Case Report

Class II Correction in a Severe Hyperdivergent Growth Pattern, Bilateral Open Bite and Oral Compromise

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Abstract: Severe vertical growth pattern and open bites are frequent problems the orthodontist must resolve but require a proper diagnosis, treatment plan, timing, and mechanotherapy to be properly treated. A case report with these problems is presented. (*Angle Orthod* 2005;75: 870–880.)

Key Words: Hyperdivergent growth; Vertical control

INTRODUCTION

A 12-year two-month-old Latin girl was brought in by her parents for evaluation of her dentofacial appearance. The medical history revealed mouth breathing since early childhood. As a possible sequela of the mouth breathing, the patient exhibited bilateral open bite in the premolar areas.

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There was no history of dental trauma or oral habits, but she exhibited hypoplasia of the enamel on the maxillary and mandibular first molars. The dentition was crowded—the mandibular left second premolar was blocked out and both maxillary canines were unerupted. There were no significant signs or symptoms of temporomandibular disorders. Range of motion and amount of opening were normal.

CASE REPORT

Diagnosis and etiology

The patient appeared facially symmetrical with normal lip competence. When smiling, she showed a full display of incisors and disharmony in the posterior

FIGURE 1. Pretreatment facial photographs.

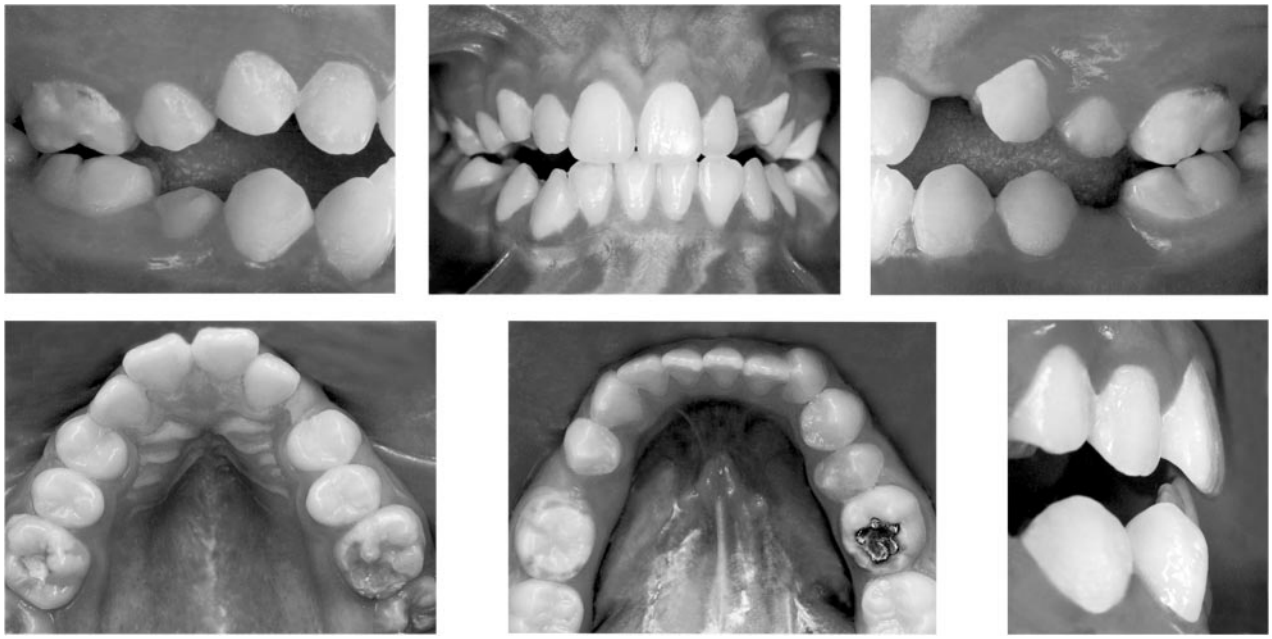

FIGURE 2. Pretreatment intraoral photographs.

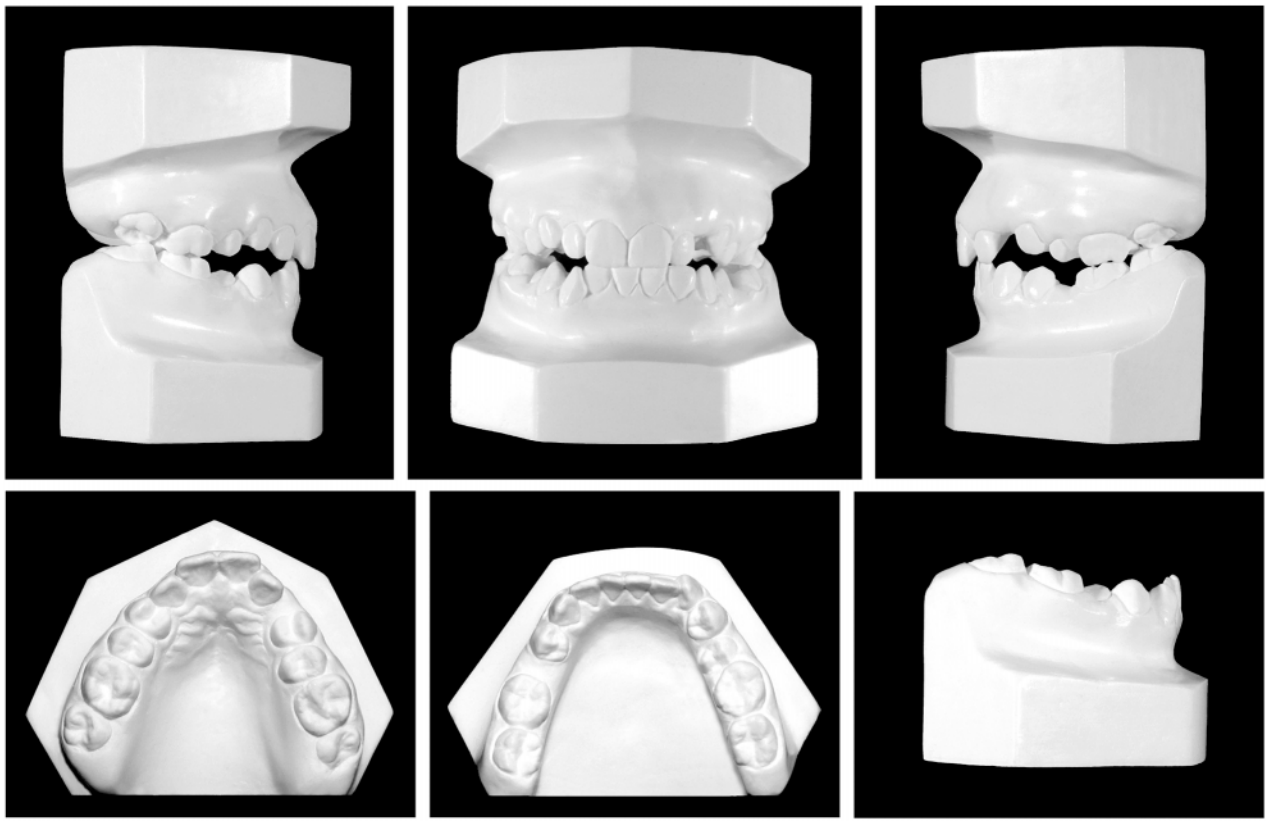

FIGURE 3. Pretreatment dental casts.

teeth. She had a straight profile with excessive vertical facial dimension (Figure 1).

The plaster models exhibited a Class II division 1 subdivision right malocclusion with the left side in Class I occlusion. She had two mm of overjet and two mm of overbite. Her upper midline deviated four mm to the right from the facial midline and the lower dental midline. The maxillary canines were impacted, and the

FIGURE 4. Pretreatment panoramic and periapical radiographs.

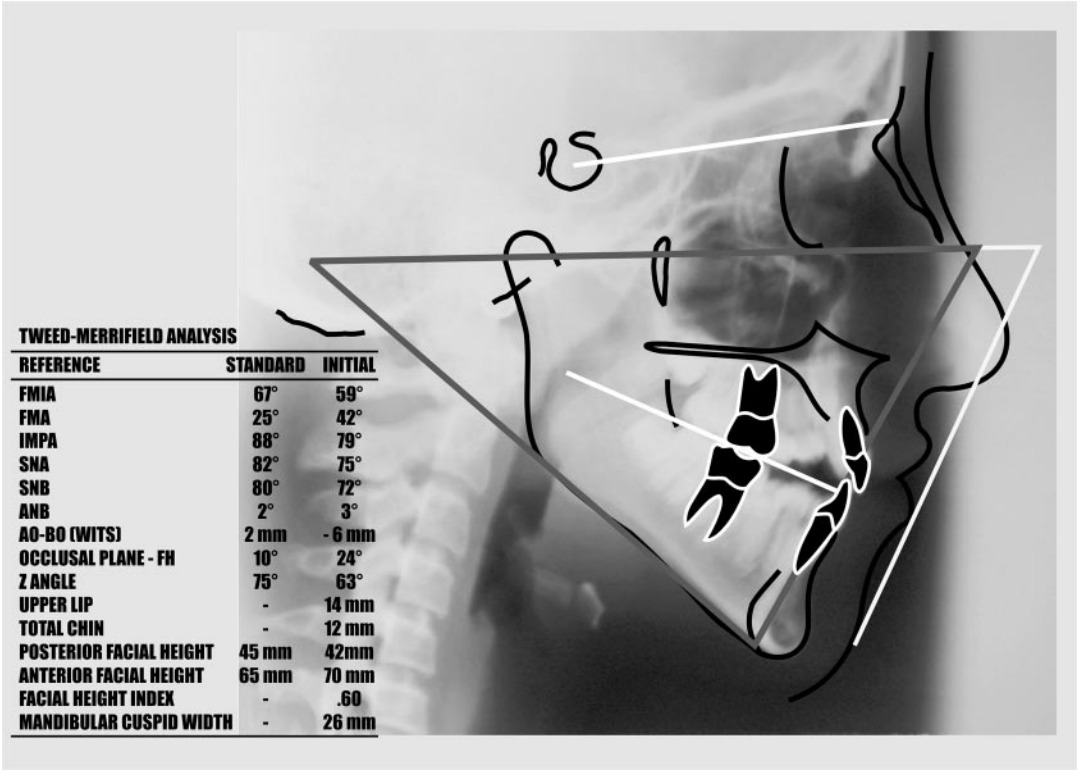

FIGURE 5. Pretreatment Cephalometric radiograph and tracing.

FIGURE 6. Directional force.

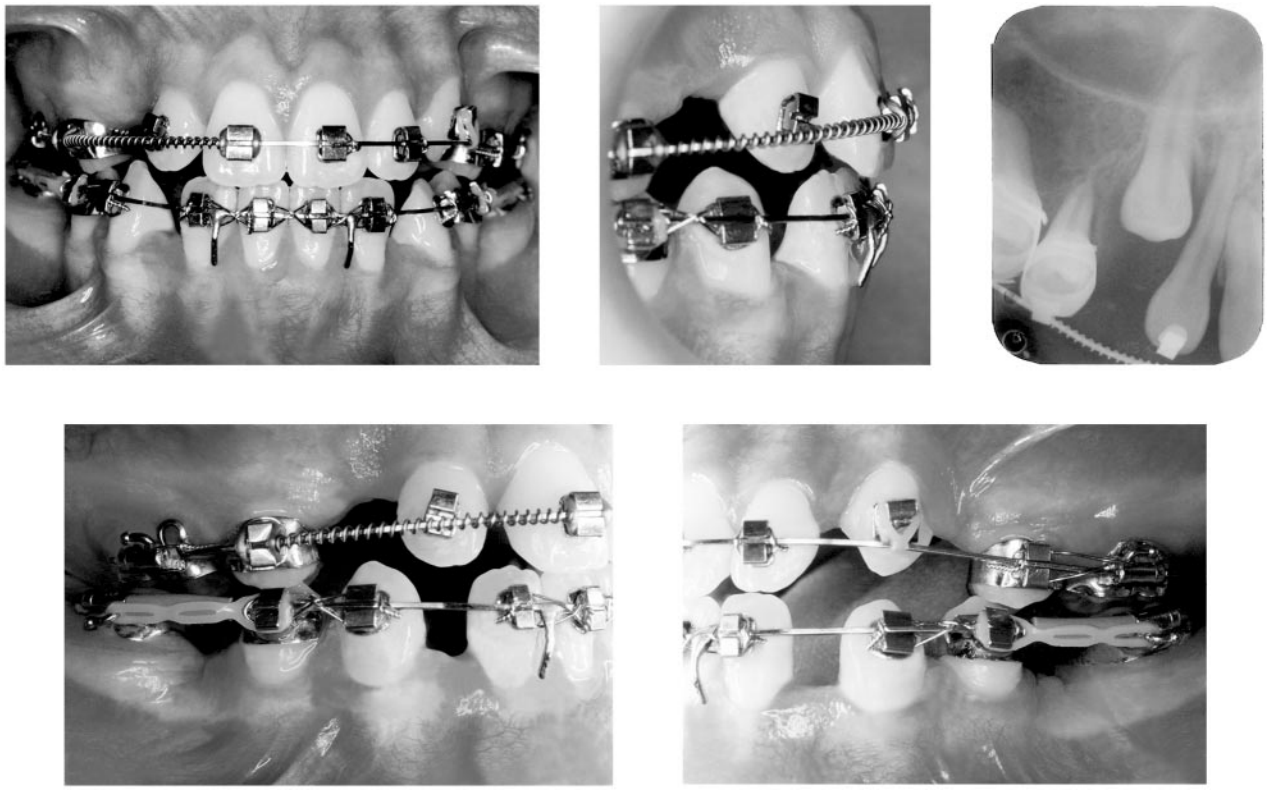

FIGURE 7. Presurgery.

maxillary arch form was triangular with a deep and constricted palatal vault. In the mandibular arch, there was moderate crowding in the second premolar area and in the anterior area. The patient also had a bilateral open bite (4.5 mm on the right and three mm on the left) (Figures 2 and 3).

The panoramic radiograph showed the complete dentition present including the third molars. The maxillary right impacted canine had a pericoronal cyst with bone loss in the area, and the maxillary central incisors had some root resorption (Figure 4).

Skeletally, the patient was a Class I (ANB 3°) but was bimaxillary retrognathic. The FMA angle and the facial index confirmed the severe hyperdivergent growth pattern (Figure 5). The maxillary and mandibular incisor inclination was good, but the steep occlu-

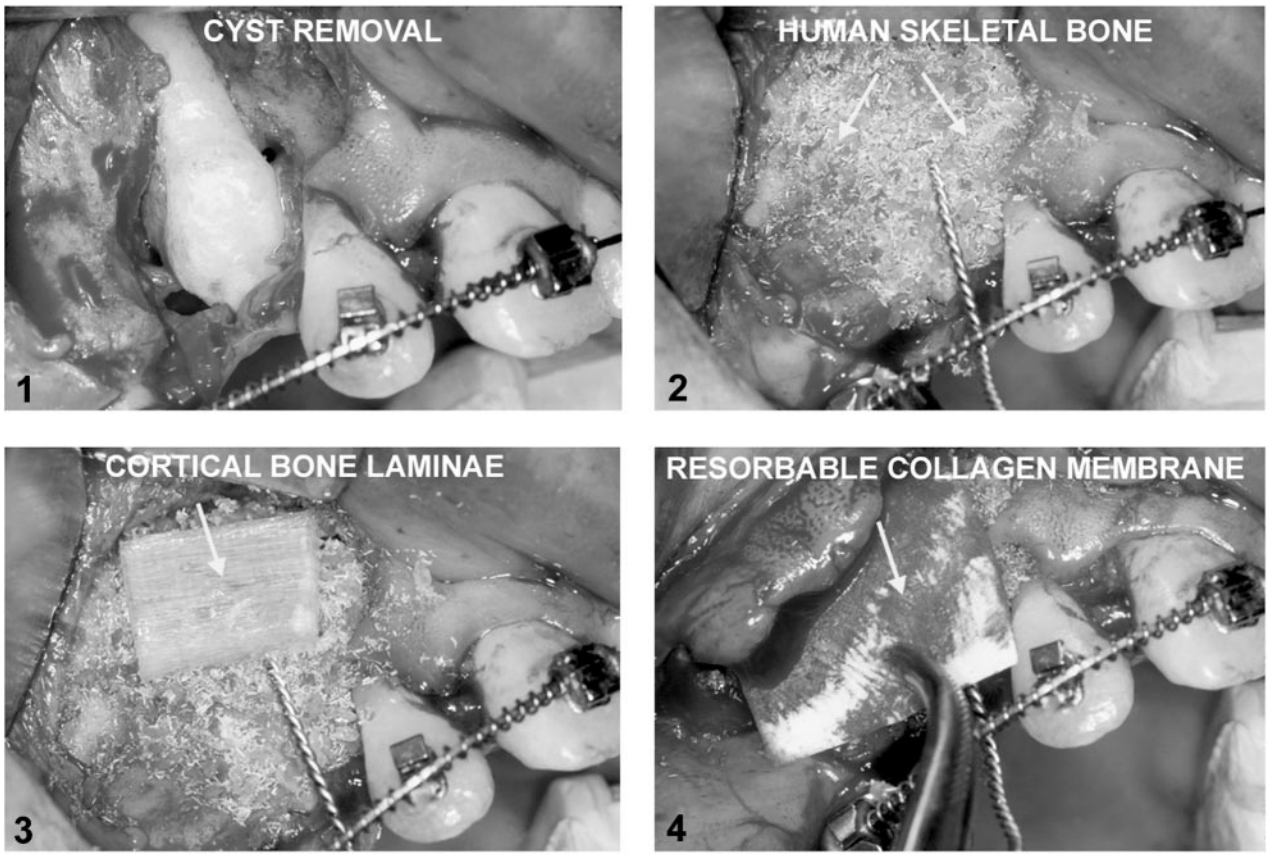

FIGURE 8. Surgery.

sal plane and the four mm curve of Spee confirmed the complexity of the problem. The etiology of the malocclusion was genetic. It was presumed that the open bite and the maxillary arch deformation were sequelae of mouth breathing during childhood.

A diagnosis was achieved with the Differential Diagnostic Analysis System[1] and Merrifield's ''dimensions of the dentition'' concept.[2] The cranial facial dental total difficulty index[1] for this patient was 206, a number that confirms a severe problem, which will present a difficult treatment.

Treatment objectives

- Facial esthetics—obtain a balanced profile and a normal Z angle.
- Function—arrange all the teeth to achieve optimal functional efficiency and achieve a Class I occlusion with normal overbite and overjet.
- Health of the dentition—position and arrange all the teeth for health of the teeth, the jaws, the joints, and the periodontal tissues;
- Stability—position and arrange the teeth for maximum stability.

Treatment alternatives

1. Extract the maxillary first premolars and mandibular second premolars—followed by maxillary first molars and mandibular third molars and restore the mandibular first molars.
   - Advantage: This approach would eliminate some ''bad'' teeth (the maxillary first molars) and help with vertical control because of molar extractions.
   - Disadvantage: The mandibular first molars have to be restored.
2. Orthodontics and orthognathic surgery (genioplasty).
   - Advantage: A better facial result might be possible.
   - Disadvantage: i) The surgical risk factor; and ii) the dentition would have to be significantly expanded.
3. Extract maxillary canines and mandibular second premolars.
   - Advantage: The teeth might be aligned with this amount of space.
   - Disadvantage: i) The bad molars have to be restored; ii) third molars have to be removed; and

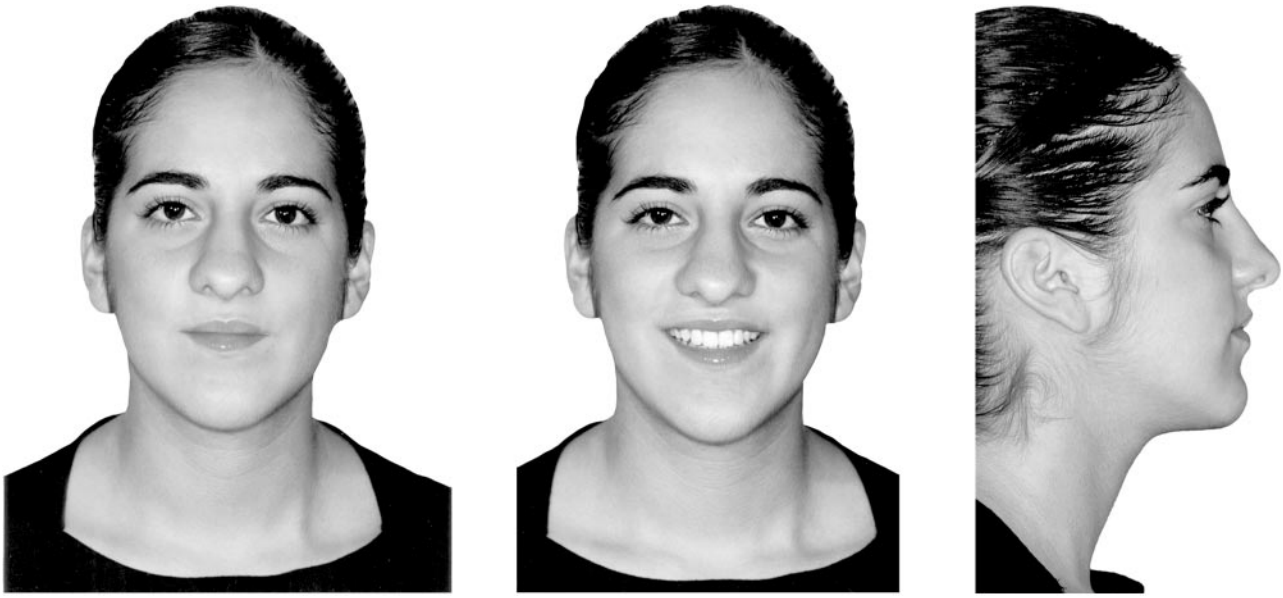

FIGURE 9. Posttreatment facial photographs.

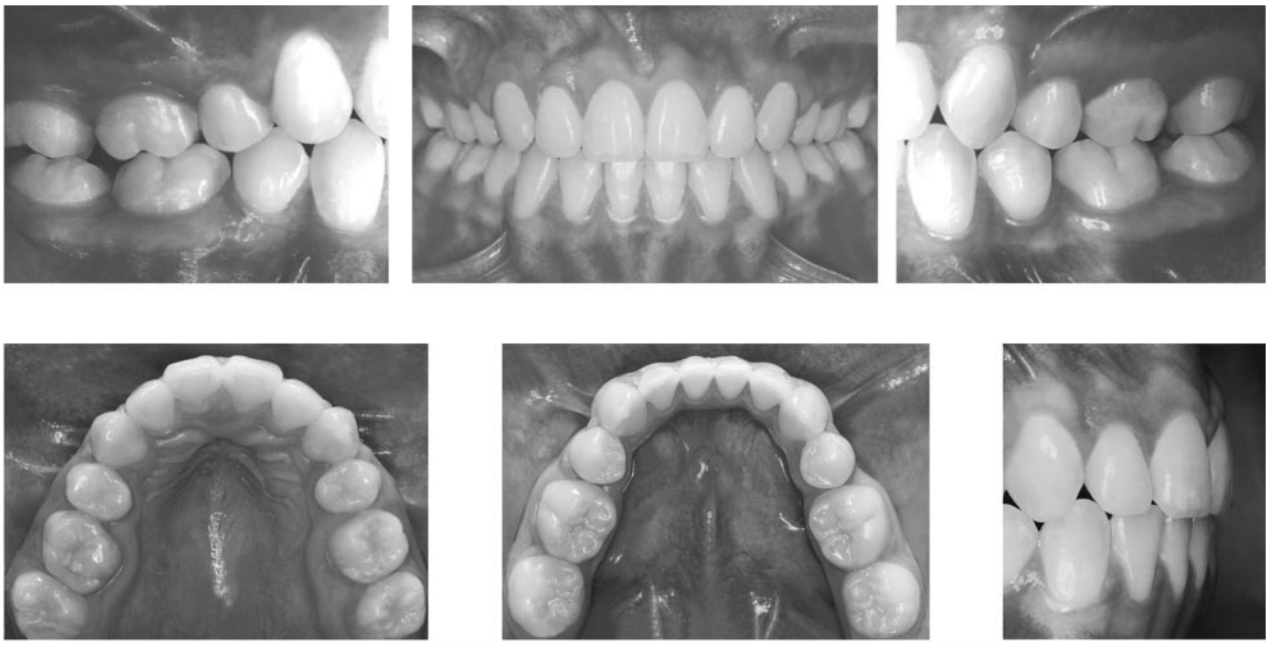

FIGURE 10. Posttreatment intraoral photographs.

iii) one might not have enough space to get the occlusion to a solid Class I.

4. Extract maxillary and mandibular first molars.
   - Advantage: The bad teeth are eliminated.
   - Disadvantage: The space created by molar extraction is in the mouth. The premolars have to be distalized with no anchorage loss.
5. Extract the maxillary first premolars, mandibular second premolars, and the maxillary and mandibular first molars.
   - Advantage: (1) Enough space is created and (2) poor teeth are eliminated.
   - Disadvantage: (1) A lot of space must be closed and (2) third molars have to erupt and be functional.

Treatment plan

The treatment was done in two phases:

- Phase 1: Extract the maxillary first and mandibular

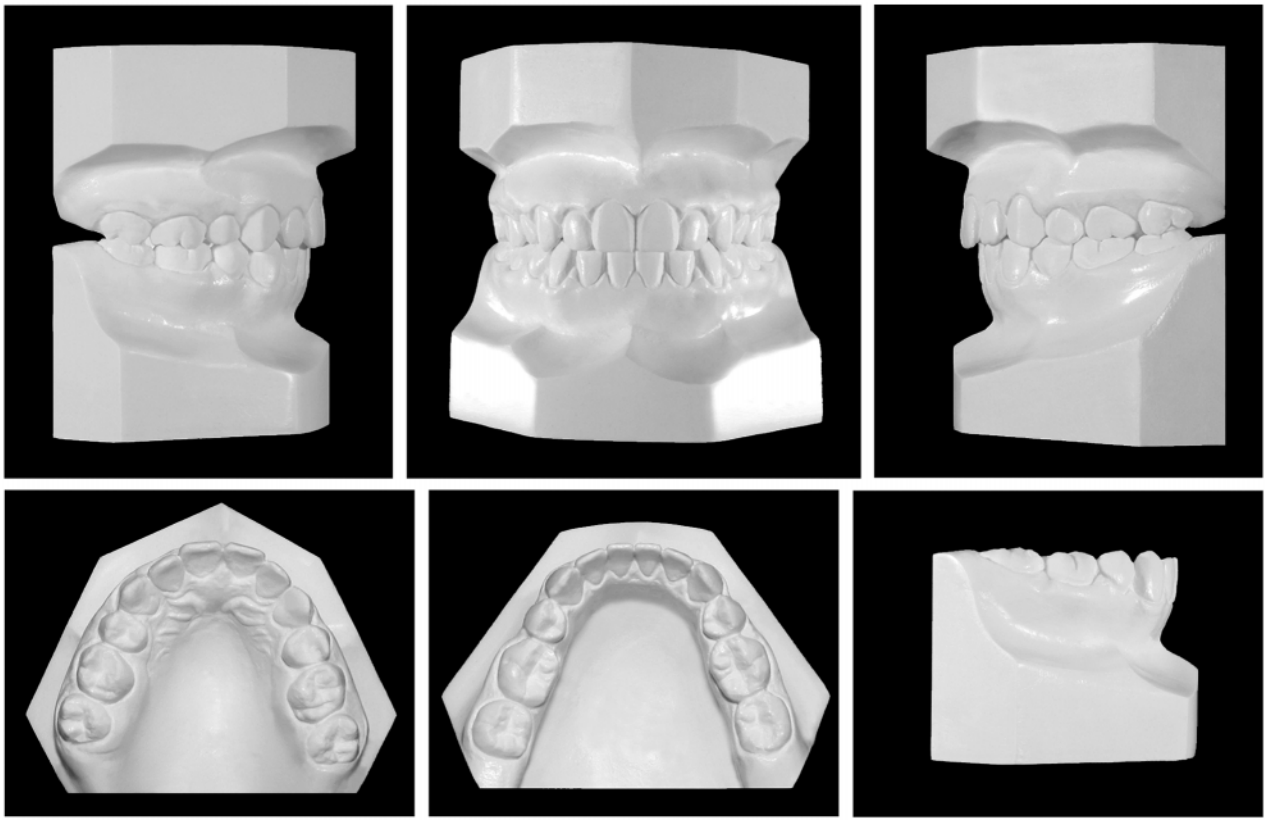

FIGURE 11. Posttreatment dental casts.

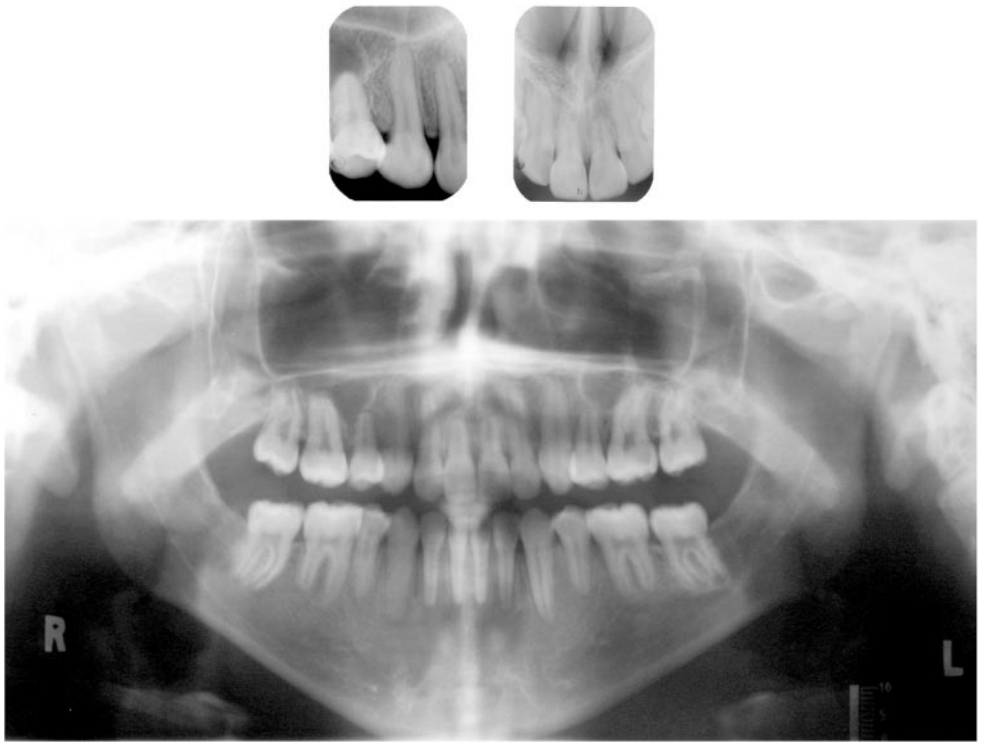

FIGURE 12. Posttreatment panoramic and periapical radiographs.

FIGURE 13. Posttreatment cephalometric radiograph and tracing.

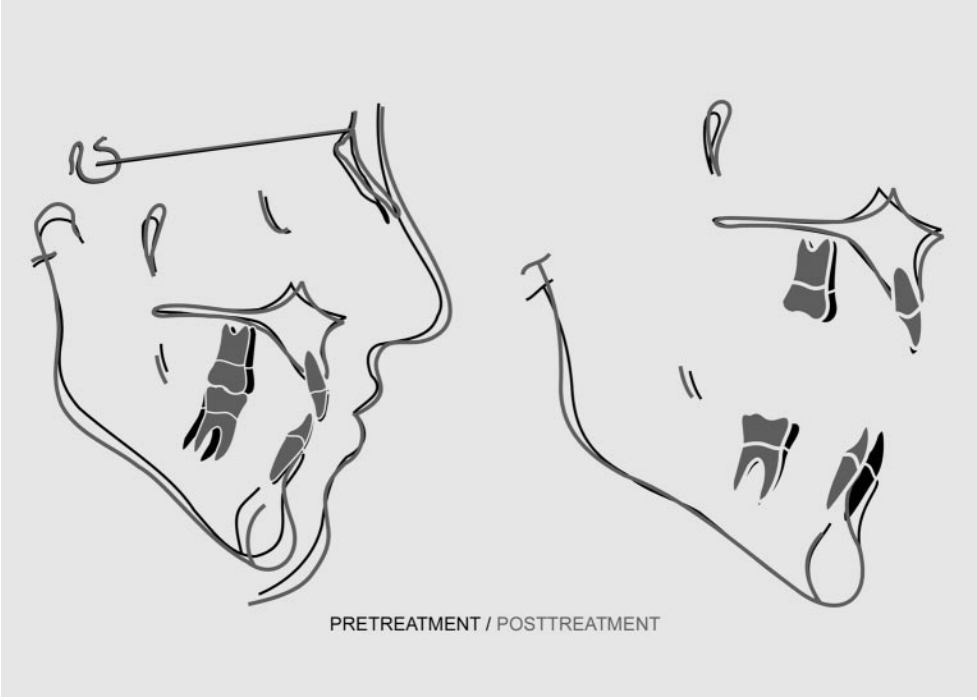

FIGURE 14. Composite cephalometric tracings.

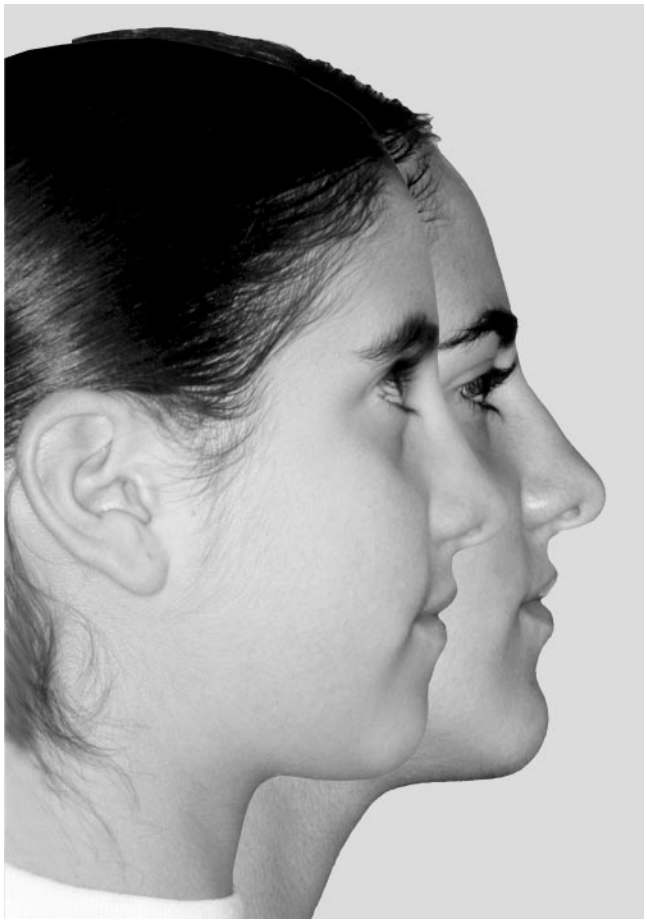

FIGURE 15. Facial change, pretreatment, and posttreatment composite.

second premolars to gain room for the maxillary canines. Bite closure and general crowding correction.
- Phase 2: Extract the hypoplastic maxillary and mandibular first molars, use directional forces to help improve the abnormal skeletal pattern, and complete the closure of the open bite. Gain room for optimal tooth positioning and expose and ligate the maxillary right canine.

Treatment progress

Treatment was accomplished with the Tweed-Merrifield Directional Force System[3,4] (a 0.21- × 0.28-inch nontipped, nontorqued edgewise appliance), which uses directionally controlled precision archwire manipulation and an extraoral J-hook headgear. Teeth were sequentially banded and bonded after maxillary and mandibular premolar extractions. Maxillary and mandibular 0.016- × 0.022-inch titanium archwires were used for leveling for only two months. This leveling phase was completed with a maxillary 0.017- × 0.022-inch and a mandibular 0.018- × 0.025-inch resilient stainless steel archwire for space management, correction of minimal rotations, and axial inclinations. A high-pull J-hook headgear was attached to spurs soldered between the mandibular central and lateral incisors. The headgear was worn 14 hours per day to control the anterior vertical dimension (Figure 6).

While space was closing, the bilateral open bite was also closing. Maxillary and mandibular first molar extractions were done to facilitate control of the horizontal planes and gain more space. After the maxillary second molars were moved forward, the maxillary third molars were allowed to erupt into function. This tooth movement was accomplished without Class II elastics. During this phase, maxillary and mandibular 0.019- × 0.025-inch resilient stainless steel archwires were used for better control. Elastic chains were used for space closure.

In the maxillary right canine area a titanium coil spring was used to make room for this tooth and to center the maxillary midline. After five months, the canine was simply not erupting. To expedite the treatment progress, the patient was evaluated for surgical exposure of the canine (Figure 7). This procedure included canine exposure, cyst removal, and ligation of the canine. The surgeon added demineralized and sterile skeletal bovine bone that was processed in a lab; its physical and chemical characteristics are comparable with human bone mineral matrix. This bone was used to fill the bone loss caused by the follicular cyst and to promote guided bone regeneration. The surgeon also inserted a piece of cortical bone laminae to provide bone regeneration and to attempt to avoid gingival recession. Finally, a resorbable collagen membrane was used to maintain the skeletal bone in place to enhance preservation of the formed alveolar ridge (Figure 8).

Orthodontic traction to the canine started two months later with about 100 g, a minimal amount of force. At this time, it was necessary to give special attention to bone integration and periodontal health.[5,6] The importance of supragingival plaque control was emphasized. A personal oral hygiene regimen was developed for this patient. She was scheduled at least twice a year for oral prophylaxis, oral examination, and radiographic control.

During maxillary incisor retraction in the final stage of treatment, maxillary and mandibular 0.020- × 0.025-inch resilient stainless steel coordinated archwires with first-, second-, and third-order bends were placed to achieve an ideal occlusion. Total treatment time was 32 months. A removable wrap around Hawley was placed on the maxillary teeth, and a Donher retainer from second molar through second molar was placed on the mandibular teeth. The retention

plan was for retainers to be worn full time for a year, then night time for another eight months, followed by an as needed basis.

Treatment results

Patient cooperation was excellent. Photographs show a symmetric, harmonious relationship of the facial soft tissue and a pleasant profile[7,8] (Figures 9 through 15). A Class I occlusion with normal anterior relationships was obtained (Figures 10 and 11). The maxillary arch length deficiency was corrected by proper positioning of the canines; in the mandibular dentition, normal alignment was achieved without altering the arch form and intercanine width (see table in Figure 13).

The panoramic radiograph revealed good root parallelism and bone integration in the maxillary right canine area, as well as root length control in the maxillary right incisors (Figure 12).

The facial, skeletal, and dental changes are detailed in Figures 13 and 14. Merrifield's Z angle, the FMA, the occlusal plane, and the anterior facial height–posterior facial height ratio are the most significant values that describe the patient's facial, skeletal, and dental balance. The superimposition (Figure 14) illustrates favorable mandibular spatial change in a downward and forward direction and proper control of the vertical dimension.

DISCUSSION

From a clinical standpoint, the treatment of patients who have long lower anterior facial height and a high mandibular plane angle is difficult. It is even more difficult if the patient has bilateral open bites, impacted canines, and short root length of the maxillary central incisors. Because of the popularity of orthognathic surgery, the typical patient who has excessive vertical facial dimension has been often treated with orthognathic surgery. However, if the patient has enough growth potential, the severe malocclusion can be corrected without surgery. This change depends on a careful clinical evaluation and a valid differential diagnosis followed by proper treatment planning that must include a directionally controlled force system.

During differential diagnosis, the orthodontist must consider where the teeth should be positioned. For a patient with excessive anterior vertical dimension who does not desire a surgical correction, the mandibular incisors must be positioned over basal bone to help resolve lip procumbency for optimal facial and dental balance.[9] In this growing patient, it was absolutely necessary to extract teeth because of the lack of space in some areas of the dentition and to facilitate the directional force mechanotherapy that controlled the vertical dimension during the active phase of orthodontic treatment.

During the treatment of a patient with a ''high angle'' Class II malocclusion, it is very important to avoid the extrusion of maxillary and mandibular posterior teeth with Class II forces. Equally important, the maxillary anterior teeth should be intruded as they are retracted. Without intrusion and control of the axial inclination of the maxillary anterior teeth, the patient is likely to have a longer face and more gingival display. For this patient, it was appropriate to extract the premolars to eliminate the anterior crowding and to provide space for the impacted maxillary canines. First molar extractions were done to eliminate bad teeth and to allow for mandibular autorotation. The exposure, ligation, etc of the maxillary right canine was done only after it did not erupt on its own. To not prolong treatment, the canine was surgically exposed. The premolar extraction option followed by maxillary and mandibular first molar extraction offered this patient a treatment plan that addressed her three problems of crowding, vertical excess, and poorly formed enamel on the first molars.

CONCLUSIONS

The successful correction of this difficult malocclusion depended on vertical dimension control. The diagnostic decisions and proper treatment planning were accomplished to enhance a favorable mandibular response so that the optimum improvement of facial balance and harmony could be achieved. To enhance the response of the mandible to treatment, the orthodontist must use a directionally oriented force system to control the three horizontal planes, ie, the palatal, occlusal, and mandibular planes.[10]

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