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Orthodontic and Surgical Treatment of Hemimandibular Hyperplasia

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ABSTRACT

Correction of facial asymmetries is still a major problem in need of an adequate solution. In this case report, the differential diagnosis and treatment strategies of hemimandibular hyperplasia are described with the present patient.

KEY WORDS: Facial asymmetry, Skeletal Class III, Hemimandibular hyperplasia, Orthognathic surgery.

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INTRODUCTION Return to TOC

Facial asymmetry, defined as difference in the size, shape, or relationship of two sides of the face, has high correlation with facial harmony, attractiveness, and beauty.[1,2] It was first observed by the early Greek artists, and the term *normal facial asymmetry* was used. Later, Leonardo da Vinci and Albrecht Durer described the classic concept of human facial symmetry and found absolute bilateral symmetry a normal morphologic characteristic.[3]

Minor asymmetries of the human skeleton are common in the general population and usually have no esthetic or functional significance.[4] It is reported that skeletal asymmetry is found even in the most pleasing and apparently symmetrical faces.[3] This is not observed externally because dentoalveolar structures and the facial soft tissues show compensatory changes to minimize the underlying asymmetry[2,3]; however, moderate and severe asymmetries are easily noticed by the human eye.[4]

Unfortunately, prominent abnormalities of the facial structures play an important role in a growing individual's developing identity and often create undesired psychological results.[1] Waite and Urban[1] emphasized that great degrees of asymmetry are correlated with clinical depression, inferiority complex, poor self-esteem, and neurosis.

The etiologic factors that cause facial asymmetries and their underlying mechanisms are not yet completely understood.[1,3] Nevertheless, it is thought that facial structures can show different degrees of asymmetries as a result of lowered genetic control over the formation and development of bilateral structures of the face or environmental influences and accidents during development.[5] It is appropriate to classify facial asymmetries into the two basic categories of developmental or acquired asymmetries. Developmental asymmetries include agenesis, hypoplasia, hyperplasia, atrophy, hypertrophy, and malpositions of the facial bony structures. Acquired

asymmetries occur as a result of traumas, infections, functional shifts, and tumors.[3]

Hemimandibular hyperplasia is a developmental asymmetry characterized by three-dimensional enlargement of half of the mandible.[6] The hyperplastic side includes the condyle, condylar neck, ramus and corpus, and the anomaly terminates at the symphysis. The unilateral increase in height of the face on the affected side results in a sloping rima oris or mouth and rotated facial appearance. The maxilla usually follows the mandible and grows downward on the affected side. As a result, the occlusal plane tilts and is at a lower level on the affected side, whereas the teeth generally remain in occlusion.

The aim of this report is to present the orthodontic and surgical treatment of an adult patient having severe facial asymmetry and dentofacial deformity.

CASE REPORT Return to TOC

Diagnosis and Etiology

The patient was a 27-year-old woman who had no history of significant medical problems or any family history of hereditary disease. However, she had an accident that caused a serious trauma to her chin when she was 10 years old. Her main complaint was the asymmetric look of her face. The asymmetry of the face was outstanding in all three dimensions. The mandibular ramus and corpus appeared longer and wider, with the bulk of the mandibular bone obviously larger in all three dimensions on the right side (Figure 1). We observed an accompanying transverse deviation of the occlusal plane, which canted down on the right side. Clinical examination of the temporomandibular joint revealed no restriction of joint movements, pain, or clicking.

The cephalometric examination indicated that she had a skeletal Class III relationship with a retrusive maxilla, protrusive mandible, and a concave soft tissue profile (Table 1). In the radiographic evaluation, the condyle was enlarged and elongated, the heights of the ramus and corpus were essentially increased, the lower border of the mandible was bowed downward, and the distance between the tooth roots and the mandibular canal was increased on the affected (right) side. Dentally, a Class I molar and canine relationship and normal overjet and overbite with protrusive upper and retrusive lower incisors were present (Figure 2). On the basis of these clinical and radiological findings, we diagnosed a hemimandibular hyperplasia.

Treatment Objectives

In each different stage of the treatment, we planned to achieve the following goals determined according to our diagnostic setup:

a. Orthodontically align the teeth, correct tooth inclinations and angulations, and arrange the dental arches in the presurgical orthodontic phase;

b. Orthodontically prepare the teeth and dental arches for surgery by decompensating the dental relationships in the presurgical orthodontic phase;

c. Correct the compensatory transverse cant of the occlusal plane in the surgical phase by a Le Fort I osteotomy;

d. Level the lower border of the hyperplastic side of the mandible with the normal contralateral side in the surgical phase by a sagittal split ramus osteotomy (SSRO) and excision of a bone block from the lower border of the mandible;

e. Correct the skeletal Class III relationship in the surgical phase by the Le Fort I osteotomy and SSRO;

f. Accomplish an ideal occlusion with maximum intercuspation in the postsurgical orthodontic phase; and

g. Improve the facial esthetics.

Treatment Progress

Presurgical orthodontic phase. The impacted third molars found in the osteotomy site were extracted, and edgewise fixed orthodontic appliances were placed on all the teeth. At the beginning, 0.014-inch continuous nickel- titanium archwires were used for leveling. After the leveling stage, rigid archwires were used to correct the incisor and molar inclinations. Meanwhile, Class II elastics were used for retracting the upper teeth and protracting the lower teeth and, as a result, decompensating the dental relationship. Just before surgery, 0.017- × 0.025-inch stainless steel archwires with surgical spurs were applied. Eventually, with an orthodontic treatment of 1 year of fixed appliances, the upper and lower dental arches were aligned and arranged. Throughout this stage, the upper incisors were retruded and lower incisors were protruded, and consequently decompensation of the dental arches was accomplished by using Class II elastics (Figure 3). In this manner, the incisors were brought to their ideal positions in their alveolar processes, and negative overjet was obtained (Figure 1).

Surgical phase. By a Le Fort I osteotomy the maxilla was advanced 2 mm and the transverse canting of the occlusal plane was corrected. This movement was realized with a 4-mm impaction of the right posterior maxilla and 3-mm vertical augmentation to the left posterior maxilla. During this procedure, the triangular bone graft obtained from the right osteotomy side was placed into the left osteotomy side. Furthermore, the mandible was moved 5 mm backwards by SSRO, and a corticocancellous bone block approximately 10 mm thick was excised from the lower border of the mandible between the right parasymphisial region and right angular notch to correct the asymmetry of the mandibular corpus. To prevent the soft tissues of the affected right side from hanging loosely after the operation, the soft tissues of the cheek and lower border of the mandible were pulled upward from the periosteum.

Postsurgical orthodontic phase. The day after surgery, Class III elastics with vertical component and anterior box elastics were applied to obtain a good Class I molar and canine relationship and a normal overbite and overjet. Postoperative orthodontic treatment lasted 7 months. Finally, 0.016-inch stainless steel finishing archwires were used with the necessary elastics. All the disharmonies were eliminated, and an ideal occlusion with maximum intercuspation was accomplished. After 19 months of total treatment time, the edgewise appliances were removed. Retention consisted of a Hawley retainer in the maxillary arch and fixed lingual retainer in the mandibular arch.

Treatment Results

As a result of the orthodontic and orthognathic procedures, the cant of the occlusal plane was corrected and the asymmetry of the mandibular body and face was largely eliminated (Figures 1 and 4). Together with the correction of the sagittal relationship of the upper and lower jaws, a plain and esthetic profile was obtained. A favorable occlusal result was achieved with acceptable interdigitation and incisor relationship (Figure 4). A genioplasty operation to correct the remaining asymmetry of the chin was suggested to the patient, but she rejected a second operation because she was satisfied with the treatment outcome (Figure 5).

DISCUSSION Return to TOC

Among all dentofacial abnormalities, asymmetries are one of the most complicated problems in both childhood and adulthood. In a growing child, functional asymmetries often can be corrected by obtaining a proper function and eliminating occlusal interferences. These can be realized by aligning teeth, occlusal adjustments, and maxillary expansion.[2,7] However, in an adult with facial asymmetry related to a functional shift, an additional muscle memory deprogramming with diagnostic splints is indicated to set the centric relation position. On the other hand, dental asymmetries can be treated with orthodontics at all ages by using asymmetric mechanics with oblique elastics and asymmetric tooth extractions.[2,7]

Skeletal asymmetries are treated with a combination of orthodontic and orthopedic mechanics in growing individuals.[2,7–9] However, usually the asymmetry cannot be completely eliminated, and the treatment needs to be compromised. Besides, future orthognathics is usually needed if the asymmetry is severe. In adulthood, correction of the asymmetries usually requires a series of complex surgical procedures.[2,9–12] Moreover, diagnosing the morphologic pattern of deficient or excessive growth is extremely important because it completely changes the orthodontic and surgical treatment plan.[7]

Obwegeser and Makek[6] suggested classifying asymmetries as either a hemimandibular hyperplasia defined as half of the entire mandible being enlarged three dimensionally or a hemimandibular elongation defined as vertical elongation of condyle and ramus or horizontal elongation of corpus.[7,12,13] Evaluating a patient according to this classification is important for both the orthodontist and the oral maxillofacial surgeon to determine the presurgical orthodontic tooth movements and the type of orthognathic surgery required.

It is reported in the literature that the treatment becomes much complicated if the asymmetry takes place in both the sagittal and vertical and horizontal planes, which is the situation observed in hemimandibular hyperplasia cases.[7] As a result of the volumetric excess of the hemimandible, one side is completely affected up to the midline.[12,14] Increased distances from the tooth apices to the lower border of the hemimandible side compared with the normal contralateral side and the definite notching of the mandibular lower border midline on the panoramic film are the characteristics of this anomaly.[7]

In the present case, because the mandibular ramus and corpus were longer and wider, with the bulk of mandibular bone larger in all three dimensions on the right side compared with the left side, the patient was diagnosed with typical hemimandibular hyperplasia.

In the presurgical orthodontic phase, tooth positioning in both arches was based on the diagnostic setup, and this predetermines tooth movement goals. Correcting the malpositions of the teeth into regularly aligned maxillary and mandibular arches as well as creating negative overjet from a proper occlusion showing good Class I molar and canine relationship with positive overjet and overbite were extremely important in this case. Consequently, destroying the compensation of the teeth and dental arches orthodontically in the presurgical orthodontic phase was necessary to enable the required sagittal movements and asymmetric correction of the upper and lower jaws in the surgical phase.

Surgical correction of hemimandibular hyperplasia can be realized by different surgical techniques, with each having its own advantages and disadvantages.[14–24] Intraoral vertical ramus osteotomy and SSRO techniques are well-known surgical methods used for this

purpose.[10] Jensen[19] introduced a combination of a conventional SSRO with a modification of this technique, which includes dissection of the neurovascular bundle from the mandible, horizontal intermediate bone reduction of the proximal fragment, and vertical reduction of the lower border of the distal fragment. Obwegeser[14] described an alternative method for correction of hemimandibular hyperplasia that included a high or total condylectomy combined with resection of the enlarged mandibular lower border and transferring the free bone graft to the opposite mandibular lower border. Modified and extended SSRO is another alternative method recently reported by Ferguson,[12] with its certainly invasive and effective approach. This method, which is the simplification of the technique described by Jensen,[19] has some advantages over the other conventional methods for correcting the asymmetric mandibles; however, it is time consuming, and the risk of causing neurologic complication is high.[12]

In the modified technique by Ferguson,[12] maxillary surgery is used to level the occlusal plane or correct the maxillary midline. The buccal vertical osteotomy cut for the SSRO is placed just behind the mental foramen, and the inferior dental neurovascular bundle is dissected completely free of the foramen and the mandible. Then the proximal fragment is rotated cranially until the lower border is level with the opposite side of the mandible. Next, an appropriate amount of bone is removed from the upper border of the horizontal osteotomy cut in the proximal fragment, instead of horizontal intermediate bone reduction of the proximal fragment. Bone reduction at the lower part of the distal fragment is then carried out to the new level of the lower border on the proximal fragment.

The cranial rotation of the proximal fragment offers the opportunity to bring the gonial angle forward on the affected side, which is more posteriorly positioned than the unaffected side. It was considered unlikely that cranial rotation of the condyle might adversely affect temporomandibular functions or result in condylar resorption.[25] Condylar resorption appears in patients who are dolichocephalic, whereas patients with hemimandibular hyperplasia have brachycephalic facial structure.

In the treatment of the patient in the current case report, we used the SSRO combined with asymmetric vertical reduction osteotomy at the lower border of the mandible. This technique was chosen because it was easy to apply, it was less time consuming, and the risk of causing nerve injury or neurologic complication was lower. A panoramic radiograph taken 7 months after the surgery showed formation of new compact bone at the lower border of the mandible on the right side (Figure 1). This finding supports the advantages of the vertical reduction osteotomy applied to the lower border of the mandibular compact bone as compared with the more invasive approaches.

However, with the surgical technique we used in this case, it may not be possible to remove a sufficient amount of bone from the lower border of the mandible on the affected side when the inferior dental neurovascular bundle is positioned at a much lower level in the mandible. In such a case, using the surgical technique we applied would result in insufficient correction of the lower mandibular border asymmetry, or attempts to level the lower border of the affected side with the opposite side would put the nerve at risk. In a more severe case of this kind, it would be necessary to include some different goals to the treatment objectives such as intrusion of the mandibular posterior teeth, shortening the distance between the tooth roots and the mandibular canal and, as a result, shortening the vertical dimension of the mandibular corpus on the affected side. Therefore, diagnostic setup is necessary at the beginning of the treatment for defining the goals of the presurgical orthodontic treatment and the required tooth movements according to the different surgical techniques planned for use.

CONCLUSIONS Return to TOC

a. Hemimandibular hyperplasia can be corrected by using different methods, with each having its own advantages and disadvantages.

b. The structures involved in this abnormality and the patient's expectations must be taken into consideration when choosing the surgical technique for correction of the problem.

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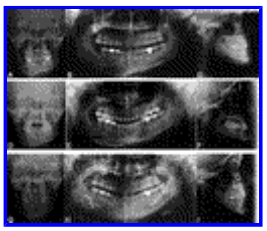
TABLES Return to TOC

Table 1. Cephalometric Summary of the Case

	Pre-treatment	Pre-surgery	Post-treatment
Skeletal measurements			
SNA, °	80	81	82
N perp - A, mm	−2.5	+0.5	+2
Co-A (eff maximum length), mm	96	97	100
SNB, °	83	83	80
N perp - Pg, mm	+8.5	+10.5	+4.5
Co-Gn (eff mandibular length), mm	128	128	126
ANB, °	−3	−2	2
Witts, mm	−7.5	−7	−4
Go-Gn/S-N, °	22	24	29
ANS-Me, mm	63.5	66	68
Gonial angle, °	122	126	132
Dentoalveolar measurements			
U1–NA, mm/°	+8/27	+4/12	+4/16
U1/PP, °	115	103	106
L1–NB, mm	−2	+4	+5
L1/MP, °	76	97	88
U1/L1, °	151	142	139
Overjet, mm	+3.5	−2	+3
Overbite, mm	+3	+3	+2
Soft tissue measurements			
UL-E line, mm	−7.5	−8.5	−7
LL-E line, mm	−7.5	−5	−7
Nasolabial angle, °	90	102	111
Posteroanterior analysis			
Occlusal plane/Lo-Lo plane, °	6	6	1
Midsagittal plane - Me, mm	9.5	9.5	3
Right/left corpus ratio (Go–Me)	1.15	1.15	1
Right/left ramus ratio (Cd–Go)	1.30	1.30	1.24

FIGURES Return to TOC



Click on thumbnail for full-sized image.

Figure 1. Posteroanterior cephalometric, lateral cephalometric, and panoramic radiographs taken before treatment (A, B, C), before orthognathic surgery (D, E, F), and at the end of treatment (G, H, I)

Click on thumbnail for full-sized image.

Figure 2. Facial and intraoral photographs taken before treatment

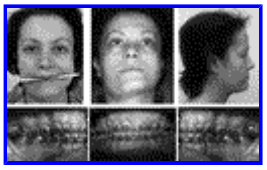


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Figure 3. Facial and intraoral photographs taken before orthognathic surgery

Click on thumbnail for full-sized image.

Figure 4. Facial and intraoral photographs taken 1 year after treatment

Click on thumbnail for full-sized image.

Figure 5. Submental photographs taken before orthognathic surgery (A) and at the end of treatment (B)

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