

Early Correction of a Developing Skeletal Class III Malocclusion

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ABSTRACT

This case report describes the treatment of a Japanese girl aged 11 years 10 months who had a severe Class III malocclusion with a concave facial profile. She presented hypodivergent skeletal pattern with a -4.0-mm anterior crossbite and a deep overbite. She also had facial asymmetry attributed partly to the lateral mandibular shift to avoid incisal interferences. The treatment plan included a monoblock appliance, rapid palatal expansion, and fixed edgewise appliances at the final stage. The monoblock appliance was used to redirect the growth of the mandible to a clockwise direction and simultaneously correct the incisal relationships along with fixed edgewise appliances. Good incisal relationships were achieved, and facial esthetics was greatly improved after 28 months of treatment. Stability of the treatment result was excellent in the 3-year 9-month follow-up at the age of 18.

KEY WORDS: Developing Class III malocclusion; Hypodivergent growth pattern; Monoblock appliance

INTRODUCTION

Timing of orthodontic treatment, especially for children with developing Class III malocclusions, has always been somewhat controversial, and definitive treatment tends to be delayed for severe Class III cases. Although the interaction between environmental and innate factors in the development of a Class III malocclusion is not completely understood,¹⁻³ young Class III patients with moderate to severe anterior crossbite and deep bite need early intervention in some selected cases. It is known that both anteroposterior and vertical maxillary deficiency can contribute to Class III malocclusion.⁴⁻⁶

If the maxilla does not grow vertically, the mandible rotates upward and forward, producing an appearance

of mandibular prognathism that may be attributed to both the position and the size of the mandible. In these cases, the mechanical interference by the overclosure of the mandible may influence the growth of maxilla and the alignment of the maxillary dentition. Also, many young children can benefit from treatment because it reduces the psychological burden of facial and dental disfigurements during some of their most formative years.⁷

In a patient with hypodivergent skeletal pattern, an increase in facial height with the decrease in the prominence of the chin helps in correcting the Class III facial profile.⁸ Monoblock appliances have been used in adult Class III patients⁹ with deep bites caused by overclosure of the mandible. In this case report, as one of the effective approaches for treating growing Class III patients, a monoblock appliance was used in the late mixed dentition to induce downward and backward rotation of the mandible. This approach is designed to increase the facial height and help establish a favorable environment for the growth of the maxilla at the same time. This can be quite effective within limits.

HISTORY AND DIAGNOSIS

The patient was a Japanese girl who was 11 years 10 months old at the time of initial records. Her parents worried about her prominent lower teeth and facial appearance. Her profile was concave, and the frontal view showed facial asymmetry (Figures 1 and 2). Her

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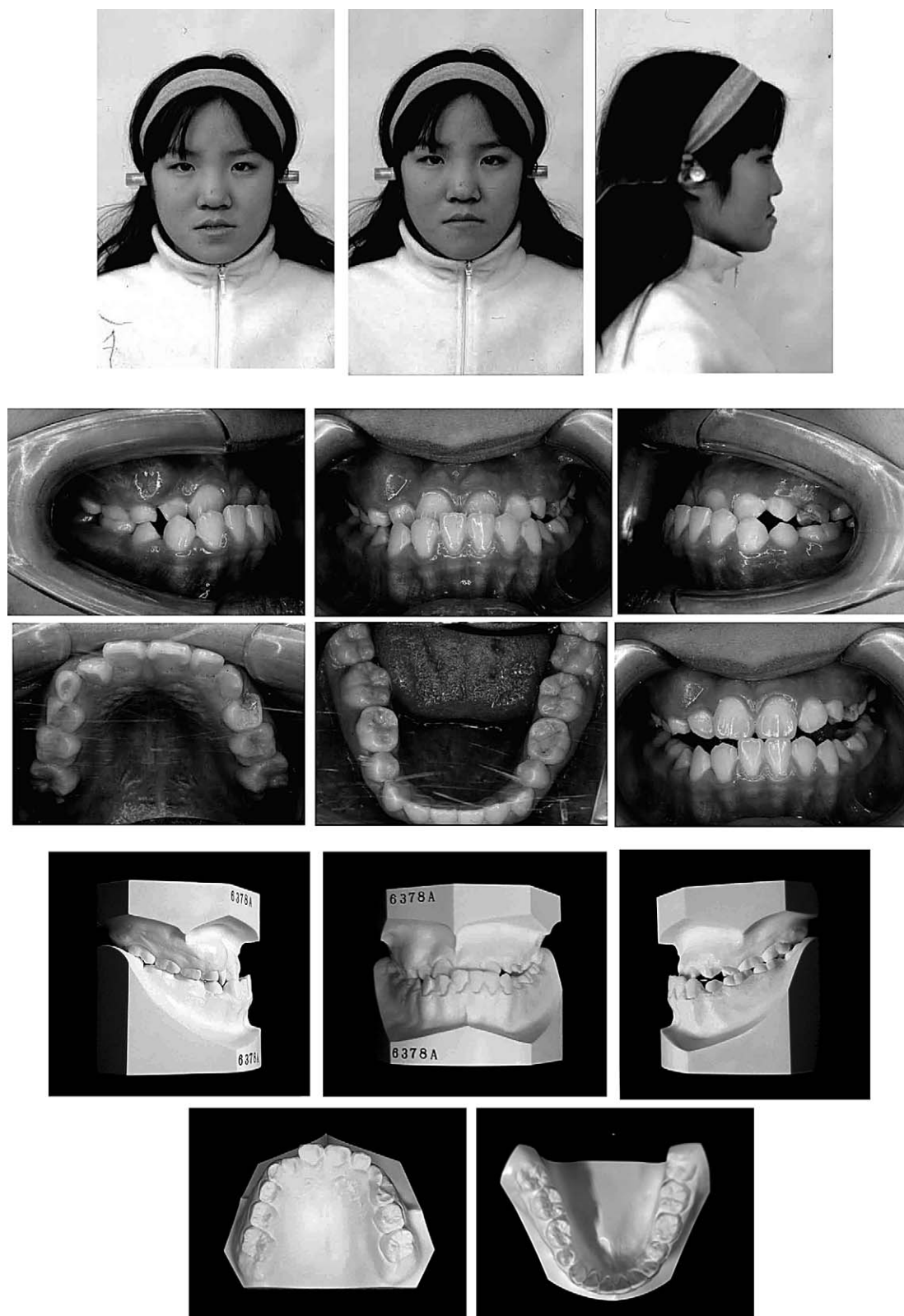


Figure 1. Pretreatment photographs and models of a patient aged 11 years 10 months.



Figure 2. Pretreatment lateral and PA (postero-anterior) cephalometric radiographs.

occlusion showed Class III molar and canine relationships in her mixed dentition (Figure 3). She presented with an anterior crossbite (overjet -4.0 mm), deep bite (overbite $+4.5$ mm), and lower midline deviation to the left side (3.0 mm). The mandibular incisors contacted prematurely in an end-to-end relationship, and the mandible slid anteriorly and laterally to complete the occlusal relationship (Figure 1). Oral hygiene and gingival conditions were normal. The hand-wrist radiographs (not shown) showed that epiphyseal closure

had not taken place and the sesamoid bone had started to calcify, indicating the patient was approaching the peak of the growth spurt (S stage). Her distant relatives had mild Class III malocclusions.

The cephalometric analysis showed a skeletal Class III jaw relation (Figure 2; Table 1). The patient had a combination of prognathic mandible and retrognathic maxilla (SNA 76.0° , mean 80.5° ; SNB 81.0° , mean 76.2° ; ANB -5.0°). Vertically, she presented a short



Figure 3. Pretreatment panoramic radiographs.

Table 1. Cephalometric comparison

Measurements	Pre-treatment (11 y 10 mo)	Post-treatment (14 y 3 mo)	Retention at 3 y 9 mo (18 y 0 mo)
SNA, $^{\circ}$	76.0	77.5	77.5
SNB, $^{\circ}$	81.0	80.0	80.5
ANB, $^{\circ}$	-5.0	-2.5	-3.0
FMA, $^{\circ}$	23.0	26.5	28.5
SN-GoGN, $^{\circ}$	34.0	38.0	38.0
U1 to FH plane, $^{\circ}$	116.0	121.5	117.0
IMPA, $^{\circ}$	81.0	72.0	71.0
Interincisal angle, $^{\circ}$	166.0	148.5	146.0
Upper lip to E-line, mm	-3.0	-3.5	-4.5
Lower lip to E-line, mm	$+2.5$	-1.5	-2.0

face, that is, a hypodivergent skeletal pattern (FMA 23°, SN-GoGN 34°). The diagnosis was skeletal Class III malocclusion with facial asymmetry.

TREATMENT OBJECTIVES

Because of the patient's skeletal disharmony, we explained to her parents that surgical-orthodontic treatment might be necessary if any significant mandibular growth were to take place in the future. However, we also informed them of the possibility of a non-surgical approach. Considering that the overclosed mandible may influence the potential growth of the maxilla, and because the patient was in her mixed dentition period, we decided to start the treatment, tentatively, and reassess the treatment response. In addition, her parents strongly preferred a nonsurgical treatment.

Our treatment objectives were (1) to improve the facial profile, (2) to improve the skeletal jaw relationship as much as possible by redirecting the growth of the mandible toward a downward and backward direction, (3) to accomplish desirable anterior occlusion for establishing functional occlusion, (4) to correct midline deviation, and (5) to follow up the remaining growth to assess the need for further treatment.

TREATMENT PROGRESS

Treatment was started with a monoblock appliance constructed at the edge-to-edge bite because the patient had a functional shift in the mandible, meaning she could move her mandible back to edge-to-edge incisor relationship. A spring was placed on the lingual side of the maxillary anterior teeth to induce labial movement of the anterior teeth. The posterior part of the monoblock was trimmed to enhance extrusion and uprighting of the posterior teeth. Shortly after the lower second premolars were fully erupted, intermaxillary elastics were used to facilitate raising the bite. The elastics ran from the sectional archwire of 0.016- × 0.22-inch L & H® Titan Wire (Tomy International Inc, Tokyo, Japan) on the mandibular posterior teeth to the buttons on the upper first premolars (Figure 4).

After 1 year of treatment, the treatment response was favorable and we proceeded to the next phase of treatment. Expansion of the maxilla was started with a banded-type rapid maxillary expander for 3 weeks. Upon completion, the appliance was stabilized and left in place for 2 months. Thereafter, a fixed edgewise appliance was bonded to all the permanent teeth, and Class III elastics were used. After 11 months of edgewise appliance treatment, a Hawley retainer was placed in the maxilla and a lingual fixed-type retainer was bonded between the canines of the mandible. Pa-

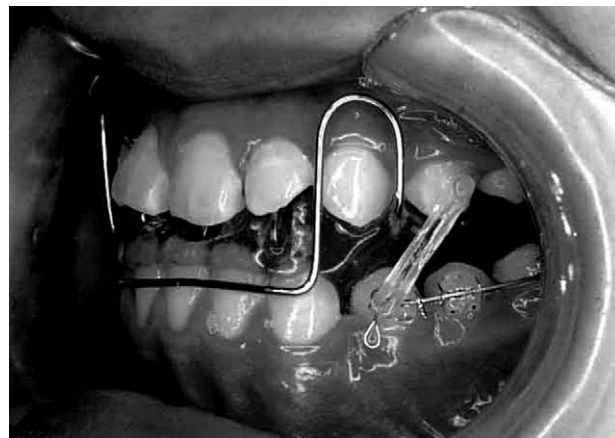


Figure 4. Simultaneous use of the monoblock and intermaxillary elastics.

tient compliance was excellent throughout the treatment.

TREATMENT RESULTS

After 28 months of active treatment, including 11 months of full-bonded treatment, the anterior crossbite and deep overbite were corrected and normal functional occlusion was established (Figure 5). The patient profile was greatly improved and the mandibular deviation was corrected.

The cephalometric superimposition (Figures 6 and 7; Table 1) shows that the anteroposterior relationship was improved (ANB $-5.0^\circ \rightarrow -2.5^\circ$). The maxilla grew anteriorly, and the mandibular growth was camouflaged by downward and backward rotation of the mandible (FMA $23.0^\circ \rightarrow 26.5^\circ$).

In the panoramic view, root parallelism was good (Figure 8). Lower third molars were removed 6 months after debonding. A long-term follow-up at age 18 years showed that the patient maintained a balanced and esthetic profile and occlusion, and she was pleased with the result (Figure 9).

Comparison of the posttreatment and 3-year 9-month retention cephalograms (Figure 10; Table 1) illustrated a small amount of vertical mandibular growth. Given that the minimal mandibular growth has occurred after the patient turned 17 years old (cephalometric superimposition not shown) and that the cessation of growth is known to be earlier in girls than in boys,^{10,11} no significant further growth was expected.

DISCUSSION

The success of orthodontic treatment in a growing patient with a severe Class III malocclusion depends on his or her individual growth and the adequate timing of the treatment. In moderate to severe skeletal Class III patients, the decision whether to treat early or to

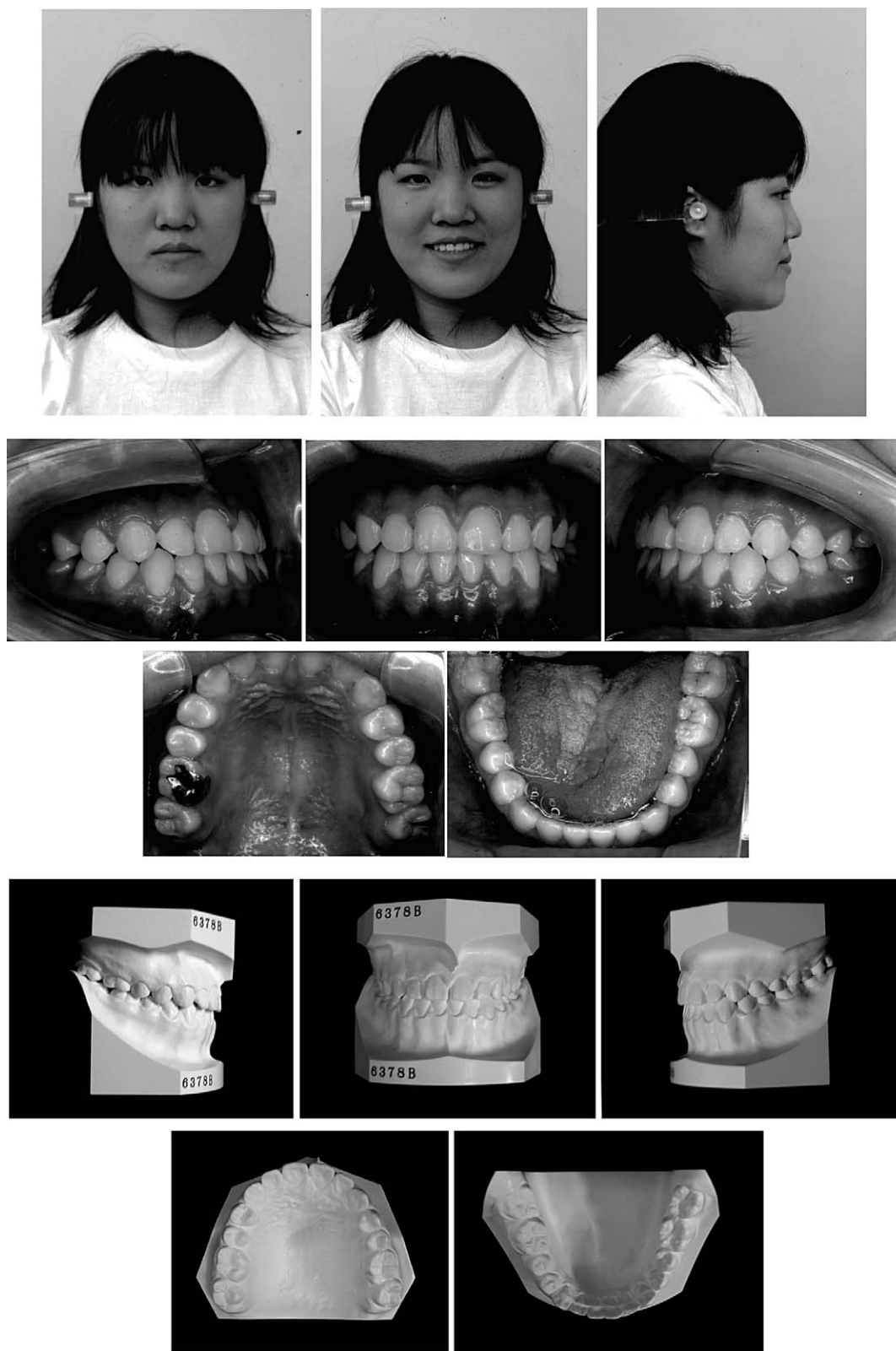


Figure 5. Posttreatment photographs and models (14 years 3 months old).

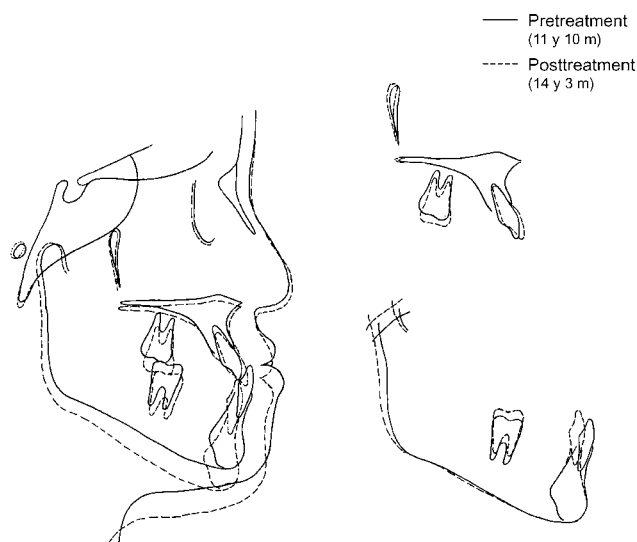


Figure 6. Posttreatment lateral and PA (posterior-anterior) cephalometric radiographs.

wait until the end of growth is difficult. Moreover, to what extent the growth modification can be successful is a challenging question for many clinicians. Therefore, it is important to diagnose the degree of skeletal discrepancy in order to develop a proper treatment plan. Here we treated this patient by a growth modification treatment with a monoblock appliance.

The monoblock appliance is used as an alternative to correct an anterior crossbite in the first phase of treatment for hypodivergent Class III patients who are still growing. The roles of the monoblock appliance⁹ were (1) to raise the bite by promoting the extrusion and uprighting of the mandibular posterior teeth, (2) to stabilize the mandibular position and remove a lateral

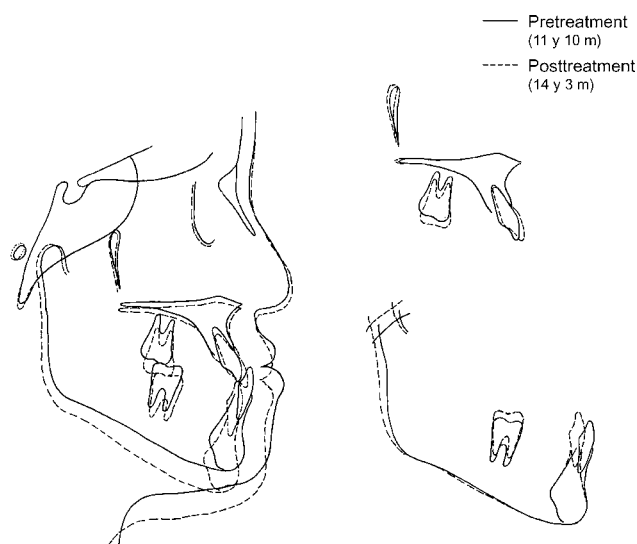


Figure 7. Superimposition of cephalometric tracings before (solid line) and after (dotted line) treatment.



Figure 8. Posttreatment panoramic radiograph.

slide caused by an occlusal interference, (3) to therefore reconstruct the occlusal plane and control the growth of the overclosed mandible to the downward and backward direction, and (4) to let the young patient adapt to the first stage of orthodontic treatment. Class III or vertical intermaxillary elastics can be used simultaneously to aid in modifying the direction of the maxillofacial growth.

A combination of maxillary protraction and rapid maxillary expansion is one of the most popular orthopedic approaches to early treatment of skeletal Class III patients.¹²⁻¹⁷ Despite the merits of anterior displacement of the maxilla with minimal posterior displacement of the mandible, this often results in a profile with bimaxillary protrusion in some borderline skeletal Class III children who have a combination of maxillary retrusion and mandibular protrusion. In addition, the effect of the maxillary protraction by a face mask is usually a combination of skeletal and dental movements.^{12,16-18} In the patient in our case report, we achieved a favorable treatment result by reestablishing the occlusal environment through orthodontic treatment with the monoblock appliance. This growth included clockwise rotation of the mandible and labial movement of the maxillary anterior teeth (Figure 7; Table 1). Additionally, the release of the anterior crossbite may have benefited the maxillary growth.

We planned that the treatment should be completed effectively in a short time because the possibility of orthognathic surgery at the end of the growth was not completely ruled out. Starting fixed edgewise treatment after the permanent second molars had erupted allowed this, and the treatment time for the definitive second phase treatment was only 11 months. To maximize the growth potential and patient compliance, skeletal problems were addressed in the late mixed dentition, whereas definitive treatment was addressed in the permanent dentition.

Although camouflage treatment of skeletal Class III malocclusion is successful in some patients, careful

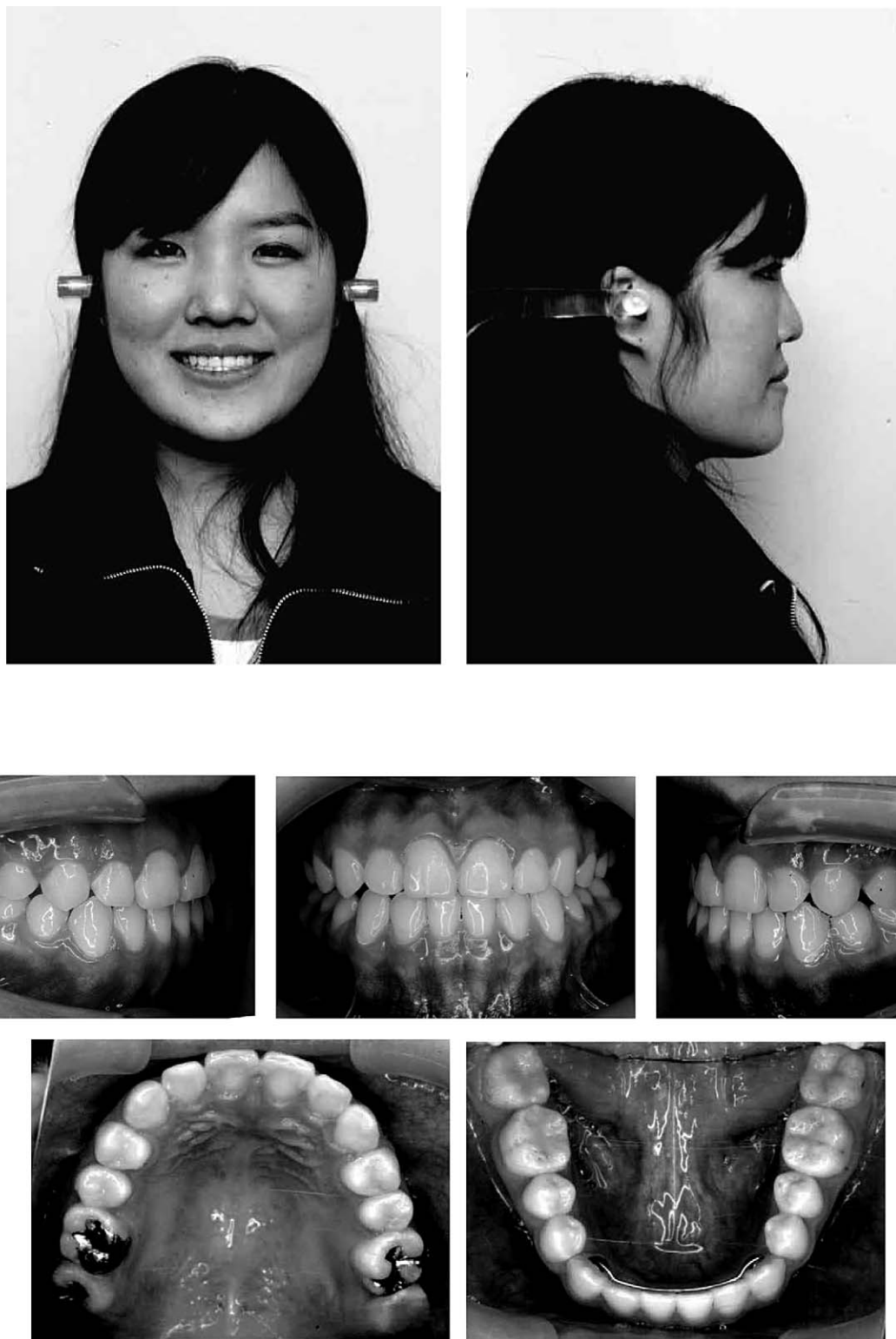


Figure 9. Posttreatment photographs at 3-years 9-months follow-up (18 years old).

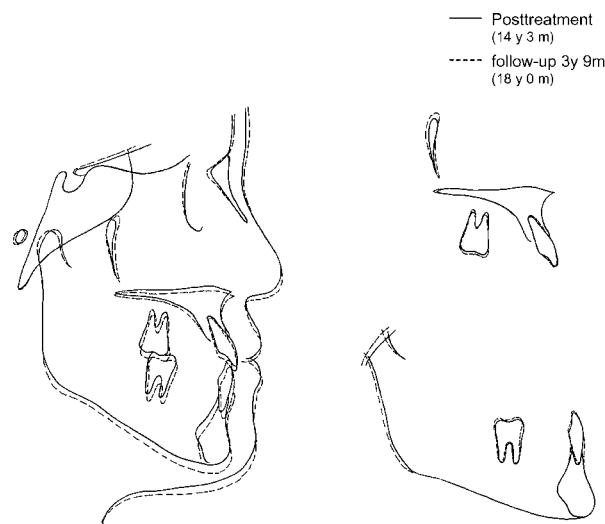


Figure 10. Superimposition of immediate posttreatment and follow-up cephalometric tracings.

attention should be paid until the end of growth. Moreover, the important benefits of early treatment should not be denied because of concerns that a few patients may still require further treatment.

CONCLUSIONS

- In properly selected cases, dentoalveolar camouflage for Class III malocclusion by growth modification with the monoblock appliance can be a useful modality of treatment.
- This case demonstrates significant improvement in esthetics and occlusion with long-term stability.

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