for developing the treatment plan so that severity of the defect and rate of progression into secondary deformity can be evaluated before the treatment.

Classification of Craniofacial Microsomia

Craniofacial microsomia can be classified according to skeletal, auricular and soft tissue deformities.

Skeletal classification based on mandibular deformity[3-6].

Grade I : Small mandible, temporomandibular joint is present with reduced joint space due to minimal condylar cartilage and missing disc, small condylar head with rather normal shape, shallow or missing glenoid fossa, reduced gonial area and is positioned more medially if the masseter and medial pterygoid muscles are hypoplastic.

Grade II : Small mandible with distorted components.

Grade IIA : Condylar process is cone shaped and positioned antero-medially to normal position, coronoid process and gonial angle are well developed, lack of well defined condylar head and neck, condylar process situated antero-medially to the normal position, severe asymmetry of mandible and secondarily of maxilla and nasal structures, well developed gonial angle.

Grade IIB: Missing condylar process, coronoid process varies in size, gonial area is poorly developed.

Grade III : Missing condylar and coronoid process to complete agenesis of ramus.

Auricular Classification[7]

Grade I : Malformed auricle with smaller size but retaining characteristic features.

Grade II : Rudimentary auricle with hook at cranial end corresponding to the helix.

Grade III : Malformed lobule, absent pinna.

Degree of auricular involvement is not associated with the degree of mandibular deformity. Some patients with auricular malformation may have normal occlusion while others present malocclusion.

Soft Tissue Classification[6,8]

Mild : Minimal deficiency, no cranial nerve involvement.

Moderate : Between mild and severe.

Severe : Major defect plus cranial nerve deficits, eye / ear involvements, cleft of face and lip.

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Treatment of Craniofacial Microsomia

Goals of the treatment are to create the environment that enables normal facial growth and to minimize secondary distortion to the related structures. Multidisciplinary approaches are required for obtaining acceptable facial appearance and masticatory function. The treatment modalities depend on severity of malformation, patient's concern and craniofacial growth. Orthodontic treatment with an asymmetric functional appliance is a treatment of choice in a growing patient under the hypothesis that the alteration of muscle-bone interaction can stimulate growth of the mandible at the affected side, whereas further eruption of the teeth into the predetermined position and elongation of the ascending ramus of the affected side provide stability of the mandibular position[9,10].

The objectives of this article were to present basic principle of orthodontic treatment in a craniofacial microsomia patient and to evaluate the treatment effects by clinical and radiographic examinations.

Case Report

A 7-year old girl came to plastic surgery section for removing of the preauricular tag on the left ear.

Clinical examination

Additionally clinical examination revealed micropthalmos of the left eye, facial asymmetry with chin deviated to the left side. Remarkable deviation was detected at the maximum mouth opening. The lip line and occlusal plane tipped upward towards the left side. The lateral facial profile was convex due to the retrognathic mandible.

Oral examination

Dental development was in the early mixed dentition. The permanent four incisors and first permanent molars were erupted. The occlusal plane tipped upward towards the left side. Class I molar with decreased overbite and overjet were presented.

Radiographic examination

Panoramic radiograph (Figure 2) indicated Grade IIB mandibular deformity with missing condylar process and prominent antegonial notch on the left side, missing the permanent mandibular second bicuspid.

Postero-anterior radiograph (Figure 3) confirmed facial asymmetry due to bony chin deviated towards the left side, short ramus length on the left side.

Cephalometric analysis (Figure 3) indicated skeletal Class II open bite tendency due to mandibular retrognathism and backward rotation.



Figure 1. Clinical feature and oral manifestation before treatment.

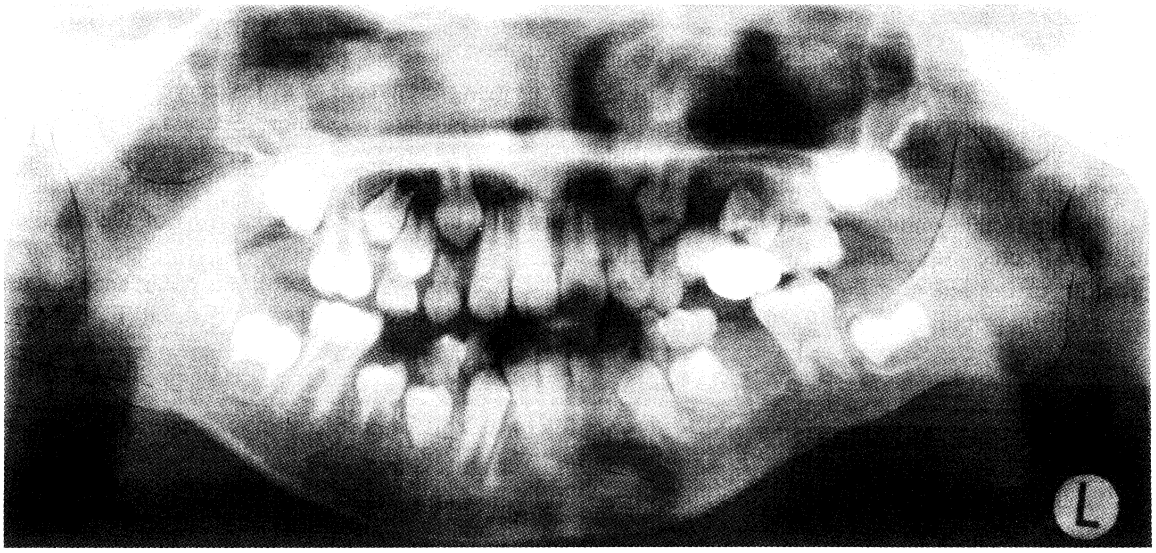


Figure 2. Panoramic radiograph before treatment.

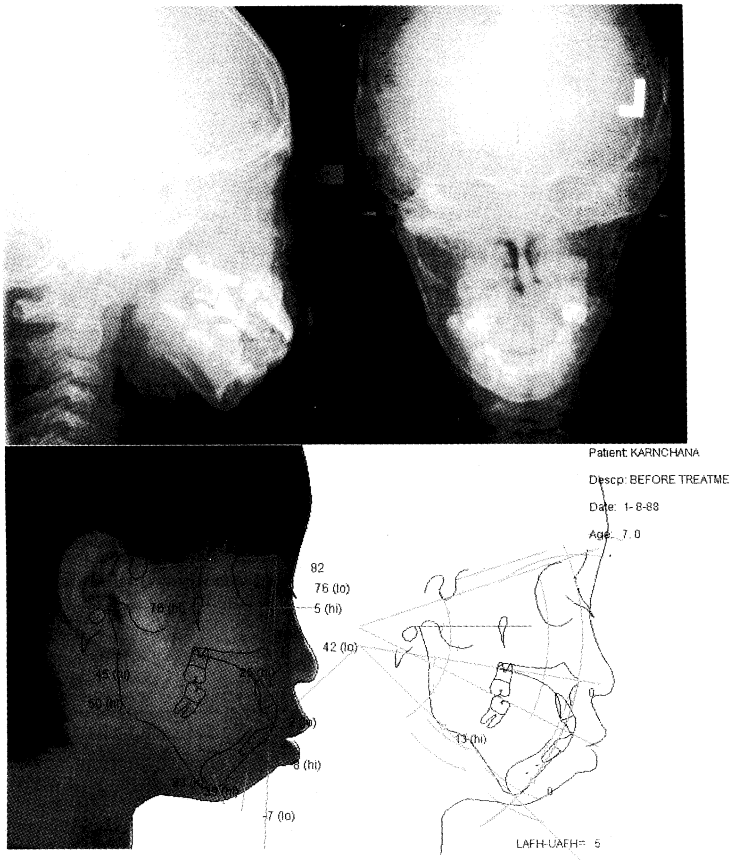


Figure 3. Radiographic features and analyses.

Treatment

Asymmetric functional appliance (Figure 4a) was provided to the patient for correction of facial asymmetry and create normal maxillary occlusal plane. The construction bite moved the mandible downward, forward, and medially to the unaffected side so that facial symmetry and dental bite opening on the affected side could be achieved. Further eruption of the left maxillary posterior teeth was enhanced by grinding the acrylic over the occlusal surfaces of the maxillary posterior teeth. Whereas the incisal edges and occlusal surfaces of all remaining teeth were covered with the acrylic and served as retention of the appliance. Success of the treatment with the functional appliance was determined from the improved facial symmetry, symmetric movement of the mandible and parallelism of the maxillary occlusal plane with posterior bite opening on the unaffected side (Figure 4b). Fixed appliance was used for final adjustment of tooth position (Figure 4c).

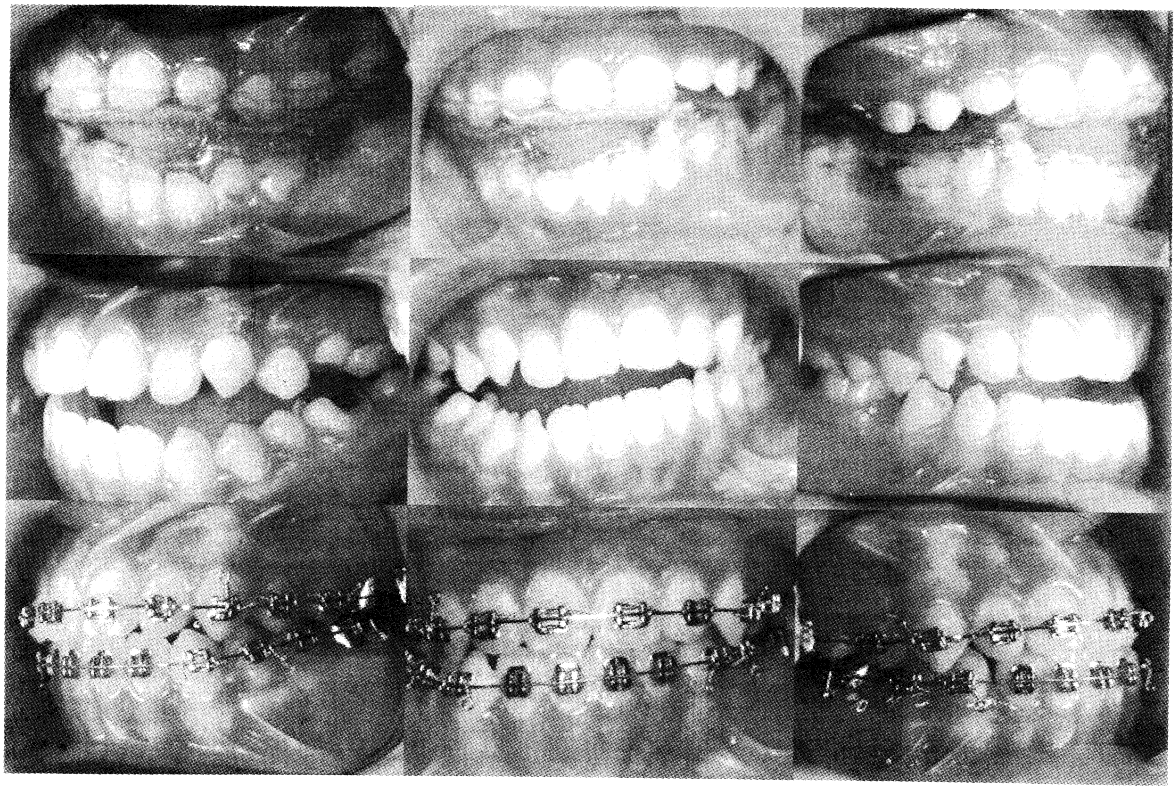


Figure 4. Oral feature during orthodontic treatment.
a. with asymmetric functional appliance.
b. result of asymmetric functional appliance.
c. with fixed appliance.

Result (Figure 5)

After 6 years follow up, facial asymmetry was improved. The postero-anterior radiograph after active treatment indicated increased ramus length on the left side. Superimposition of the cephalometric radiographs along the Sella-Nasion plane (SN plane) at Sella (S) point indicated mainly forward growth of the mandible, meanwhile superimposition along the mandibular plane (Me-Go plane) at Menton (Me) point revealed upward and backward displacement of the condyle and the ascending ramus thus indicating bone remodeling at the posterior border of the ramus.

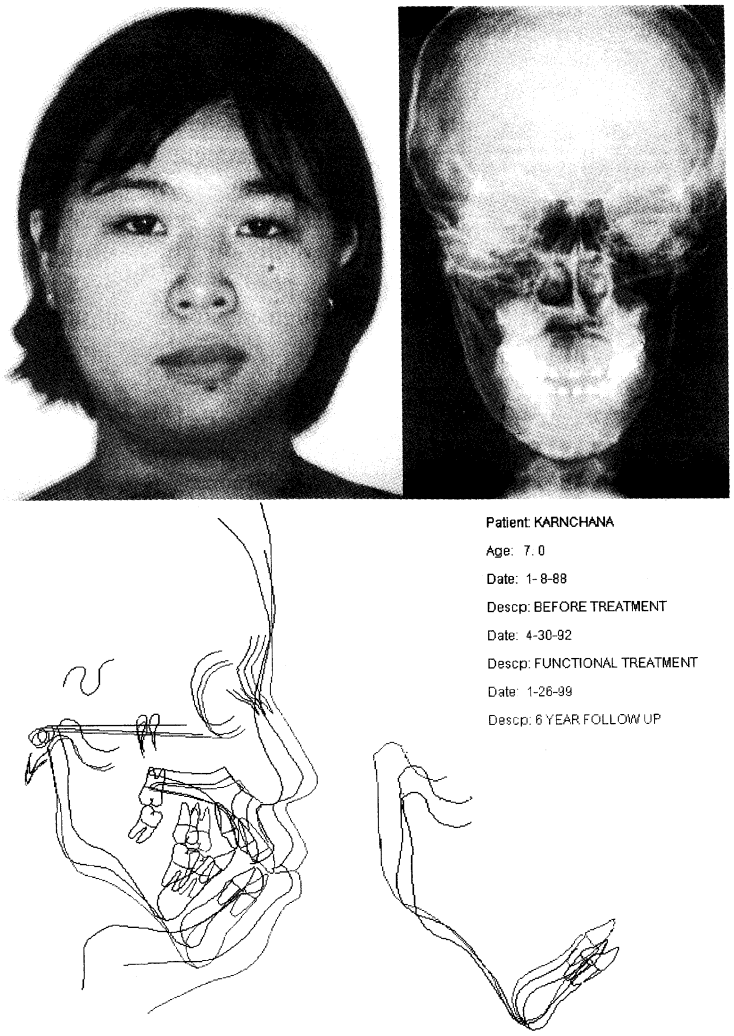


Figure 5. Result of orthodontic treatment.
a. clinical feature.
b. radiographic feature.
c. superimposition along the Sella Nasion plane (SN plane) at S point.
d. superimposition along the mandibular plane (Me-Go plane) at Me point.

Discussion

The asymmetric functional appliance has been used for the treatment of craniofacial microsomia as it is an intraoral device that can change mandibular position in three dimensions. This mode of action is required in the patient who presents with mandibular growth deficiency so that muscular activity can be changed and new stress system is established. The predetermined construction bite and proper grinding enable the occluded teeth especially on the affected side to erupt until the maxillary occlusal plane is paralleled to the pupil line. Consequently, this treatment procedure is recommended for a growing patient since muscular adaptation to the new mandibular position and active eruption of the teeth with simultaneous growth of the alveolar bone are necessary for stability of the treatment result. Functional temporomandibular joints and reliable cooperation of the patient are also required for success of the treatment. Result of the case report indicated that there was bone deposition at the condylar region although lacking of the condylar cartilage at the condylar neck that has been known as the growth center of the mandible. Thus supported the concept of functional matrix theory[11] that muscular functions play major role in the growth of the mandible. The advantage of the functional appliance in correction of facial asymmetry is that the malformed mandible presented growth pattern similar to those of the normal. There was no remarkable backward rotation of the mandible during treatment. Thus relapse of the treatment should be avoided. However, this treatment modality still has some disadvantages since the treatment requires good cooperation, long treatment time, optimum skeletal alteration depending on dental occlusion and finally soft tissue augmentation is still necessary for facial esthetics.

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