Three-dimensional longitudinal changes in craniofacial growth in untreated hemifacial microsomia patients with cone-beam computed tomography

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Introduction: The purpose of this study was to evaluate the concept that the affected and contralateral sides do not grow at the same rate in patients with hemifacial microsomia. Changes in the cranial base, maxilla, mandible, and occlusal plane were evaluated on 3-dimensional images from cone-beam computed tomography data in untreated patients. **Methods:** Six patients were classified as having mandibular Pruzansky/Kaban type I, IIA, or IIB hemifacial microsomia. Cone-beam computed tomography (MercuRay; Hitachi, Tokyo, Japan) scans were taken before orthodontic treatment during both growth and postpuberty periods. **Results:** The cranial base as defined by the position of the mastoid process was in a different position between the affected and contralateral control sides. The nasomaxillary length or height was shorter on the affected side for all 6 patients with hemifacial microsomia regardless of its severity, and it grew less than on the contralateral control side in 5 of the 6 patients. The occlusal plane angle became more inclined in 4 of the 6 patients. The mandibular ramus was shorter on the affected side in all patients and grew less on the affected side in 5 of the 6 patients. The mandibular body grew slower, the same, or faster than on the control side. **Conclusions:** The cranial base, position of the condyle, lengths of the condyle and ramus, and positions of the gonial angle and condyle can vary between the affected and contralateral control sides of patients with hemifacial microsomia, with the ramus and nasomaxillary length usually growing slower than they grow on the control side. These results suggest that many factors affect the growth rate of the craniofacial region and, specifically, the mandible in patients with hemifacial microsomia. (Am J Orthod Dentofacial Orthop 2014;145:579-94)

Hemifacial microsomia (HFM) refers to a relatively common craniofacial anomaly that is induced prenatally in the embryonic or fetal stage and that expresses itself postnatally in the development of an asymmetrical mandible and associated disorders of the ipsilateral mandible, maxilla, zygomatic arch, and auditory bones.[1-4] HFM is a progressive skeletal and soft-tissue deformity.[5,6] Although the long-term concept has been that local embryonic hemorrhage or disorders in the neuroectodermal migration cause HFM, it is also possible that interference in chondrogenesis induces it.[7-10] Animal models have been developed that appear similar to HFM and involve administering triazine to pregnant mice to produce hemorrhage in the stapedial artery[8] or exposing animals to retinoic acid, which kills neural crest cells and interferes with their movement.[9] HFM expresses phenotypically in a range of disorders from a mild expression involving the condyle to the most severe condition in which the ramus, condyle, and coronoid process are missing on 1 side, and the cranial bones and orbits of the midface can demonstrate marked asymmetry. HFM is differentiated from asymmetrical mandibles, which develop only postnatally.[11] Whereas postnatally developed asymmetrical

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Table I. Distribution of subjects with HFM

		Age					Craniofacial deformity scoring system‡		
Patient	*Sex*	*Examination 1*	*Examination 2*	*Period**	*Skeletal type†*	*Affected side*	*MDS*	*CDS*	*CFDS*
1	Male	12 y 6 mo	15 y 9 mo	3 y 3 mo	I	Right	4	3	7
2	Female	12 y 10 mo	16 y 1 mo	3 y 3 mo	I	Right	4	1	5
3	Male	4 y 10 mo	9 y 2 mo	4 y 3 mo	IIA	Left	5	9	14
4	Female	6 y 0 mo	8 y 10 mo	2 y 10 mo	IIA	Left	6	9	15
5	Male	10 y 0 mo	14 y 0 mo	4 y 0 mo	IIB	Right	13	14	27
6	Male	12 y 1 mo	13 y 8 mo	1 y 7 mo	IIB	Right	11	13	24

MDS, Mandibular deformity score; *CDS*, cranial deformity score; *CFDS*, MDS plus CDS.
*Mean period, 3 y 4 mo; †Pruzansky[4] and Mulliken and Kaban[21] classifications; ‡Huisinga-Fische et al[67]

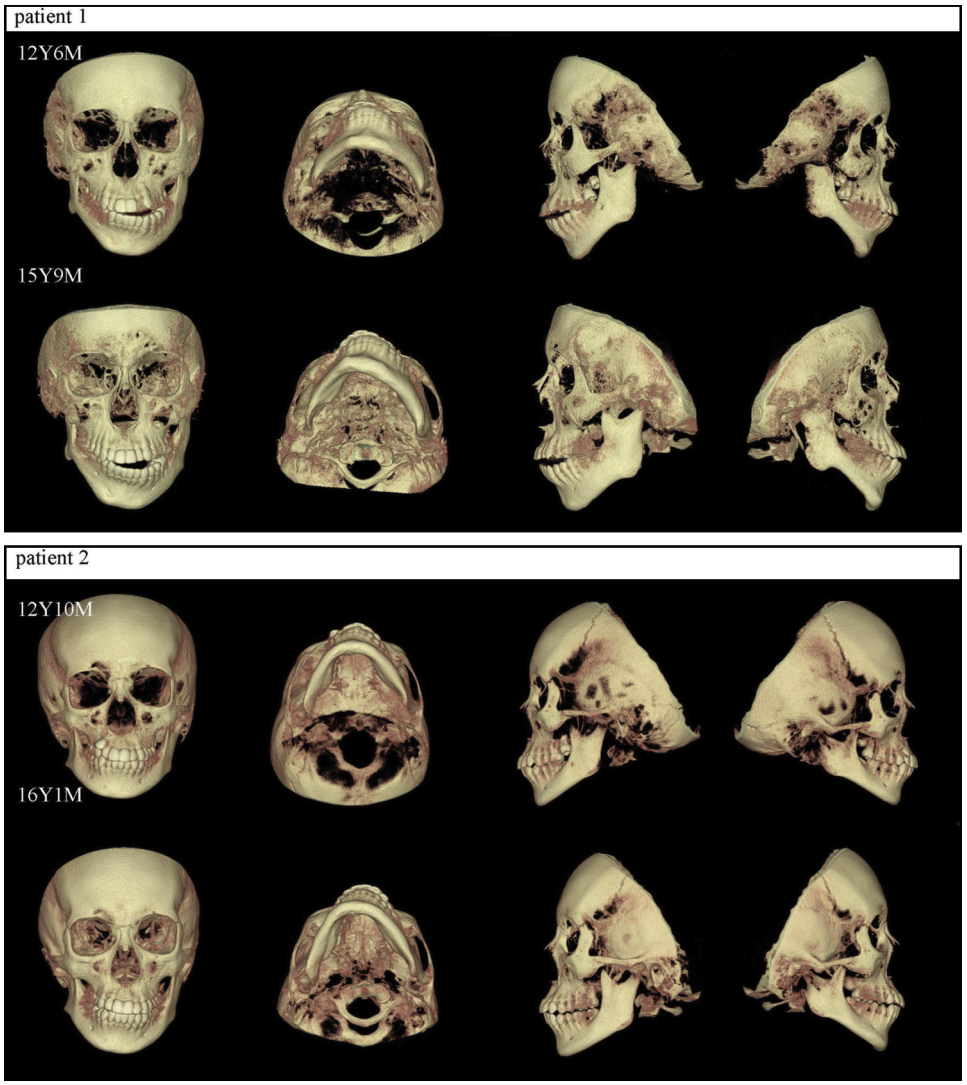

Fig 1. Three-dimensional volumetric surface-rendered views of 2 patients with Pruzansky type I HFM. The craniofacial skeleton was reconstructed from a 9.6-second scan using the Hitachi Cone Beam CT MercuRay, generating DICOM formatted data that were reconstituted into surface mesh images with the CB works software. Four views of each patient (frontal, submental, left and right lateral views) are shown at 2 time points for patient 1 and patient 2.