

Non-Surgical and Non-Extraction Treatment of a Severe Skeletal Class III Deep Bite Patient

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Abstract

This case report describes the orthodontic treatment of a young adult Thai male aged 17 years 9 months with a severe skeletal Class III malocclusion, negative incisor overjet substantial mandibular anterior shift, maxillary incisor crowding, and deep overbite. Treatment was only orthodontics without extraction. Self-ligating appliances combined with removable posterior bite-raiser, Class III and triangular Class III intermaxillary elastics were used. The active treatment required 27 visits unavoidably spread over 58 months. Achieving positive overjet together with maxillary incisor alignment enabled correction of the anterior functional displacement of the mandible, also allowing a more stable Class I dental occlusion and significant improvement of facial profile. For more than three years post-treatment, the occlusion has remained stable with no signs or symptoms of temporomandibular disturbance.

Key words: CO-CR discrepancy; Non-surgical orthodontics; Posterior bite-raiser; Severe Class III deepbite; Triangular Class III intermaxillary elastics

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Introduction

As with all Angle classes of malocclusion, Class III malocclusion occurs in a wide range of dento-skeletal types. The skeletal types such as represented by a straight to concave facial profile, often a prognathic mandible and/or retrusive maxilla, a prominent lower third of the face and a reverse incisor overjet, present special problems in their correction particularly among older adolescents and adults.¹⁻⁴ The influence of environmental factors and oral function on the etiology of a Class III malocclusion is not understood. Orthodontists are satisfied to proceed with correction of Class III malocclusions without pursuing the so far insoluble question of the nature of gene-environment interactions when considering the etiology of malocclusion other than its various ethnic associations. Among Thai orthodontic patients the prevalence is 13.2 %.⁵

Mild skeletal Class III malocclusions can be corrected orthodontically.^{2,6} For severe skeletal Class III malocclusions, orthodontics combined with orthognathic surgery is often required.^{2,6,7} Various treatment protocols have been proposed to camouflage mild to moderate skeletal Class III malocclusions, including fixed appliances with Class III intermaxillary elastics,⁷⁻²² and some incorporating Multiloop Edgewise Archwire Technique (MEAW),^{7,8} maxillary protraction appliance,⁷ J-hook headgear to the mandibular arch,⁹ chin cup,¹⁰ and Temporary Anchorage Devices (TADs).^{7,11,12} Extraction of teeth is often a part of treatment plans for adult patients, such as one mandibular incisor, mandibular premolars, sometimes also maxillary premolars, and including a surprising frequency of reports recommending extraction of mandibular first or second molars.^{7,13-19} Reports of camouflage correction for adults with skeletal Class III malocclusion without extractions are difficult to find,²⁰⁻²² contrasting with reports of adults being treated with a range of extraction protocols.

Class III malocclusion presents dental and skeletal discrepancies even at early age, and it may become worse with continuing growth.²³ The timing for

camouflage orthodontics in Class III should take into account of the pattern of prolonged mandibular growth, duration of retention, and timing for the evaluation of stability resulting from the treatment protocol.

It is common clinical experience that the characteristic anterior crossbite of both dental and skeletal Class III malocclusions is frequently associated with anterior functional mandibular shift, often referred to Centric Occlusion-Centric Relation (CO-CR) discrepancy. Thus, this feature is important in differential diagnosis of anterior crossbite for orthodontic treatment planning of all Class III malocclusions and assessment of treatment outcomes.^{7,10,22,24,25}

The purpose of this case report is to present a young adult male with a severe skeletal Class III malocclusion and deep overbite treated with self-ligating appliances, removable posterior bite-raiser, Class III and triangular Class III intermaxillary elastics to correct a functional mandibular anterior displacement along with dentoalveolar compensation of anterior teeth to camouflage the severe skeletal Class III deep bite malocclusion.

Diagnosis and etiology

An adult Thai male aged 17 years 9 months presented for an orthodontics consultation. His chief complaint was dissatisfaction with his maxillary anterior teeth being behind the mandibular incisors and required to have better chewing and biting ability. He had previously consulted six orthodontists who advised him to have orthodontics combined with orthognathic surgery, but he denied any surgery.

The extra-oral examination (Fig. 1) showed that he had a symmetrical mesofacial type and slightly concave profile. Paranasal areas were flat. Lips were competent at rest. On smiling, 70 % of his maxillary incisor crowns were displayed. The intra-oral examination (Fig. 1) found an anterior crossbite of all maxillary incisors with negative overjet 7 mm and positive overbite 5 mm. His mandibular dental midline was deviated to the right-hand side 1 mm. Canine and molar relationships

were extreme Class III on both sides. The patient's functional examination showed 5 mm of CO-CR discrepancy with almost edge-to-edge contact of his anterior teeth in maximally retruded CR. There was no lateral functional shift and no symptoms of temporomandibular disorders. The patient was in good general health and had no history of systemic diseases.

Both maxillary and mandibular dental arches had symmetrical ovoid arch forms. The depth of the curve of Spee was 4 mm on both sides. The posterior

occlusions were not well-seated and there was incomplete occlusion of the premolars on the left-hand side. The maxillary incisors had 2 mm of crowding. Bolton's analysis indicated no tooth size discrepancy.

The panoramic radiograph (Fig. 2) showed all teeth were present, except maxillary third molars. The mandibular third molars were developing. There were no supernumerary teeth. The crown-root ratios were normal with good alveolar bone levels, no bone pathology, and nasal floor and maxillary sinuses appeared normal.

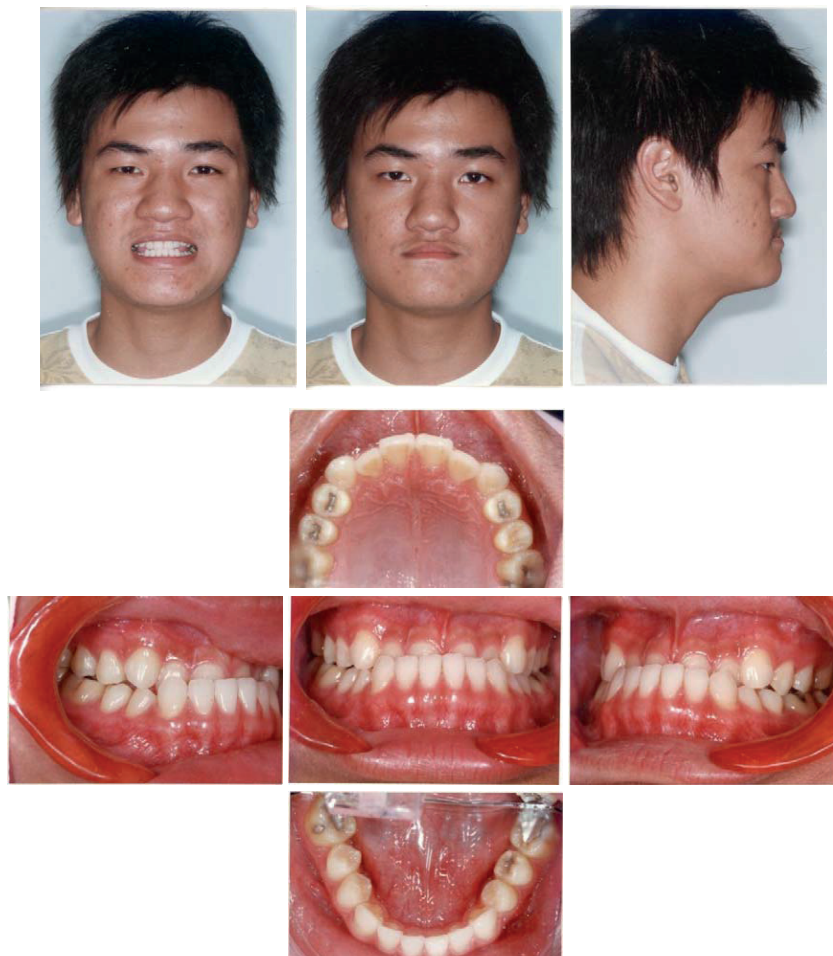


Figure 1 Pre-treatment facial and intra-oral photographs

The lateral cephalometric analysis in CO position indicated a severe Class III skeletal jaw relationship (ANB, -13°) with retrognathic maxilla (SNA, 78°) and prognathic mandible (SNB, 91° and SN-Pog, 93°). Both ANB and SNB measurements were accentuated by the CO-CR

discrepancy. Facial Height Index (N-ANS:ANS-Me = 80 %) indicated decreased lower facial height. The maxillary incisors were labially proclined (U1-NA, 40° , U1-SN, 121°) with a lingual inclination of the mandibular incisors (IMPA, 80°) and an interincisor angle of 143° . His profile

was slightly concave (H-angle, 4°) and short upper lip (UL-Length, 18 mm) with retrusion of upper and lower lips (Fig. 3A and Table 1). The lateral cephalometric analysis in CR position showed mild prognathic profile (Fig. 3B).

The patient was diagnosed as a severe skeletal Class III deepbite with retrognathic maxilla and prognathic mandible and 5 mm of CO-CR discrepancy. His Class III

malocclusion was primarily associated with the skeletal discrepancies combining retrognathic maxilla and prognathic mandible, accentuated by the functional anterior displacement of the mandible. None of his family members had skeletal Class III, but his mother mentioned that her son had an anterior crossbite of his primary dentition.



Figure 2 Pre-treatment panoramic radiograph

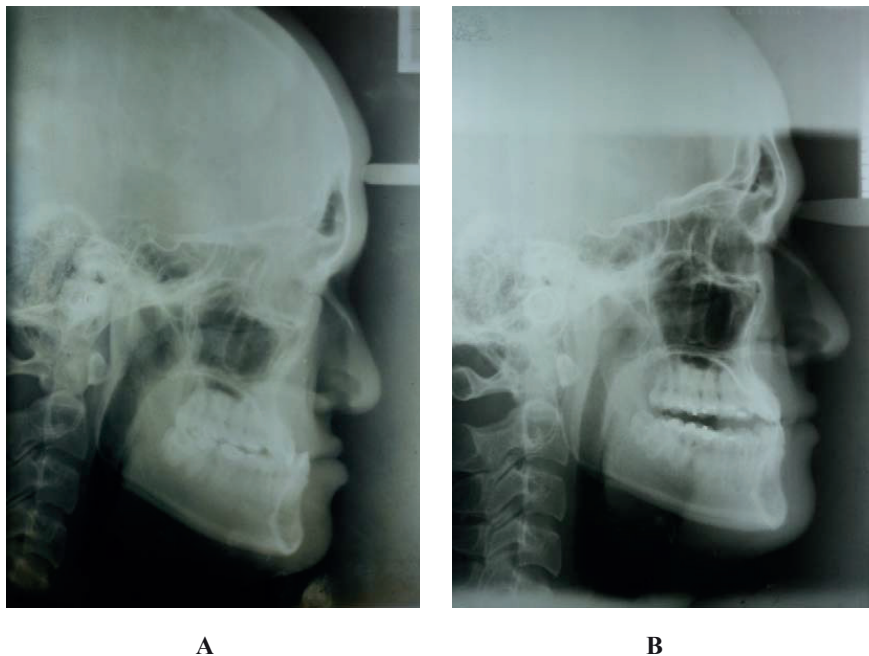


Figure 3 Pre-treatment lateral cephalometric radiograph

A. Cephalometric CO position

B. Cephalometric CR position

Table 1 Cephalometric measurements

Measurements	Pre-treatment	Post-treatment
SNA (degree)	78.0	78.0
SNB (degree)	91.0	90.0
SN-Pog (degree)	93.0	92.0
ANB (degree)	-13.0	-12.0
SN-MP (degree)	15.0	17.0
U1 to L1 (degree)	143.0	144.0
U1 to NA (degree)	40.0	55.0
U1 to SN (degree)	121.0	136.5
IMPA (degree)	80.0	70.0
Facial height index (%)	80.0	76.0
Nasolabial angle (degree)	86.0	87.0
H-angle (degree)	4.0	6.0
UL length (mm)	18.0	21.0
UL-EP (mm)	-6.5	-7.0
LL-EP (mm)	-2.5	-3.5

Treatment objectives

The treatment objectives were to 1) correct the anterior crossbite and establish normal incisor relationships with good positive overbite, 2) achieve Class I molar and canine relationships, 3) correct CO-CR discrepancy, 4) reduce the deep curve of Spee, 5) correct the mandibular midline deviation, 6) correct the left side of incomplete occlusion of the premolars, and 7) improve facial profile.

Treatment alternative

Possible benefit of ideal orthodontics with surgery previously explained and offered had been rejected by the patient. Therefore, treatment by orthodontic camouflage was considered and presented to the patient on his understanding that correction to his full satisfaction could not be guaranteed. The first camouflage alternative consisted of conservative orthodontic treatment without extractions – even though there was maxillary anterior crowding – and to retract the mandibular incisors and dental arch. The treatment would be made with fixed

labial appliances, removable posterior bite-raiser, and initial Class III and subsequent triangular Class III intermaxillary elastics to correct the maxillary anterior crowding and anterior crossbite. This camouflage approach would produce dento-alveolar compensations through more labially proclined maxillary incisors and more lingually retroclined mandibular incisors, as well as correcting the CO-CR discrepancy and establishing together with maintaining positive anterior overjet and overbite.

It was explained to the patient that the above treatment plan without extraction might not be successful because of difficulties in full correction of the anterior crossbite and because of the large skeletal Class III problem. Any difficulty should become apparent within six months of the start of treatment using the non-extraction approach. In this event, an extraction alternative would be considered while in other respects treatment would continue as described before. At the same time, the patient was informed that going to his

undesired surgical option might also need to be considered before deciding on camouflage with extractions. The treatment protocol needed excellent patient compliance.

The patient accepted the advice to commence with non-extraction camouflage orthodontic treatment with fixed appliances and Class III intermaxillary elastics, with initial use of a mandibular bite-raiser.

Treatment progress

The treatment was initiated using 0.022-inch self-ligating maxillary appliances (Damon 3MX) combined with mandibular removable posterior bite-raiser (Fig. 4). The bite registration of posterior bite-raiser was recorded in centric relation position using Dawson's technique.²⁶



Figure 4 Initial treatment; fixed appliance in maxillary combined with removable posterior bite-raiser in mandible

In the first stage of treatment lasting four months, the maxillary incisors were levelled and aligned with a nickel-titanium archwire. A 0.016 x 0.025-inch stainless steel archwire with active molar-stop loops and Class III intermaxillary elastics were then used from maxillary molars to modified U-loops of the labial bow of the removable posterior bite-raiser. Three months later, the anterior crossbite was corrected. Temporary posterior openbite occurred with only anterior contacts when the patient stopped using the posterior bite-raiser. In preparation for correction of this posterior openbite, self-ligating attachments were bonded to the mandibular teeth. The maxillary arch wire was changed to 0.019 x 0.025-inch stainless steel to provide intermaxillary anchorage for levelling of the curve of Spee through extrusion of the mandibular posterior teeth with intermaxillary Class III triangular elastics. This extrusion was completed with a sequence of archwires from 0.014-inch copper nickel-titanium to

0.019 x 0.025-inch stainless steel during a further 12 months of treatment. During this time treatment continued with further consolidation of incisor overjet with increased overbite, along with establishment of Class I buccal occlusions.

At 34 months into treatment, the patient was sent to remove the impacted mandibular third molars due to pericoronitis.

Throughout treatment, the patient gave excellent compliance with use of the removable posterior bite-raiser, Class III and triangular Class III intermaxillary elastic tractions. The total time that the appliances were in place was 58 months which was long because the patient could not attend regularly while studying in another city. However, he had only 27 visits from start to completion of treatment. After treatment, maxillary and mandibular invisible retainers were made and used full-time for one year and then at night only.

Treatment results

The patient and his mother were satisfied with the treatment results. The immediate post-treatment extra-oral photographs (Fig. 5) show significant improvement with change from the slightly concave to a straighter and more vertically balanced profile. The post-treatment intra-oral photographs (Fig. 5) show satisfactory dental alignment, Class I canine and molar relationships, well-seated posterior occlusion, overjet and overbite of 2 mm, and only a minor center line discrepancy. Periodontal health was excellent with mild root resorption (Fig. 6). Superimposed pretreatment, and post-treatment cephalometric tracings (Fig. 7A, B and C, and Table 1), the maxillary incisors tipped labially with slightly forward movement of maxillary molars. The mandibular incisors tipped lingually and there was

extrusion of mandibular molars and the premolars that followed the open bite after the completion of the first phase of treatment. This also corrected the deep curve of Spee. The concave profile was improved with an increase in the H-angle from 4° to 6° and an increase in upper lip length from 18 mm to 21 mm. There were mandibular changes: Menton moved down 4 mm, SNB and SN-Pog angle decreased from 91° to 90° and 93° to 92° respectively, mandibular plane angle increased from 15° to 17°, indicating backward and downward rotation of the mandible, and ramus height (Ar-Go) increased from 63 mm to 64.5 mm with Facial Height Index decreased from 80 % to 76 % indicating increased lower facial height. There was 2 mm incisor overbite when appliances were removed.



Figure 5 Post-treatment facial and intra-oral photographs

The three years follow-up examination (Fig. 8) found a still well-balanced soft tissue profile. His cephalometric measurements matched those at the end of treatment. The occlusion remained stable, with normal overjet and overbite. His periodontal health was

still excellent and no further root resorption was detected (Fig. 9). There were no signs or symptoms of any temporomandibular disorders during the treatment and retention periods. The patient wanted to use retainers at night only for another year.

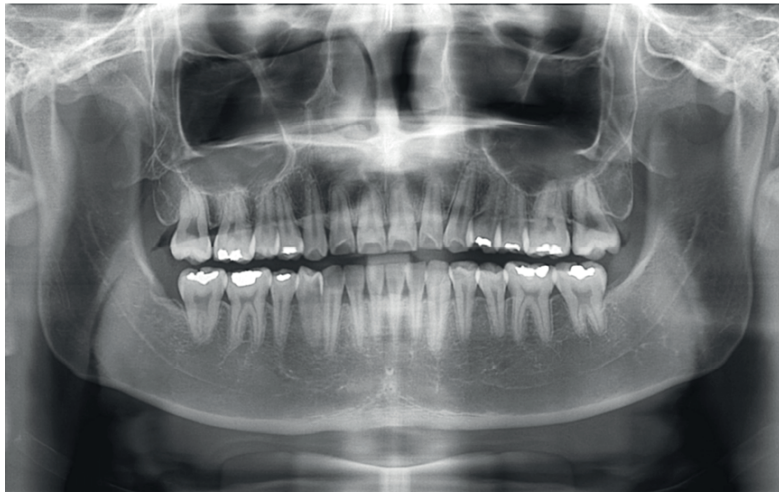


Figure 6 Post-treatment panoramic radiograph

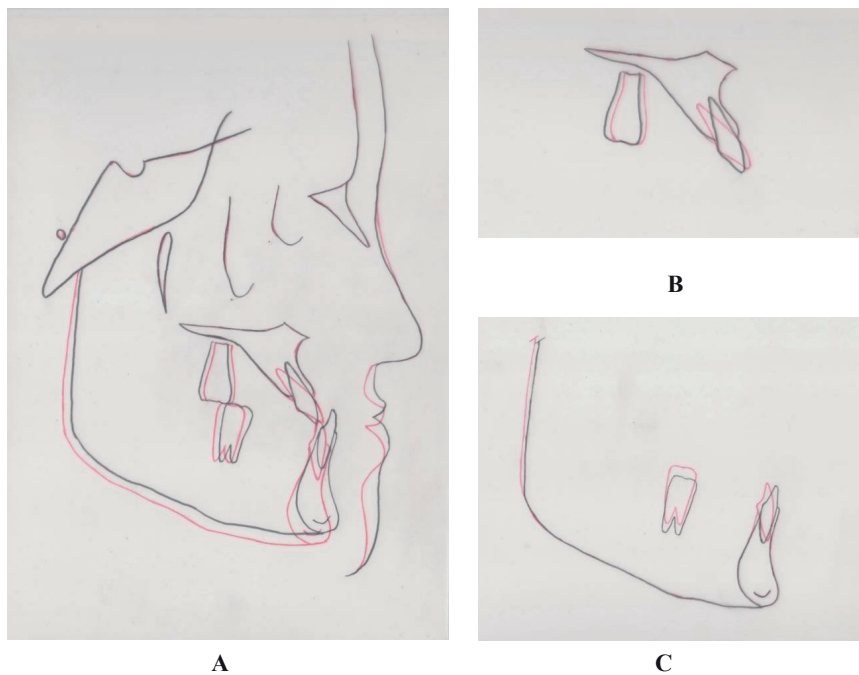


Figure 7 Superimpositions of pre-treatment (black line)

Post-treatment (red line)

A. Cranial base superimposition

B. Superimposition on the maxilla

C. Superimposition of the mandible



Figure 8 Facial and intra-oral photographs three years after treatment



Figure 9 Panoramic radiograph three years after treatment

Discussion

Although, the ideal treatment for severe adult Class III must be orthodontics combined with orthognathic surgery, a few cases of non-extraction camouflage of severe Class III with long-term stable outcomes have been reported.²⁰⁻²²

As already noted, the patient in the present case report had previously been diagnosed as an orthognathic surgery case by several orthodontists. His dento-skeletal appearance of mandibular prognathism and maxillary incisor crowding would have encouraged them to advise surgical correction rather than camouflage orthodontics. For the severe skeletal Class III patients with CO-CR discrepancy, profile at CR position can be used to predict the prognosis.²⁷ If the CR profile is orthognathic, it suggests a good prognosis. In case of minor degree of prognathism, camouflage orthodontics may be an acceptable compromised treatment but with increasing dental compensation.²⁷

The deficiencies of antero-posterior and vertical development of the maxilla presented significant problems for camouflage correction. However, the expectation of substantial improvement to overall facial profile by mandibular retraction from the CO position and opening rotation to correct obvious overclosure and related large incisor overbite offered some encouragement to try camouflage correction. This could answer the patient's several concerns although at the same time it was necessary to warn him of difficulties in following this conservative approach.

Repositioning splints therapy can alter condylar position at occlusal contact, so aiding correction of habitual anterior displacement of the mandible.^{10,21} There is no question as to whether or not this patient's mandibular condyles should be positioned in the mythical "relaxed and normal" positions in their respective fossae that clinicians are required to achieve.²⁸ Necessarily his mandibular

occlusal contact position is now maximally retruded, being constrained by the corrected incisor crossbite. Throughout his period of attendance at the clinic, the patient has never shown signs or identified symptoms of temporomandibular joint disturbances. A report of a meta-analysis also indicated that the conventional orthodontic treatments do not increase the prevalence of temporomandibular disorders.²⁹

Application of Class III intermaxillary elastics may result in maxillary molar extrusion.³⁰ In the first phase of treatment, Class III intermaxillary elastics combined with removable posterior bite-raiser was applied for correction of the anterior crossbite. The extrusion of the maxillary molars was controlled with use of the bite-raiser and the stiff maxillary rectangular archwire.³⁰

The mechanics of tooth movement were fixed labial appliances, removable posterior bite-raiser, and Class III intermaxillary elastics to camouflage the severe Class III malocclusion. As the results show, this protocol produced labial tipping of maxillary incisors with slight forward movement of maxillary molars; the mandibular incisors were tipped lingually and there was extrusion of mandibular molars and premolars. The removal of impacted mandibular third molars in the latter part of treatment, would facilitate some tipping back of the mandibular dentition due to the effect on Class III elastics.

The satisfactory occlusion, well-balanced facial proportions, and better upper lip profile were the results of small increases to pre-existing dentoalveolar compensations, which improved mid-facial height with small opening rotation of the mandible.²

At three years post-treatment, positive overbite and better maxillo-mandibular skeletal relationships (Fig. 8) were very important for prevention of relapse of occlusal relationships and return of mandibular functional protrusion.¹⁰

For severe skeletal Class III malocclusions, orthodontics combined with orthognathic surgery can completely change concave facial profile.² This patient, with a severe skeletal Class III deepbite, was successfully treated orthodontically without extractions, and has a significant improvement of facial profile.

The continuing stability of the correction could also be attributed in part to the exceptionally long period of 58 months of wearing the appliances due to unavoidable irregular clinic attendances. This extended use of the fixed appliances provided a useful form of fixed retention. However, long term follow up of this case is needed to check for relapse of the incisor relationship and any residual apical resorption of the incisor teeth.

An important note about extraction alternatives for non-surgical correction of skeletal Class III malocclusions

The non-extraction alternative is preferable to extractions in many cases where camouflage correction is being considered. As the patient was warned at the start, experience has shown that lack of expected orthodontic improvement will be apparent within the first six months. In such a situation it may be advisable then to reconsider whether or not to continue further compromise with one of several extraction options. A multiple premolar extraction option without surgery carries an important risk of problems if it also fails to assist orthodontic correction. Baik illustrated such a case of a patient who had camouflage treatment of a Class III malocclusion, including four premolars extraction. There was return to Class III malocclusion attributable to “late mandibular growth” that necessitated recourse to two-jaw surgery.⁷ Multiple extractions with failed attempt at camouflage correction can create significant difficulty if the orthodontist (and patient) is then faced with transferring to an orthodontic-orthognathic surgery approach. In such circumstances, the significant problem in achieving a desired treatment outcome would be

difficulty in reversing (i.e., decompensating for) any failed camouflage of Class III incisor relationships using a multiple extraction option, while also preventing space openings where there had been extractions.

Conclusion

This severe Class III deepbite was successfully treated non-surgically by orthodontics only and without extractions. The success of orthodontics only avoids the risks and complications of surgery with less financial costs for the patient and his mother.

Fixed appliance with removable posterior bite-raiser and Class III elastics followed by Class III triangular elastics effectively tipped maxillary incisors labially and the mandibular incisors lingually to correct the patient’s anterior crossbite, and related CO-CR discrepancy, and to close a transient posterior open bite while retaining positive incisor overbite, so camouflaging this severe skeletal Class III.

This camouflage protocol produced a significant improvement of facial profile, a slightly concave facial profile changing to straight facial profile with underlying skeletal disturbances.

Stability of correction over the three-year follow-up period could be attributable to the extended period of maintenance of fixed appliances acting partly as fixed retention, and to retention of positive incisor overbite. For long-term stability, prolonged wearing retainers are recommended.

A significant factor in the success of the camouflage treatment and post-treatment outcome was the excellent patient compliance.

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