Management of Craniofacial Development in the Parry-Romberg Syndrome: Report of Two Patients

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Objective: **The aim of this article is to describe the orthodontic therapy for Parry-Romberg syndrome. The therapeutic goal is to minimize the wasting effects of progressive atrophy on facial development of a part of the face.**

Design: **To correct problems affecting craniofacial development of these patients, occurring during puberty, an orthodontic appliance was employed, which helps maintain parallelism of the facial planes, in particular the mandibular plane.**

Setting: **Orthodontic care was carried out in the Dental Clinic of the Catholic University of the Sacred Heart of Rome.**

Intervention: **Two patients underwent orthodontic therapy for 6 years. Appliances were checked every month and modified periodically so as to adapt to facial bone growth.**

Results: **At the end of craniofacial growth, the mandible was almost symmetric and the problem relating to atrophy remained confined to the initial area. Cephalometric analyses demonstrated that the occlusal plane and the mandibular plane maintained a straight orientation in relation to the bizygomatic plane. The ratio between the left and right side of the ramus and condyle, in the mandible, improved.**

Conclusions: **The use of orthodontic therapy allows patients affected by hemifacial progressive atrophy to present a more harmonic face at the end of puberty when final reconstruction can be planned. These results provide for a limitation of surgical intervention to the sclerodermic area alone.**

KEY WORDS: *craniofacial growth, orthodontic therapy, Parry-Romberg syndrome*

The Parry-Romberg syndrome was described first by Parry (1825) and then Romberg (1846) as a trophoneurosis facialis. It is a progressively ingravescent disease in which only a localized area of the face is affected (Gorlin et al., 1990). The condition usually arises during the first decade of life.

The main features of the disease are progressive atrophy of the skin, underlying subcutaneous tissue, muscles, and bones (Shafer et al., 1983; Gorlin et al., 1990; Mazzeo et al., 1995). Parry-Romberg syndrome is considered to be a localized scleroderma with hemifacial atrophy (Wartenburg, 1945). Lewkonia and Lowry (1983) described this disease as a form of scleroderma in which only the head and neck are affected. Three types of facial scleroderma were classified by Rees (1976). Type I, called morphea, shows a localized depressed area of the superficial epidermal layer. Progressive hemifacial atrophy follows distribution of the trigeminal nerve with additional lymphocytic neurovasculitis. In type II, the inflammatory features and distribution along the trigeminal nerve are more evident than in type I. Rees (1976) divides this class into two groups: Parry-Romberg syndrome and linear scleroderma. Type III is characterized by bilateral scleroderma in which soft and underlying skeletal tissues deteriorate.

A study of the histological characteristics of this disease provides a description of the pathogenetic mechanisms. Lymphocytic neurovasculitis of the dermis occurs during the active progressive phase, followed by a burning out of the trophic process and subsequent stability. Histologically, an increase in collagen fibers is observed. In Parry-Romberg syndrome, elastin fibers are present and represent the only element for differential diagnosis with linear scleroderma.

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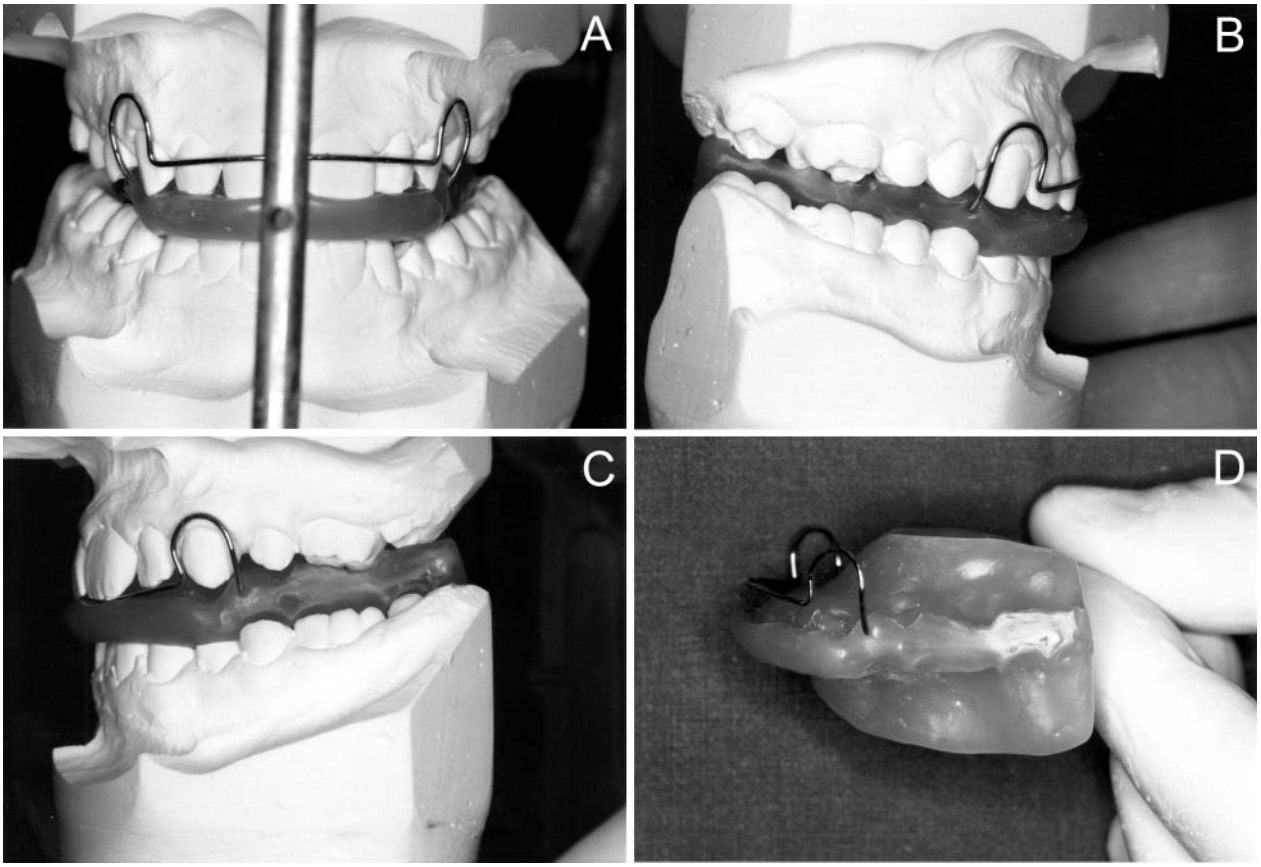

FIGURE 1 The orthodontic appliance. A. Frontal view. B. Lateral view of healthy side. C. Lateral view of affected side. D. Prepared in wax to be checked in patient's mouth.

Although several clinical cases have been described, etiological factors are not yet well known. At present the sympathetic trophic etiological theory bears greater support (Vickery, 1971; Foster, 1979). Other theories have been suggested, including trauma, infections, genetic factors, and peripheral trigeminal neuritis (Dechaume et al., 1954; Moss and Crikelair, 1960; Shafer et al., 1983; Zafarulla, 1985; Miller et al., 1987; Pensler et al., 1990).

The pathology is observed more frequently in females, in equal percentage on both sides of the face (Lakhani and David, 1984; Miller et al., 1987). The period during which this pathology is active ranges widely with respects to onset and duration (usually 7 to 9 years).

Progressive atrophy is generally localized to a small area of the skin corresponding to the temporal or buccinator muscles. This wasted area increases in size downward toward the neck and labial commissure, and upward toward the eyebrow (Glass, 1963; Jurkiewicz and Nahai, 1985). Initially the skin may be pigmented, with characteristic white, brown, or blue patches (Gorlin and Pinborg, 1964). The scalp on the involved side can be affected by alopecia. The wasting process extends from months to years during which time the skin becomes dry and thin but freely movable. Atrophy of underlying muscles, bones, and cartilage is responsible for the typically aged appearance of the patient (Glass, 1963; Schnall and Smith, 1974; Souyris et al., 1983; Moore et al., 1993). Neurological complications such as paresthesia, trigeminal neuralgia, severe migraine, and epilepsy, often of the sensory Jacksonian type, can be associated phenomena (Gorlin and Pinborg, 1964; Paradise et al., 1980; Jurkiewicz and Nahai, 1985; Sagild and Alving, 1985). Ocular localization is described as enophthalmos and other less frequent signs (Wolf and Weber, 1940; Glass, 1963; Gorlin and Pinborg, 1964; Rees, 1976; Miller et al., 1987). As a consequence of the syndrome, several cases of tooth root resorption and anatomical dimensional changes in tooth size have been reported on the affected side (Rushton, 1953; Foster, 1979; Miller et al., 1987; Lehman, 1992; Fayad and Steffensen, 1994). These problems can cause open bite and lateral mandibular deviations (Bramley and Forbes, 1960; Glass, 1963).

Treatment

Treatment includes augmentation of the atrophic areas for aesthetic rehabilitation and symptomatic treatment for neurological disorders. Usually plastic and maxillofacial surgery is deferred until the disease process ceases (Davis, 1968; Rees et al., 1973; Souyris et al., 1983; Moore et al., 1993).

The objective in orthodontic and dentofacial orthopedic care, to treat facial asymmetry presenting in Parry-Romberg

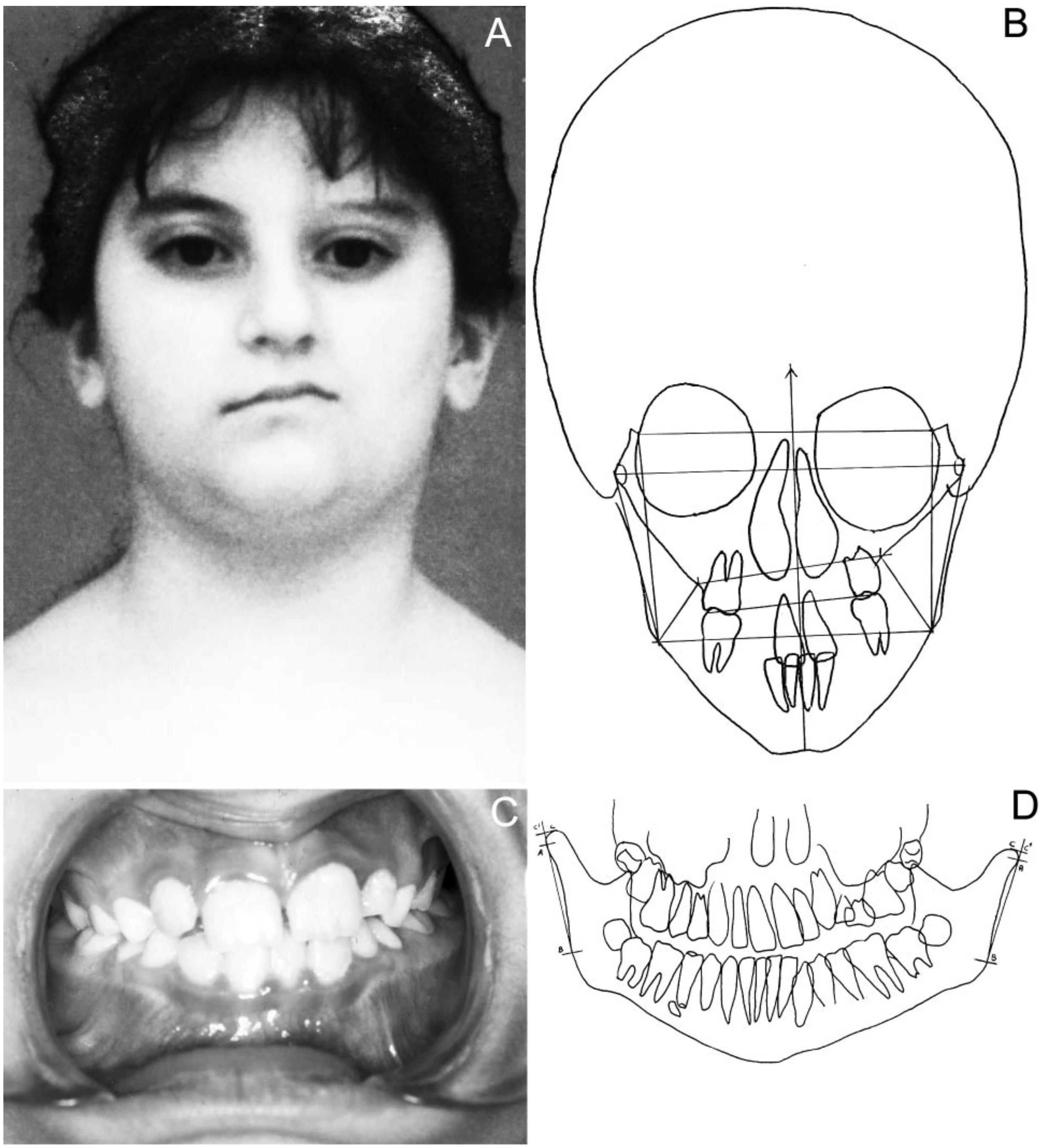

FIGURE 2 Beginning of orthopedic therapy for patient 1. A. Frontal view. B. First cephalometric analysis. C. Frontal view of dental occlusion. D. Tracing of first orthopantomogram.

syndrome, is to maintain mandibular symmetry by stimulating those growth centers that are not directly involved in the wasting process.

Without any orthodontic and orthopedic therapy during craniofacial growth, the mandible will become asymmetric, with a longer ramus and condyle on the healthy side of the face with respect to the other side. This problem is evident in all craniofacial malformations characterized by functional limitation, as shown by McNamara (1973), who described the effects of the limited mandibular function at the neuromuscular and skeletal level.

During growth the bones of the skull are influenced by reciprocal relationships because of the progressive augmentation of bone volume and peripherical remodeling of bone contours (Enlow et al., 1971). The growth process is affected by the action of genetically encoded factors such as hormone level and the nature of growing tissue. However, the end result in craniofacial growth is mainly determined by function (Moss, 1997).

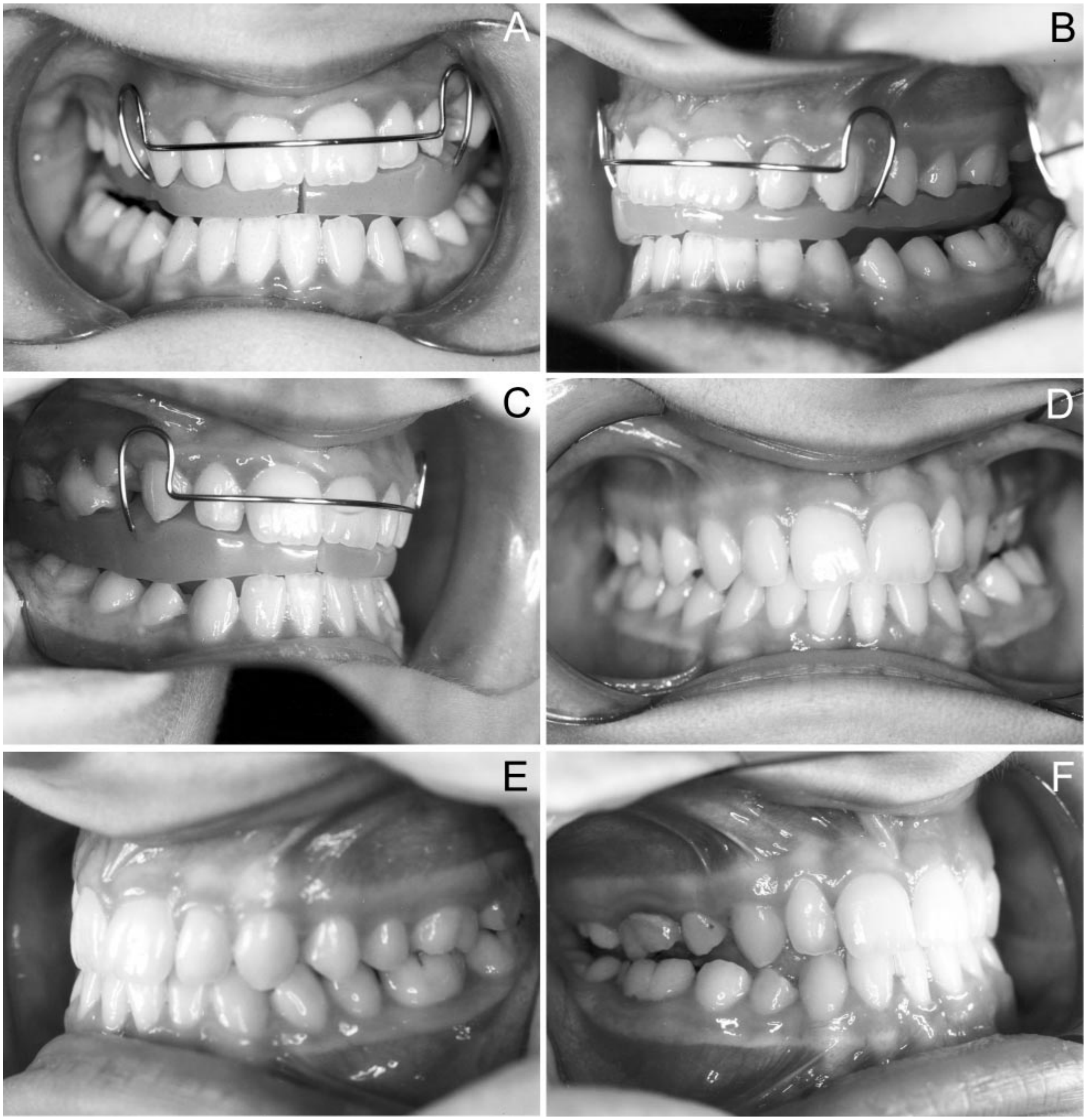

FIGURE 3 **Orthopedic therapy for patient 1. A, B, C. Frontal, healthy side lateral, and affected side lateral views during therapy. D, E, F. Frontal, healthy side lateral, and affected side lateral views of dental occlusion after treatment.**

TABLE 1 **Data for Patient 1 Showing Inclination of Maxillary, Occlusal, and Mandibular Planes Related to Frankfurt Horizontal Plane, According to Ricketts (1961) Cephalometric Analysis**

Date	*Za ^ J*	*Za ^ B6*	*Za ^ Ag*
June 1, 1994	6	4	2
June 20, 1995	5	4	4
May 7, 1996	6	3	3
April 30, 1998	7	3	2
April 14, 1999	6	2	4
September 5, 2000	5	3	0.5
October 2, 2001	1	3.5	0.5

TABLE 2 **Analysis of Habets et al. (1987) of Patient 1, Depicting Calculated Symmetry of Ramus and Condylar Heights Expressed in Percentages According to the Formula: [(right − left)/(right + left)] × 100**

Date	*Condylar Plus Ramus Height*	*Ramus Height*	*Condylar Height*
June 20, 1995	7	2.7	20
April 14, 1999	6.3	5.8	11
October 2, 2001	7	7.8	9

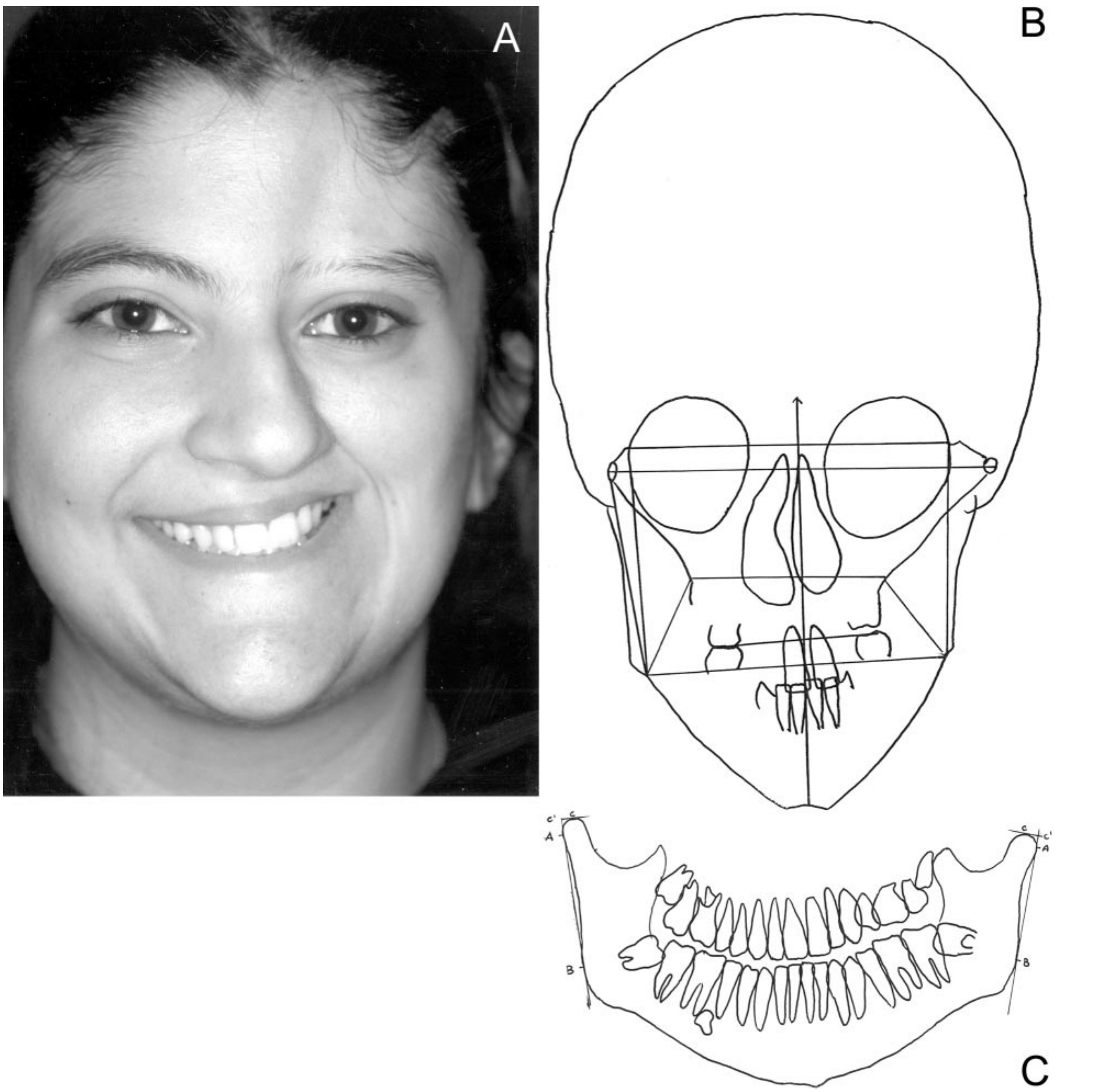

FIGURE 4 Patient 1 at end of growth. A. Frontal view. B. Last cephalometric analysis. C. Tracing of last orthopantomogram.

Petrovic and Stutzmann (1981) described the group of phenomena that interact in determining growth of the maxilla and mandible. The growth sites of the mandible, located at the condylar cartilage level, respond to mechanical stimuli exerted by muscular contraction (Petrovic et al., 1990).

If one side of the face is less developed than the other, function is asymmetrical, resulting in an inclination of the occlusal plane and mandibular bone asymmetry. Hence, the objective of orthodontic therapy in this clinical situation is to stimulate the condylar growth of the affected side in a vertical direction to obtain an equal growth of the two sides of the mandible.

In Parry-Romberg syndrome, once a sufficient parallelism of the two hemimandibles is obtained during functioning at the end of growth, an open bite is evident on the affected side caused by the hypoplasia of the superior jaw. This is due to the effects of the therapy, which exploits the mandibular growth potential during puberty, and allows an equal development of the mandibular ramus (condylion-gonion distance).

Therefore, although it is not possible to arrest the progressive involution of the affected area, it is possible to limit the effect caused by this process on the mandible. With the aid of orthodontic therapy, these patients do not need mandibular surgery but may still require soft tissue reconstruction and occlusal rehabilitation therapy in adulthood.

The aim of this article is to report two cases of patients affected by Parry-Romberg syndrome treated with orthodontic

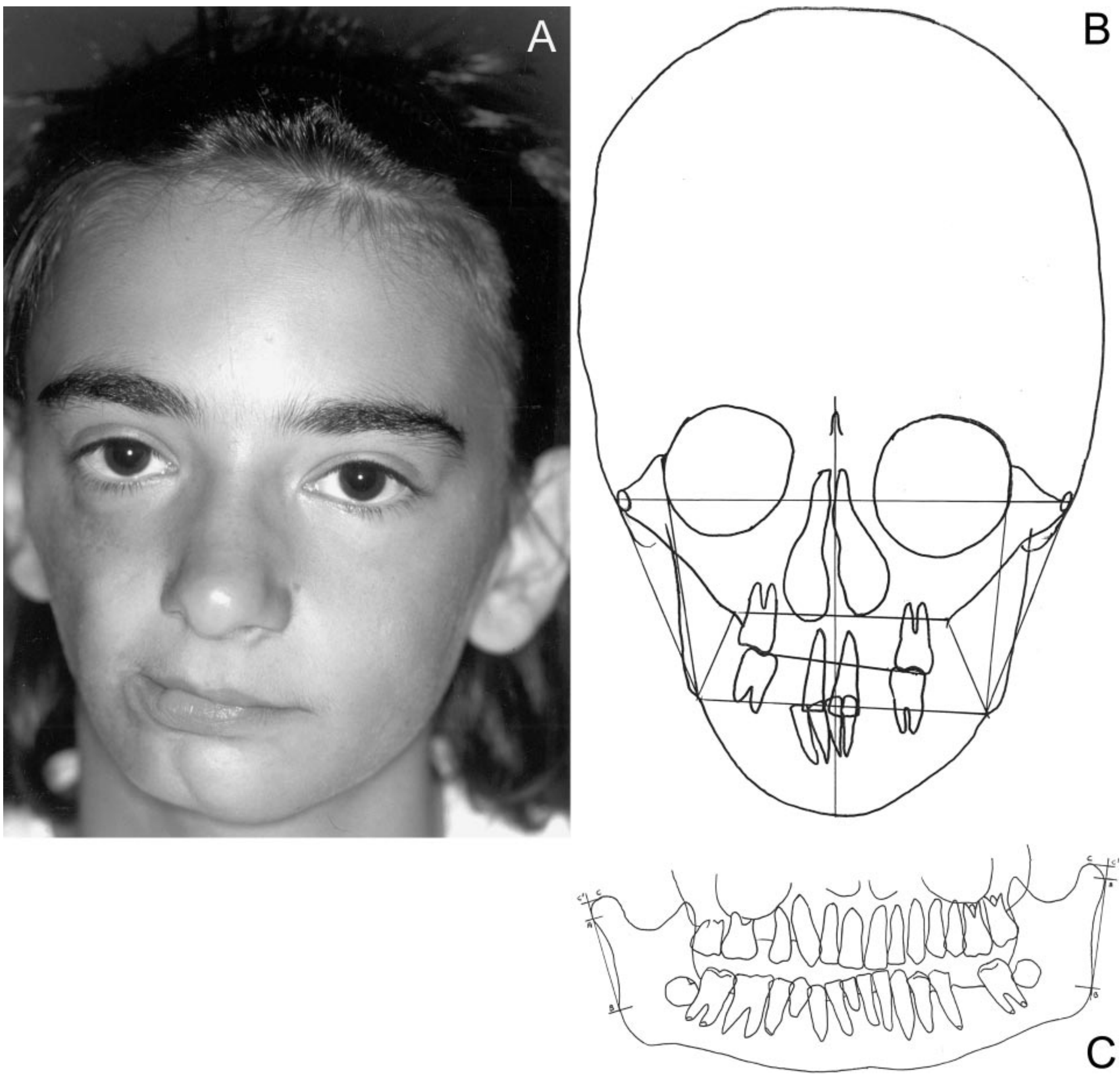

FIGURE 5 Beginning of orthopedic therapy for patient 2. A. Frontal view. B. First cephalometric analysis. C. Tracing of first orthopantomogram.

appliances designed to regulate mandibular growth. Therapy was protracted during the years of the patient's pubertal spurts and continued until the end of craniofacial growth.

Orthodontic Management

Orthodontic therapy for our patients affected by progressive hemifacial atrophy relies on the experimental findings of Petrovic et al. (1990). An orthodontic appliance, which stretches the muscles of the mandible by keeping the teeth apart on the affected side to correct the asymmetrical growth pattern, is fabricated. Thus, the straight mandibular occlusal plane is maintained, and the condyles receive a different stimulus with respect to growth and remodeling processes. Like all functional appliances, this tool modifies the physiological movements by maintaining a straight mandible to correct the skeletal problem. For this reason clasps are not necessary, and the teeth are not subjected to any orthodontic forces. The absence of these forces is favorable for use in Parry-Romberg syndrome, given the increased frequency of root malformation (and potential root resorption) often reported in this pathology. To obtain an orthopedic effect, the young patient must keep the appliance in place using muscular force for at least 12 to 14 hours a day, and the therapy must be constantly maintained during the growth period until the end of puberty.

The following procedures are used to prepare the appliance. Impressions of the dental arches are obtained to fabricate the patient's dental casts. Two occlusal wax registrations are obtained. The first records the maximum intercuspation position, and the second one is thicker on the affected side of the mandible. The height of the construction bite is obtained through the clinical observation of the symmetric distance between the

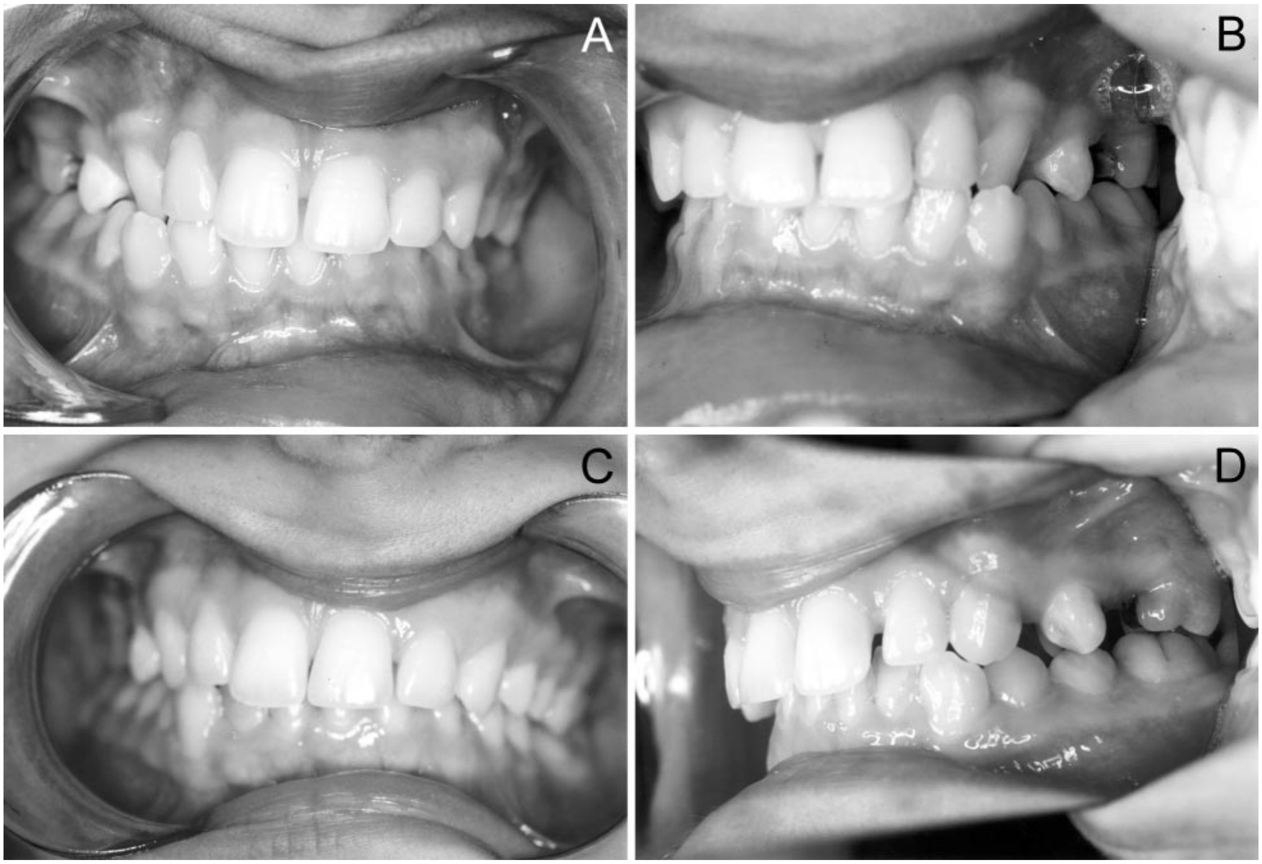

FIGURE 6 Dental occlusion at the beginning and end of therapy for patient 2. A, B. Frontal and affected side lateral view at beginning of therapy. C, D. Frontal and affected side lateral view after treatment.

opening and closing of the patient's mandible, with wax interposed between the arches.

The dental casts are fixed in a semi-individual value articulator (Whip Mix, Louisville, KY) in the position determined by the second registration wax, the first one being utilized to verify how much the dental occlusion is modified in that position. The apparatus is designed with a resin layer interposed between the arches and separated into two halves held together by a vestibular arch. On the affected side, the resin layer is about 5 to 6 mm thick. It is also necessary to have a resin layer on the healthy side to prevent dental extrusion. It can be designed to guide the eruption of several dental elements to eliminate possible occlusal interferences. For example, it may touch the inferior arch in the molar and incisive area only if the aim is to flatten the curve of Spee. Hence, the orthodontic appliance is modeled in wax to allow the orthodontist to check it in the patient's mouth prior to acrylic transformation (Fig. 1).

In Parry-Romberg syndrome, the appliance requires continuous revision because of progressive involution in the affected area. The patient is monitored every month, and the appliance is periodically modified by changing the thickness of the inner layer of acrylic interposed between dental arches when a lateral deviation in opening the mouth is detected. If necessary, the appliance is ground on the lateral aspect to model grooves for promoting dental eruption and guiding teeth into a proper position.

The clinical effect of the appliance is visible because the mandibular plane is kept straight, and the posterior teeth on the affected side do not touch.

Radiographic records are periodically taken to measure therapeutic results. Asymmetry of the face is checked on radiographic head films of the patients taken on posteroanterior projection using Ricketts' (1961) analysis.

In the mandible, the differences between the two condylar and ramus heights are determined using dental rotational panoramic radiography called an orthopantomogram (OPG), according to the technique described by Habets et al. (1987, 1988).

In the two cases illustrated, the tracing of the radiographs have been carried out by three operators and subsequently compared.

Patient 1

This female patient was diagnosed with Parry-Romberg syndrome because of the presence of signs detected by the dermatologist. On admission to the dental clinic, she was 9 years old and displayed the following characteristics.

On frontal view of the face, there was a left cheek depres-

TABLE 3 Data for Patient 2 Showing Inclination of Maxillary, Occlusal, and Mandibular Planes Related to Frankfurt Horizontal Plane, According to Ricketts (1961) Cephalometric Analysis

Date	*Za ^ J*	*Za ^ B6*	*Za ^ Ag*
July 14, 1994	1	7	3
June 1, 1995	1.5	5	1
June 6, 1996	1.5	4.5	2.5
September 1, 1999	1	3	3
October 5, 2001	0	3	2

TABLE 4 Analysis of Habets et al. (1987) of Patient 2, Depicting Calculated Symmetry of Ramus and Condylar Heights Expressed in Percentages According to the Formula: [(right − left)/(right + left)] × 100

Date	*Condylar Plus Ramus Height*	*Ramus Height*	*Condylar Height*
July 14, 1994	4.8	8.6	16
September 1, 1999	0	0.4	2
October 5, 2001	2.9	2.9	3.2

sion with an evident nasal deviation to the left. The horizontal planes were minimally altered because the onset of the pathology was recent (Fig. 2A).

The patient was in the early mixed dentition, with anterior mandibular dental crowding. Intraorally the dental occlusion was Angle Class III on the left side and Class I on the right. The frontal view suggested an upward inclination to the left of the occlusal plane (Fig. 2C).

Analysis of the first radiographic head film demonstrated a mild upward inclination of the occlusal plane to the left. A significant difference between the two sides of the maxilla could be seen, resulting in an inclination of the maxillary plane. The teeth on the left maxillary side were less erupted, and the dentoalveolar part of the bone was less developed than that on the right (Fig. 2B).

On the first OPG, the left side of the upper jaw showed malformed (first molar and first premolar) roots, agenesis of the second premolar, and resorbed roots of the primary second molar. The second permanent molar was less mineralized than the one on the right side and had malformed roots. The crown of the third molar was directed toward the second molar. In the mandible, the left side of the body was higher than the one on the right, the teeth being overerupted to touch those in the maxilla. Analysis of the panoramic film demonstrated condylar asymmetry, with the condyle on the left side being longer than that on the right (Fig. 2D).

On the basis of these diagnostic data, orthodontic therapy was planned and started a few months later (Fig. 3A, 3B, and 3C). During the period the patient underwent orthodontic therapy, she was monitored by photographic, OPG and cephalometric analyses at least once a year. In addition, periodic radiographs of the teeth on the left maxillary side were taken to check root development and evidence of root resorption.

The therapy permitted maintenance of symmetry at the mandibular level, the most evident sign being the opening of the bite on the left side. During growth, the left nasal fossa progressively inclined toward the left, the maxillary bone being arrested in its developmental process on that side.

This patient underwent orthodontic therapy for 7 years. During this period, she was followed up with all the aforementioned diagnostic tools. The corresponding data, derived from the analyses according to Ricketts (1961) and Habets et al. (1987), are reported in Tables 1 and 2. Figures 3B and 4 describe the final outcome.

Patient 2

This female patient, affected by progressive hemifacial atrophy, was classified as morphea type by a dermatologist at age 7 years. The facial area affected by the disease was located on the right side, laterally from the lip commissure. On admission, the patient was age 14 years and in the last phase of puberty.

The pathological facial features observed included hyperpigmented and thickened cutaneous tissue in the middle of the sclerodermic area, the chin tilted upward toward the right, the horizontal bipupilar plane inclined down toward the left, and the nose tilted slightly to the right (Fig. 5A).

Examination of dental occlusion revealed full permanent dentition lacking the second right upper premolar and the first lower left molar with mild crowding in the lower anterior area, Angle Class II on the left side and Class I on the right, an overjet of 8 mm, and a crossbite of the upper right canine (Fig. 6A and 6C).

Cephalometric analysis showed inclination of the occlusal plane upward to the right. Nevertheless, the other horizontal planes seemed to be almost parallel with each other, although a structural alteration of the right mandibular horizontal part was evident. The maxillary defect seemed to be localized exclusively to the alveolar bone area (Fig. 5B).

The panoramic x-ray showed features of the disease in both the lower and upper jaw. There was evidenced root reduction with several teeth (the first and second right upper molar, first right upper premolar, first left lower incisor, first and second right lower incisor, first right lower premolar). The second right upper premolar and first left lower molar were absent. The apices of the roots of the first upper right molar were located within the maxillary sinus, and the thickness of the right maxillary alveolar bone appeared decreased.

Using analysis by Habets et al. (1987) to evaluate the asymmetry between the two sides of the mandible, it was evidenced that the percentage of asymmetry between the condylar height of the two sides was 16%, and the ratio between the left and right ramus was 8.6%. Thus, both segments were found to be asymmetric with a greater right condylar height and left ramus height (Fig. 5C).

Orthodontic therapy exploited the last period of mandibular growth to obtain an improved leveling of the occlusal plane. At the same time, it was decided to move the upper right canine into a better position by adding a spring on the appliance.

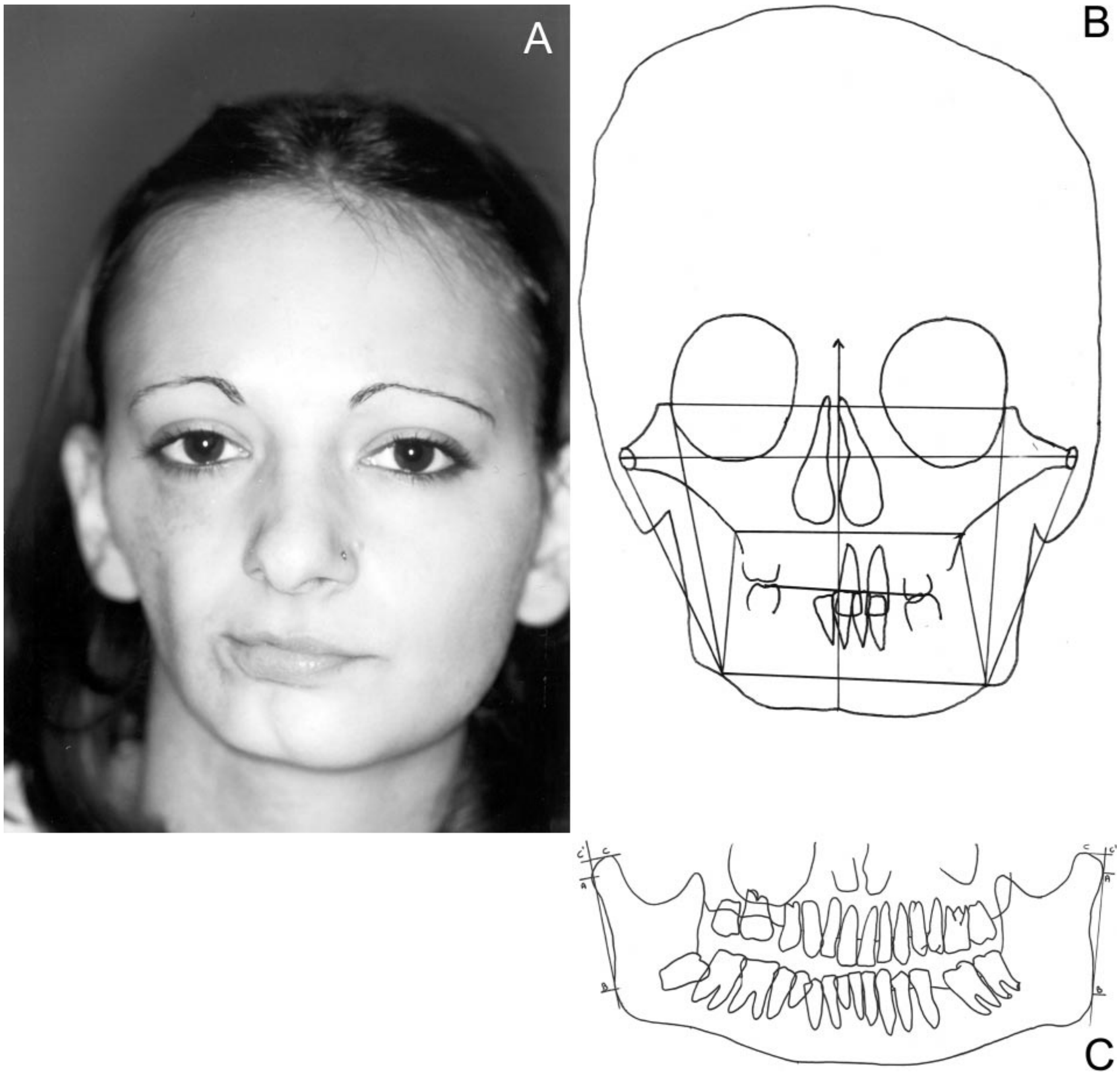

FIGURE 7 Patient 2 at end of growth. A. Frontal view. B. Last cephalometric analysis. C. Tracing of last orthopantomogram.

The patient was followed up for the 7 years in which she wore the appliance. Growth was monitoring by taking radiographs, dental impressions, and slides of the face and dentition. The results of the cephalometric and panoramic analyses are reported in Tables 3 and 4. Figures 6C and 6D and 7 show the patient at 21 years of age. The leveling of the mandibular occlusal plane had improved, and the asymmetry of the mandible had decreased.

Discussion

It is possible to observe pubertal facial changes by analyzing serial radiographs. In Parry-Romberg syndrome it is quite evident that puberty stimulates facial growth, but the area affected by the pathology remains the same size. This is the reason, from its onset, the pathological process inhibits growth in a facial region and the wasting effects become more and more evident as craniofacial growth progresses. However, intraoral radiographic data showed that root malformations did not worsen.

The main orthodontic objective in these patients is to limit the skeletal deformity by stimulating mandibular growth. The effect of such orthodontic therapy is to optimize the balance of the face and symmetric function of the two hemimandibles. Obviously it is impossible to constrain all the factors leading to facial deformity in patients affected by Parry-Romberg syndrome. However, the degree of the mandibular asymmetry may be managed with orthopedic therapy so that the patient may require only surgical intervention limited to the affected area alone. Following the reconstruction of the face, dental occlusion may be refined by means of prosthetic dentistry intervention.

The last consideration concerns the duration of the active period of this disease. Literature on linear scleroderma and Parry-Romberg syndrome indicates that the end of the wasting process occurs at a variable age when the patient is a young adult. In our opinion, the end of disease progression occurs at the termination of craniofacial growth. Thus, surgical intervention should be delayed accordingly. Data offered by the orthodontist, recording the steps in craniofacial development, may be used to integrate the clinical findings that help establish the timing for final reconstruction of the face.

In conclusion, this article extends our clinical experience in mandibular asymmetry to patients with Parry-Romberg syndrome. However, results are obviously influenced by the fact that the cause of the mandibular asymmetry is not primary but derives from the adaptation to the surrounding tissue alteration, which remains in spite of the individual therapy. When there is a primary mandible asymmetry, the orthodontic therapy directly modifies the site of alteration. In Parry-Romberg syndrome, mandibular function is corrected so that the deterioration process does not also involve the mandible. Improved facial aesthetics and an optimal function of the temporomandibular joints are thus obtained. These results, integrated with those obtained by other members of the medical team, contribute to the improvement of the quality of life of the patient.

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