

Non-extraction Camouflage Treatment of Skeletal Class III Malocclusion

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ABSTRACT

Class III malocclusion can be defined as a skeletal facial deformity that is characterized by a forward mandibular position with respect to the cranial base and or the maxilla. We present a case of a 15-year-old man with skeletal Class III malocclusion who was treated with non-extraction orthodontic camouflage treatment using an orthodontic conventional technique. A fixed appliance, straight wire appliance (SWA) technique was used with a non-extraction treatment plan. Treatment was accompanied by intermaxillary Class III elastics. The total duration of active treatment was 23 months. There was a significant improvement in his occlusion, smile esthetics, and soft tissue profile pattern. Orthodontic camouflage can be considered an effective therapy for correcting milder cases of skeletal Class III malocclusion.

Keywords: non-extraction, orthodontic camouflage, skeletal Class III malocclusion, SWA technique

INTRODUCTION

The classification of malocclusion according to Angle is based on the relationship of the maxillary and mandibular first molar teeth. Angle's Class III malocclusion is when the first molar in the upper jaw is located more distally than the buccal groove of the lower jaw.¹ Other characteristics of Class III malocclusion are related to the edge-to-edge or crossbites of one or more of the incisors.^{2,3} Angle's Class III malocclusion can be divided into two types; pseudo and true malocclusion. Pseudo Class III malocclusion is a malocclusion with a Class III dental relationship but has a Class I skeletal malocclusion. On the other hand, true Class III malocclusion is a malocclusion with both a Class III dental and skeletal relationship.⁴

The treatment options for skeletal Class III malocclusion include: (1) growth modification using differential growth of the maxilla relative to the mandible; (2) camouflage of the skeletal discrepancy through tooth movements to correct the dental occlusion while maintaining the skeletal discrepancy; or (3) orthognathic surgical correction.⁵ Orthodontic camouflage treatment is a treatment process that includes extraction or non-extraction as a dentoalveolar compensation to disguise skeletal discrepancies even though they are not showing ideal skeletal changes.^{3,6} The indications for Class III camouflage treatment are: (1) too old for successful growth modification; (2) mild to moderate skeletal Class III; (3) reasonably good alignment of teeth; and (4) good vertical facial proportions, neither extreme short face nor long face. The contraindications for Class III camouflage treatment are (1) moderate or severe Class III and vertical skeletal discrepancies; (2) patients with severe



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crowding or protrusion of incisors; and (3) adolescents with good growth potential.⁷

Class III camouflage is more difficult than its Class II counterpart not because the tooth movement is more difficult, but because it is more difficult to obtain acceptable esthetics. Typically, the upper incisors are proclined and protrusive relative to the maxilla, whereas the lower incisors are upright and retrusive relative to the chin. Class III camouflage logically would be the reverse of Class II camouflage, based on retracting the lower incisors, advancing the upper incisors, and surgically reducing the prominence of the chin, in addition, rotating the mandible downward and backward, when the chin is prominent, can be considered a form of camouflage.⁴

Skeletal Class III malocclusions are some of the most complex cases to correct.⁸ Currently, orthognathic surgery and orthodontic camouflage are common options to manage this condition in fully grown patients. Although the surgical approach aims to improve their facial esthetics and correct their skeletal and dental discrepancies, the result of surgical correction might not produce enough change in the facial profile of borderline patients.⁹ Camouflage treatment may also not give the desired outcome. Orthodontic camouflage treatment can give good results if the ANB angle is in the range of -30 to 00 . Recent studies showed that patients who have less than normal overjet and overbite can achieve good outcomes with camouflage treatment.¹⁰

Orthodontic camouflage accompanied by Class III elastics can be used to treat milder cases of skeletal Class III, but it is limited to patients with a low mandibular plane angle. This method is, therefore, unacceptable for most Class III patients who have high mandibular plane angles and increased lower anterior face heights. Class III elastics extrude the maxillary molars and cause clockwise mandibular rotation that results in increased lower anterior face height.¹¹ Furthermore, using Class III elastics could exacerbate

proclined maxillary anterior teeth and compromise both esthetics and the overall stability of treatment.¹² Even so, when a patient declines orthognathic surgery or temporary skeletal anchorage devices for preventing extrusion of the maxillary molars and proclination of the maxillary dentition, camouflage treatment with Class III elastics can be a valid option.¹³

This case report presents the use of camouflage treatment accompanied by Class III elastics to correct a skeletal Class III malocclusion with anterior crossbite and mild crowding. It also describes the treatment in detailed steps which can be chosen to treat skeletal Class III malocclusion using a conventional orthodontic technique with a non-extraction treatment plan. The treatment aims to achieve an acceptable dental profile, clinically and esthetically, in Class III malocclusion without extraction.

CASE REPORT

Introduction

A 15-year-old man consulted at the Faculty of Dental Medicine Airlangga University's Rumah Sakit Gigi dan Mulut for orthodontic treatment. His chief complaints were anterior crossbite and crowding. Extraoral examination showed that he had a mesofacial and concave profile and a prominent chin (Figure 1). There were no temporomandibular joint abnormalities. There was no prior orthodontic intervention.

Case Summary

Intraoral examination showed an anterior crossbite on the right side between #12 and #42 - #43, and edge-to-edge on the left side between #22 and #32 - #33. There was an overjet of 1 mm (region 12: -1 mm; region 21: 0 mm) and a 1-mm overbite of maxillary central incisors which are less than normal respectively. Class III molar relations on both

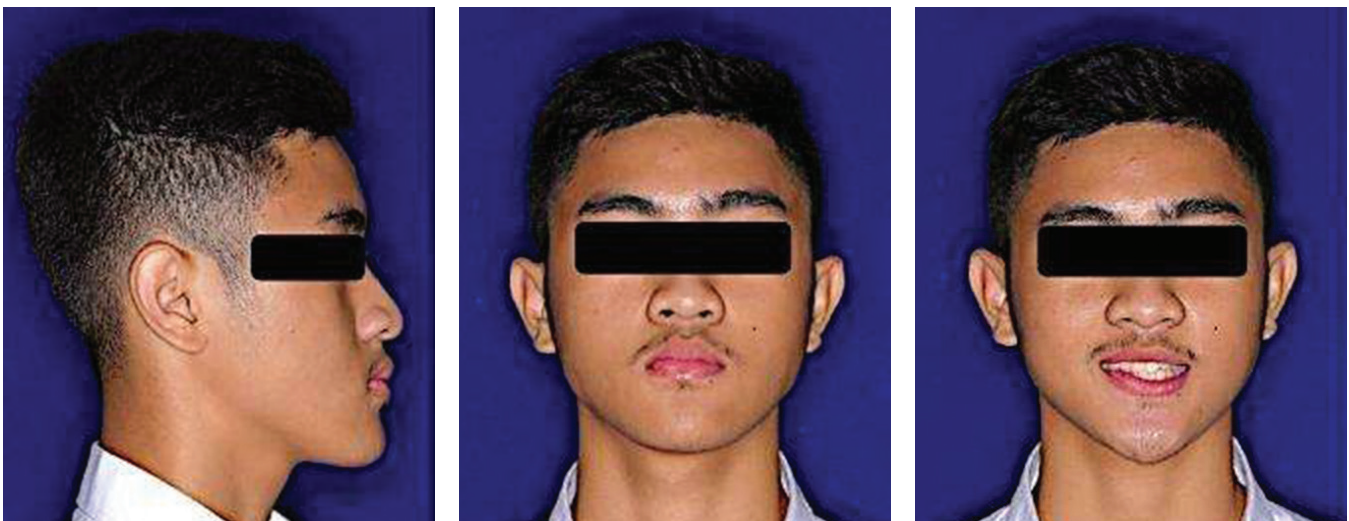


Figure 1. Pre-treatment facial photographs.

sides were shown (Figures 2 and 3). The upper and low jaw represented anterior mild crowding, with a flat curve of Spee. The mandibular dental midline was not coincident with the facial midline and was shifted to the left by about 1.5 mm

(Figure 2). A dental study model measurement showed the mesiodistal width to be within the normal range (Figure 3). A panoramic radiograph showed all the impacted third molars in four regions (Figure 4).



Figure 2. Pre-treatment intraoral photographs.

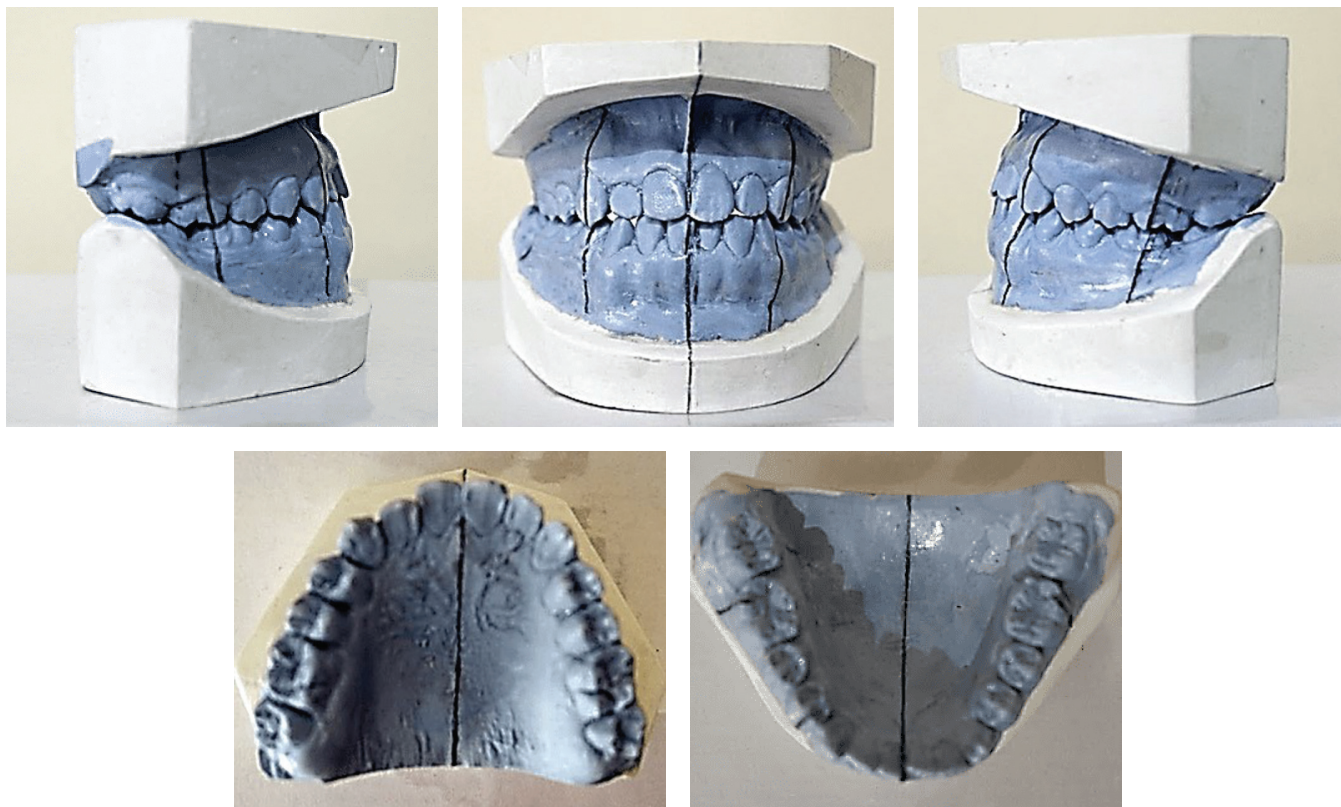


Figure 3. Pre-treatment dental casts.

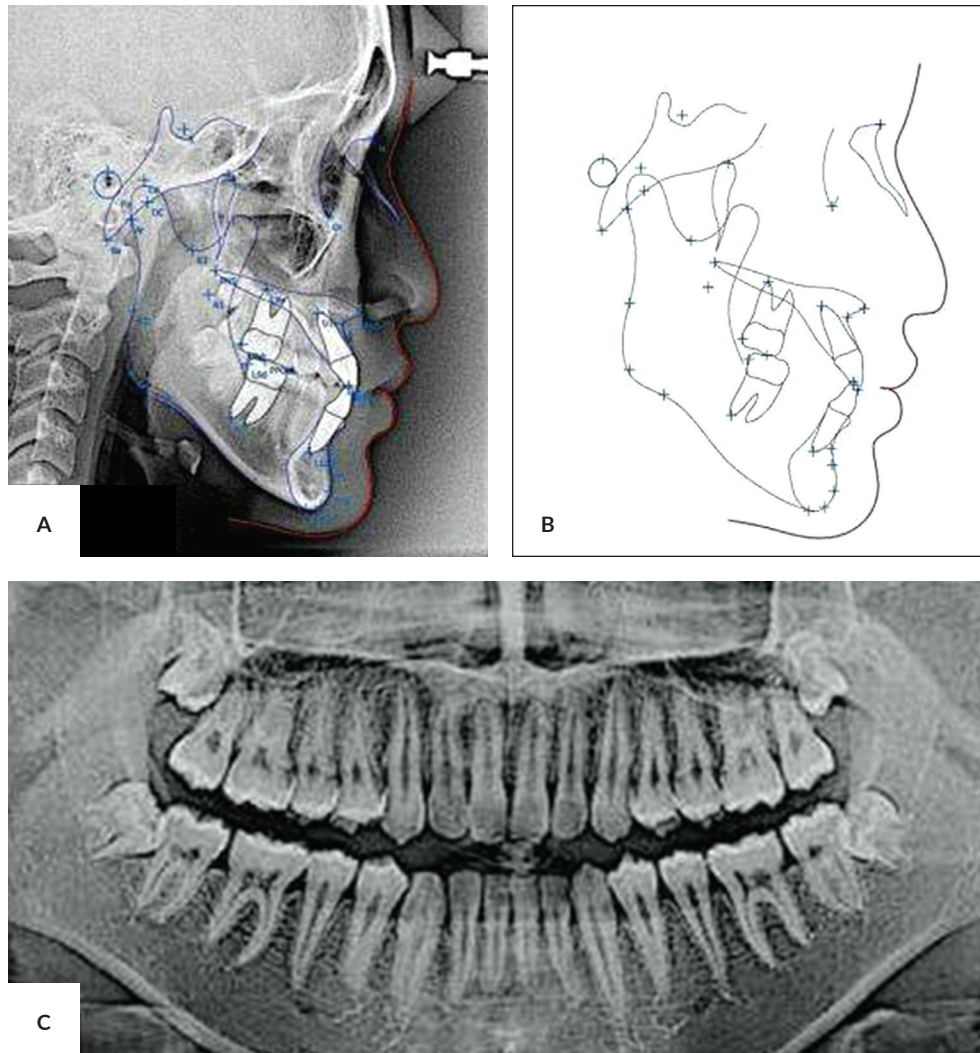


Figure 4. Pre-treatment radiographs: (A) Lateral cephalogram, (B) cephalometric tracing, (C) panoramic radiograph.

The diagnosis of Angle's Class III malocclusion with skeletal Class III pattern was confirmed. The patient's biological father had a skeletal Class III pattern and the etiology of his Class III malocclusion appeared to be a combination of heredity and environmental factors.

Case Management

The following treatment objectives were established: (1) reduce facial concavity, (2) correct anterior crossbite, (3) correct the dental midline, (4) establish Class I canine and molar relation, (5) obtain normal overjet and overbite, (6) relieve crowding, (7) obtain a stable occlusal relation, and (8) improve facial and dental appearance by establishing an esthetic smile.

Orthodontic treatment could help our patient camouflage some skeletal and dental aspects of the malocclusion and improve esthetics and function. Orthodontic options included: (1) distalization of the mandibular dentition with temporary skeletal anchorage devices to establish Class I

dental relation and expansion of maxilla to slowly correct the anterior crossbite;^{14,15} (2) a protraction facemask at night to correct the anterior crossbite; (3) if necessary, mandibular incisor extraction to correct the anterior crossbite.¹⁶ Since the mandibular incisors were retroclined, extraction of two mandibular first premolars to correct the negative overjet was not advisable.

To correct the anterior crossbite, further protraction of the upper incisors and retraction of the lower incisors would be necessary. As upper incisors are tipped forward, their inclination becomes an esthetic problem, torquing the roots labially is difficult and stresses the anchorage teeth. Labial root torque of upper incisors means that more retraction of the lower incisors was needed. This added bigger problems with orthodontic camouflage; retracting the lower incisors tends to accentuate the prominence of the chin.

After discussing all considerations, the patient refused the temporary skeletal anchorage devices option and the facemask. The patient did not want extractions; therefore,

we decided to treat him with conventional orthodontic therapy accompanied by Class III elastics.

Before orthodontic treatment, the patient was referred to a general dentist to receive good oral health treatment. It was also suggested for him to undergo extraction of impacted teeth (i.e., #38 and #48).

Calculation of discrepancy and analysis of the study model showed that the space required for this treatment was 1.5 mm for the maxilla and 2 mm for the mandible. The IPR (Inter Proximal Reduction) was done on both jaws to obtain space. Minimal anchorage was applied in this case, which allowed posterior teeth to move forward.

There are three treatment stages by using the fixed conventional orthodontic technique: the first stages are leveling and unraveling, the second stage is space closing and the third step is correcting the inclination/root paralleling.

The first stage aims to adjust the position of the teeth in sagittal and vertical directions while correcting the overjet and overbite. Pre-adjusted appliances with 0.018 x 0.025-in slots were bonded on both arches for leveling and alignment. Posterior bite blocks were placed on the maxillary first molars to relieve the teeth from the traumatic occlusion. The maxillary arch was leveled with continuous archwires, starting with 0.012-in copper nickel-titanium and working up to 0.017 x 0.025-in stainless steel to control the torque. The mandibular archwire was increased to 0.016-in stainless steel. The crossbite was already corrected during the leveling stage. Class III elastics were engaged with maxillary rectangular archwires, and mandibular 0.016-in stainless steel wires were used to correct the anterior crossbite. To correct the anterior crossbite, the maxillary archwires were expanded. The Class III intermaxillary elastics used from the first stage were 5/16" 2.5 oz.

The next step was to improve dental inclination. During the finishing stage, the final detailing of the occlusion was accomplished with 0.017 x 0.025-in titanium-molybdenum

alloy archwires in conjunction with posterior vertical elastics and with Class III vectors.

The total duration of active treatment was 20 months, and passive treatment was continued for 3 months. The plan of retention at the end of the treatment was Essix removable retainers that would be given to secure the stability of both arches because the patient declined a mandibular fixed retainer.

After active orthodontic treatment for 23 months, the anterior crossbite and crowding of the teeth were corrected (Figures 5 and 6). The post-treatment records showed that the treatment objectives were achieved. The facial concavity was improved by the downward and backward rotation of the chin. The patient's smile esthetics were significantly improved, and his dental midlines were aligned with his facial midline. The patient's anterior crossbite was corrected. An acceptable overbite and overjet were achieved along with Class I canine and molar relationships. There was a change in overjet from 1 mm (region #12: -3 mm; region #21: -1 mm) to 2 mm, and in the overbite from 1 mm to 3 mm (Figures 6 and 7). The patient did not report any temporomandibular joint pain or discomfort during orthodontic treatment.

A post-treatment panoramic image showed no signs of significant root or bone resorption. Acceptable root parallelism was observed (Figure 8). The lateral cephalometric analysis showed skeletal changes with a slight forward movement of the maxillary skeletal base (SNA, 83.0°) and a backward movement of the mandible (SNB, 83.0°). Considering the age of the patient, there was little chance of growth modification and skeletal changes were impossible without surgery.

Table 1 shows the improvement in cephalometric value for the case. ANB improvement was achieved with downward and backward rotation of the mandible (SN-MP, from 31.0° to 33.0°) with the Class III elastics during the treatment. By controlling the maxillary incisor torque, the

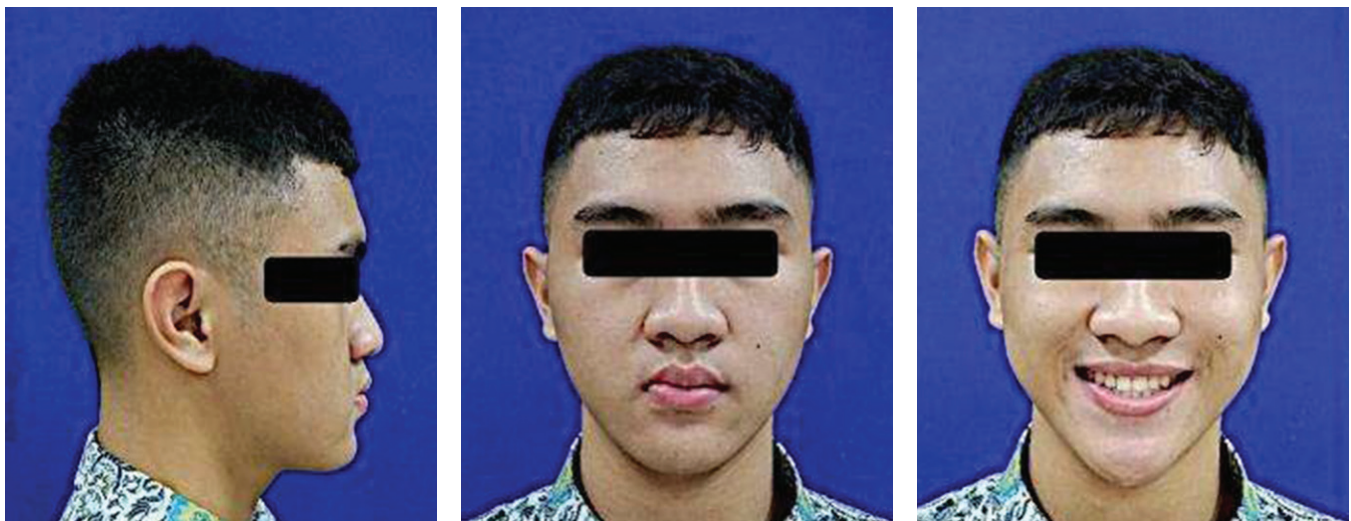


Figure 5. Post-treatment facial photographs.

posttreatment maxillary incisor inclination increased only 0.5 degrees (U1-SN, from 116.0° to 116.5°). The longer use of round wires combined with a Class III force vector caused retroclination of the mandibular incisors (IMPA, from 84.0° to 83.0°). Changes in soft tissue profile were illustrated by the positions of the upper and lower lips to the E-line. In conjunction with reduced prominence of the lower lip, the upper lip was advanced by 1 mm. It improved profile appearance by reducing the concavity of the profile (Figure 5).

DISCUSSION

Camouflage orthodontic treatment can be considered to correct mild skeletal Class III patients with decent profiles. However, when the skeletal Class III discrepancy is beyond the limit of dental compensation, orthognathic surgery may be the only option for creating a stable occlusion. Generally, orthognathic surgery is recommended for non-growing patients with larger dentoskeletal discrepancies, while

Table 1. Cephalometric measurements

Parameter	Standard	Pre-treatment	Post-treatment
Skeletal Analysis			
SNA (°)	82	82	83
SNB (°)	80	84	83
ANB (°)	2	-2	0
OP-SN (°)	14	15	13
Wits appraisal (mm)	-1	-7	-5
PP-MP (°)	21	17	20
SN-MP (°)	32	31	33
FH-MP (°)	28	29	32
LFH (ANS-Me/N-Me) (%)	55	54.7	55.7
Dental Analysis			
UI-NA (mm)	4	7	8.5
Sudut U1-NA (°)	22	33	33.5
LI-NB (mm)	4	3	4
Sudut L1-NB (°)	25	20	22
Sudut inter I-I (°)	131	130	128.5
U1-SN (°)	104	116	116.5
IMPA (°)	90	84	83
Pog ke NB (mm)	2	3	2
Soft Tissue Analysis*			
Upper lip - E Line (mm)	-2	-3	-2.5
Lower lip - E Line (mm)	-2	-0.5	-1.5

*Normal value of Indonesian (Surabaya) index



Figure 6. Post-treatment intraoral photographs.

dentoalveolar compensation or camouflage is recommended for milder discrepancies; however, the decision as to which treatment should be chosen is not always an easy task, especially in borderline cases.¹⁷

The patient's pretreatment skeletal discrepancy (ANB: -2 mm; Wits appraisal: -7 mm) originated from his prognathic mandible. Pretreatment records also showed a slight deficiency of midfacial with dental compensation. If the orthodontic camouflage treatment corrects the dental occlusion but does not camouflage the facial deformity, there is a possibility for additional surgical camouflage; reduction genioplasty.¹⁸ Stellzig-Eisenhauer et al.¹⁹ reported that the Wits appraisal is the most discriminative factor in determining whether the developing Class III malocclusion should be treated by camouflage treatment or surgery. The average Wits appraisal value for patients who were successfully treated with camouflage treatment was 4.6 ± 1.7 mm. In our study, the Wits measurement was -7 mm, significantly higher than the limit suggested by Stellzig-Eisenhauer et al. for camouflage treatment. Even though the surgical intervention was the theoretically appropriate treatment for this patient, there were several mitigating factors suggesting that camouflage treatment would be a viable option.¹⁹

Moon et al.²⁰ concluded that Class III patients with a more hypodivergent skeletal pattern generally respond better to treatment. Franchi et al.²¹ stated that a lower palatal plane to mandibular plane angle, another measurement of hyper-

divergency, is a predictive indicator of good outcomes in early Class III treatment. They demonstrated that a patient with an angle of $23.0^\circ \pm 4.1^\circ$ was treated successfully, but a patient with an angle of $29.4^\circ \pm 5.6^\circ$ had unsuccessful treatment. Although these two previous studies dealt with early treatment of Class III patients, the conclusions can be applied to adult patients such as ours: the relatively hypodivergent skeletal pattern (SN-MP, 31.0°) and low palatal plane to mandibular plane angles (PP-MP, 17.0°) indicated that our patient would be receptive to camouflage treatment.

Reyes et al.²² reported that Class III patients often have an excess in their lower anterior facial height during developmental ages. Because our patient had a relatively shorter anterior facial height to total facial height ratio (54.7%), the mild increase from Class III elastics and clockwise rotation of the mandible should be considered to secure his facial proportions.

For adult patients with Class III camouflage, most of the correction depends on the ability of the mandibular incisors to be retroclined. Wehrbein et al.²³ published a case report suggesting that patients with a narrow symphysis are susceptible to perforation of the incisor roots through the lingual plate during orthodontic treatment. Fortunately, our patient had plenty of bone surrounding his mandibular incisors, ensuring that the roots would stay behind the cortical plate. To correct a Class III malocclusion, Class III elastics are often used in orthodontic treatment, but they



Figure 7. Passive treatment dental casts.

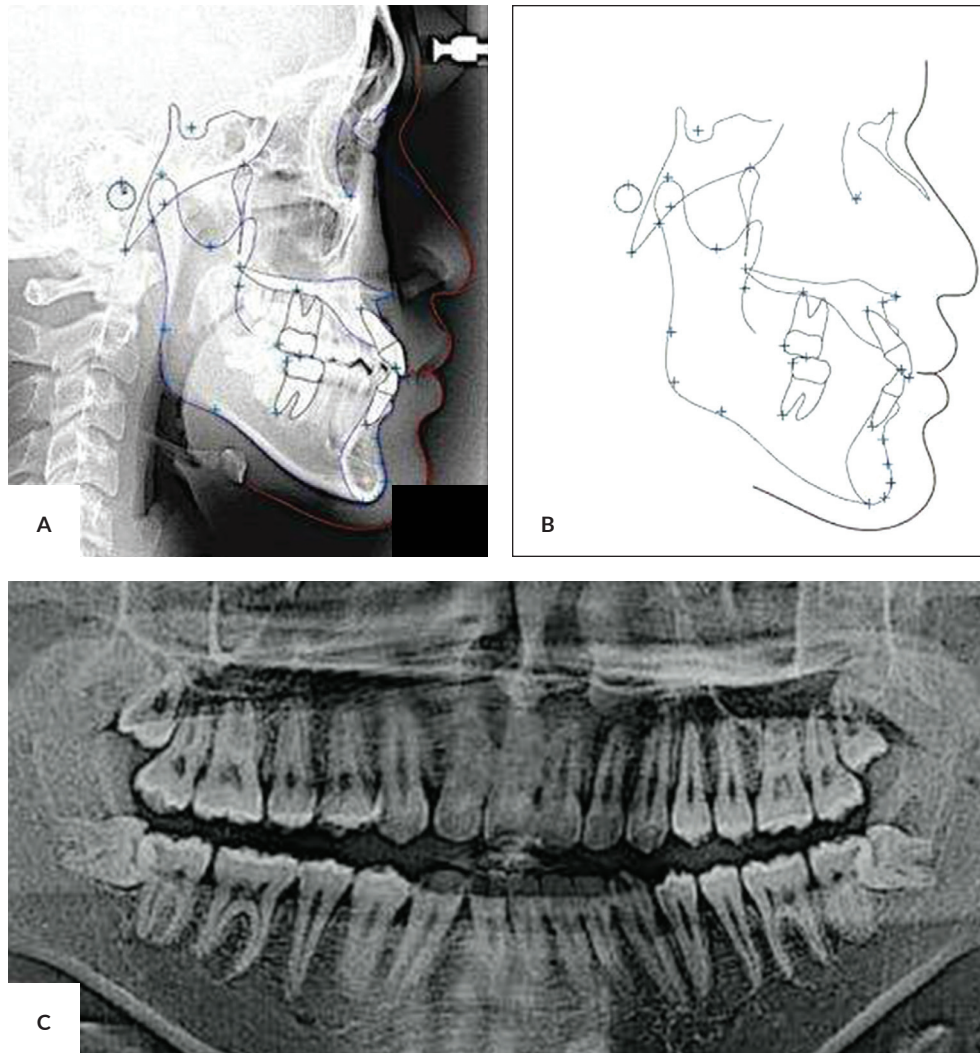


Figure 8. Post-treatment radiographs: (A) Lateral cephalogram, (B) cephalometric tracing, (C) panoramic radiograph.

not only retrocline the mandibular incisors and procline the maxillary incisors, but also extrude the mandibular incisors and maxillary molars. These vertical changes rotate the posterior occlusal plane down and the anterior occlusal plane up; this induces counterclockwise rotation of the occlusal plane. Moreover, increasing the lower anterior facial height by extrusion of the maxillary molars may not be an ideal treatment option for hyper divergent Class III patients. Therefore, when there is a long anterior facial height and a shallow overbite, the use of long Class III elastics should be minimized to prevent extrusion of the maxillary molars.²⁴ In the transverse dimension, Class III elastics also can cause changes that tend to widen the maxillary molars and roll their crowns palatally, so when using Class III elastics, these side effects should be considered.

Although the mandible moved in a clockwise direction, the occlusal plane rotated in a counterclockwise manner. If we compare the pre- and post-treatment cephalometric radiographs, we will be able to observe occlusal plane

changes. The counterclockwise rotation of the occlusal plane resulted from the extrusion of the maxillary molars and mandibular incisors. One undesirable effect of the counterclockwise rotation of the occlusal plane is further flattening of the patient's smile,²⁵ but Batwa et al.²⁶ claimed that small changes in the occlusal plane are unlikely to affect smile attractiveness. Our patient was seen from the pretreatment photos and compared with the post treatment photos still has an attractive smile even there are changes in the position of the maxillary incisors. With the expected proclination of the maxillary incisors when using Class III elastics, controlling maxillary incisor torque was a key factor of this study.²⁷ To minimize flaring of the maxillary incisors, alignment was accomplished with rectangular copper-nickel-titanium wire at an early stage in treatment; as treatment progressed, third-order bends were placed in all finishing wires to increase labial root torque. Therefore, posttreatment maxillary incisor inclination increased only 0.5 degree during treatment (U1-SN, from 116.0° to 116.5°).

Skeletal Class III malocclusion is one of the most challenging cases that we find as orthodontists. The right diagnosis based on clinical examination, analysis of study models, and cephalometric analysis can show that this case is a true class III malocclusion. In a growing patient, numerous methodologies are used to correct a skeletal Class III malocclusion. In addition to the facemask and chin-cup, success has also been reported with mini plates for maxillary protraction.²⁸ If the patient declines camouflage treatment with temporary skeletal anchorage devices, we might consider Class III elastics. However, when using long intermaxillary elastics in Class III patients, their effect on the inter arch relationship should be carefully monitored during conventional orthodontic treatment.

CONCLUSION

Orthodontic camouflage can be considered an effective therapy for correcting skeletal class III malocclusion. To prevent flaring of the maxillary incisors caused by Class III elastics, maxillary incisor torque should be controlled carefully.

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Statement of Authorship

All authors participated in data collection and analysis and approved the final version submitted.

Author Disclosure

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