
Retreatment of a skeletal Class II postpubescent patient with a convex facial profile and temporomandibular disorders

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Objectives: The present case report describes the orthodontic retreatment of a skeletal Class II postpubescent female patient who presented following previous orthodontic treatment that involved the extraction of the four first premolars, temporomandibular disorders and a convex facial profile.

Methods: The patient, aged 15 years, sought treatment for the chief complaints of an unaesthetic facial profile and difficulty in opening her mouth. The examination revealed a convex facial profile and a moderate skeletal Class II relationship within a long face. The patient had bilateral pain around the temporomandibular joints and her maximum mouth opening was only 11 mm. The treatment plan was to initially relieve the temporomandibular symptoms and then to retract the upper dentition using mini-implants.

Results: The patient's mouth opening ability reached 37 mm and a significantly improved harmonious facial profile was achieved.

Conclusions: Cases that present with previous unsuccessful orthodontic treatment may be retreated to achieve a satisfactory aesthetic and functional result by precise control of tooth movement in three dimensions.

(Aust Orthod J 2019; 35: 218-228)

Received for publication: August 2018

Accepted: March 2019

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Introduction

Orthodontic treatment results are determined by many factors and not all patients experience a desirable outcome. Some even suffer from the side effects of previous treatment. Patients seek orthodontic retreatment to improve their aesthetics as well as their oral function, but a second orthodontic course of care has particular concerns and complexities.¹⁻³ A patient seeking retreatment may have increased oral disease related to caries and periodontal problems and temporomandibular disorders but also may have higher expectations regarding the treatment result and may have psychological anxiety.⁴

A Class II malocclusion is a common problem occurring in approximately one-third of the

older population and accompanying mandibular retrusion is the most common feature.^{5,6} Since Class II postpubescent patients have minimal growth potential to advance the mandible, the correction protocol is either combined orthodontic-orthognathic surgery or camouflage orthodontic treatment. While many patients and their parents accept camouflage treatment because of a reluctance to undergo surgery, orthodontic treatment requires more accurate space management, anchorage design and vertical control.⁷

The present case report described the retreatment of a postpubescent patient who presented with a moderate skeletal Class II malocclusion, a convex facial profile and limited mouth opening. The strategies and options for treatment are discussed.

Diagnosis and etiology

A 15-year-old female patient and her parents presented with the chief complaints of an unaesthetic facial profile and difficulty in mouth opening. The patient had received previous orthodontic treatment involving the extraction of the four first premolars when she was 12 years old. In addition, she had been experiencing a gradual reduction in mouth opening after the previous orthodontic treatment.

The diagnostic facial photographs (Figure 1) showed a slightly asymmetric face, a convex facial profile with an acute nasolabial angle. The patient's asymmetry was caused by the chin slightly deviated toward the right and associated with a long lower third of the face.

An intraoral examination (Figure 1) revealed an Angle's Class II, division 1 malocclusion. The occlusion was unbalanced by poor intercuspation. The four first premolars had already been extracted. Bilaterally, the canines and first molars were in a cusp-to-cusp distal relationship. Mild maxillary and mandibular anterior crowding was observed.

A dental cast (Figure 2) measurement analysis revealed that the anterior overjet was 3.0 mm and the curve of Spee was 3.0 mm. The maxillary dental midline was generally coincident with the facial midline, but the mandibular dental midline was 1.0 mm deviated to the right side. The Bolton ratio of the anterior teeth was 80%.

The patient's temporomandibular disorder symptoms were evident. Difficulty was experienced in establishing a stable occlusal position and mouth opening was only 11 mm. The patient had bilateral pain around the temporomandibular joints during mouth opening and closing movements.

A panoramic radiograph (Figure 3) showed that all third molars were impacted, and the upper left third molar was particularly small. There was no obvious root resorption.

A lateral cephalometric radiograph (Figure 4) showed that the skeletal maturity of the patient was at stage CS6 according to the cervical vertebrae maturation method. The cephalometric tracings revealed a skeletal Class II discrepancy ($ANB = 5.9^\circ$; $Wits = 5.1$) with mandibular retrusion ($SNB = 76.1$). A Z-angle of 69° confirmed a protrusive soft-tissue overlay. The cephalometric analysis also indicated bimaxillary protruded incisors.

Treatment objectives

The treatment objectives were to (1) relieve the temporomandibular disorder symptoms, (2) reduce the dentoalveolar protrusion and obtain a harmonious facial profile, (3) establish a Class I dental relationship with a functional occlusion, (4) achieve optimal inclination of the anterior teeth and obtain a normal overbite and overjet.

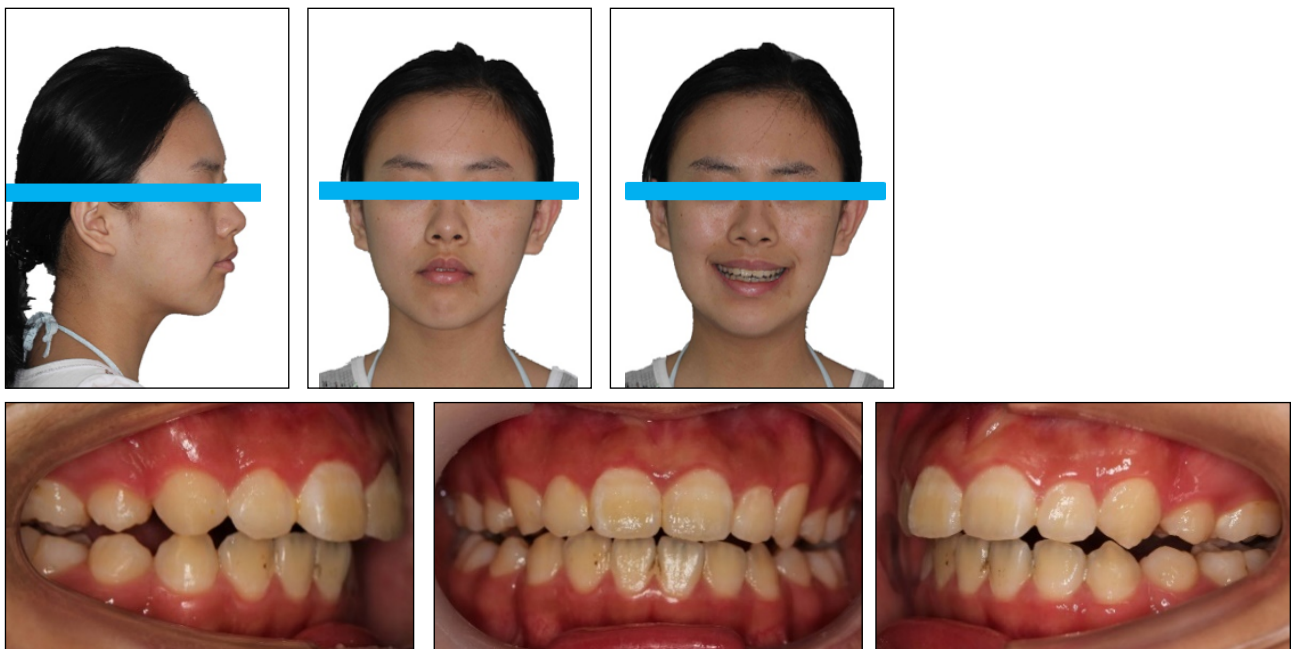


Figure 1. Pretreatment facial and occlusal relationship photographs.

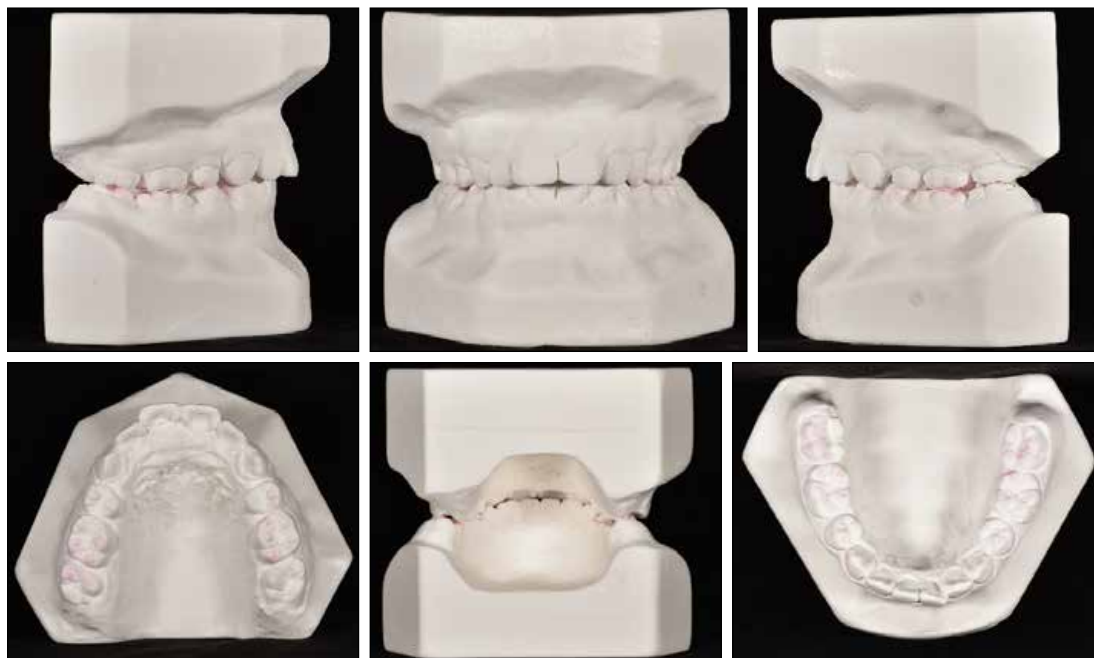


Figure 2. Pretreatment dental cast.

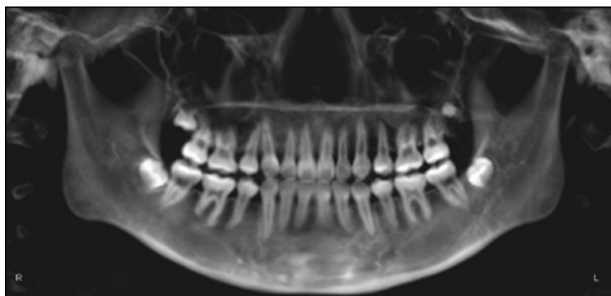


Figure 3. Pretreatment panoramic radiograph.

Treatment plan

The temporomandibular disorder symptoms were given priority. After three months of conservative neuromuscular treatment (Figure 5), the patient's pain disappeared and her mouth opening greatly improved to 30 mm. After the mandible was set in a stable occlusal position (Figure 6), the space requirements and anchorage control were analysed. The final treatment plan included the extraction of the maxillary right second molar and the mandibular third molars, followed by the placement of bone anchorage to distalise the maxillary posterior teeth to achieve a Class I molar relationship and create space for anterior tooth retraction. Mini-implants were planned for insertion in the maxillary posterior quadrants to enable intrusion of the entire upper dentition with the expectation of a counter-clockwise rotation of the mandible to improve the facial profile.



Figure 4. Pretreatment cephalometric radiograph and tracing.

Treatment progress

The patient was initially treated with a neuromuscular appliance (J5 Myo-monitor, MYOTRONICS) to relieve the TMD-associated pain during mandible movement and in an effort to improve mouth



Figure 5. Neuromuscular apparatus.

opening. Subsequently, the maxillary right second molar and the mandibular third molars were extracted. Standard edgewise brackets (0.022 × 0.028-inch) were bonded from the right first molar to the left second molar in the upper arch. The mini-implants were inserted buccally between the upper second premolars and the first molars. A 0.019 × 0.025-inch stainless steel arch wire was placed, with bilaterally-attached soldered hooks between the lateral incisors and canines and helical bubble loops sited at the distal of the first molars. Within three months the molars were distalised, which created 3.0 mm of space on each side. A mini-implant was then placed in the palatal midline to bilaterally intrude the first molars (Figure 7).

Standard edgewise brackets (0.022 × 0.028-inch) were bonded from the right second molar to the left second molar in the lower arch. A 0.018 × 0.025-inch stainless steel arch wire with omega loops and bilateral tip back bends at the mesial of the second molars

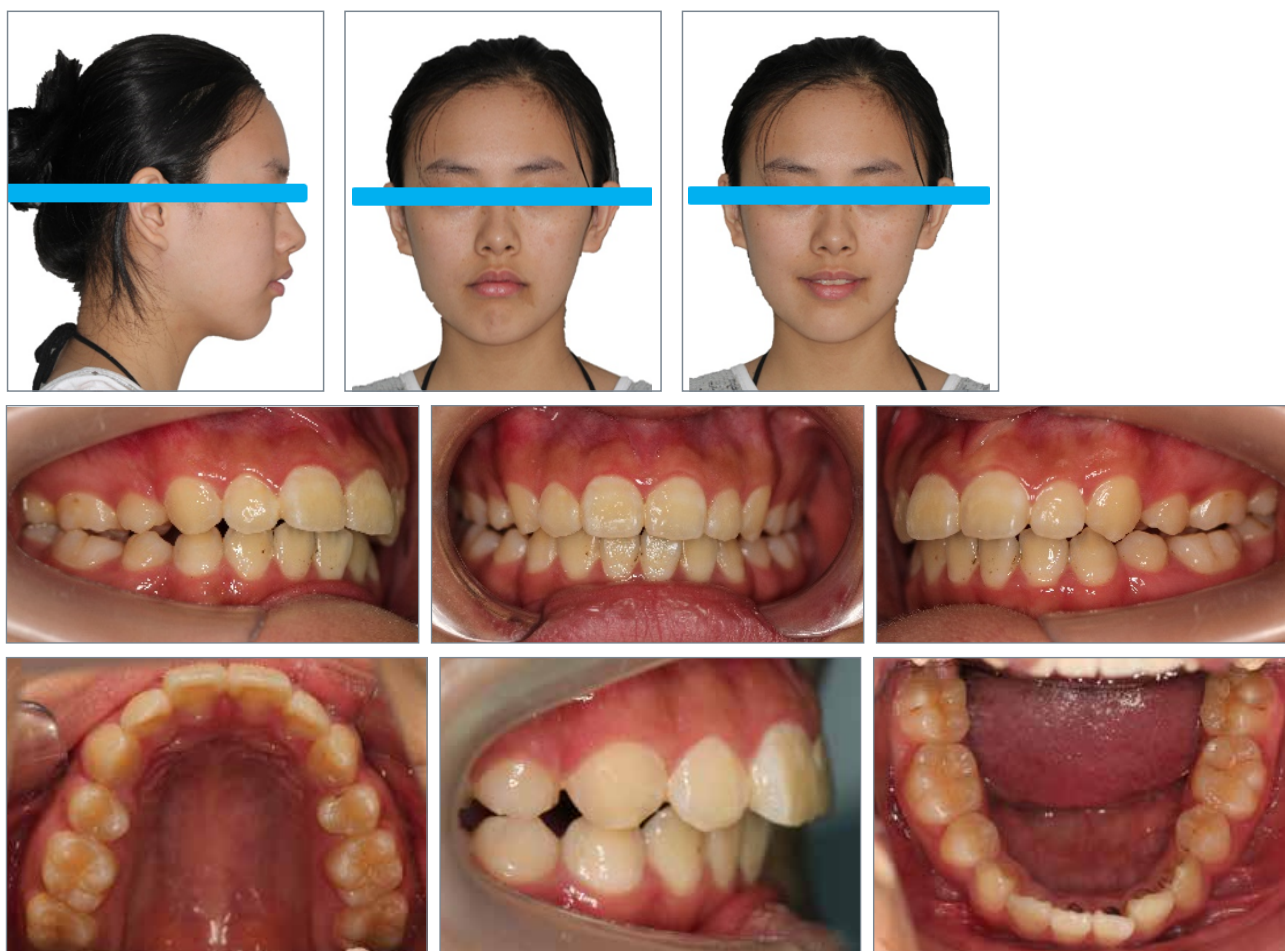


Figure 6. Facial and intraoral photographs after the mandible found its stable position and before fixed appliance correction.

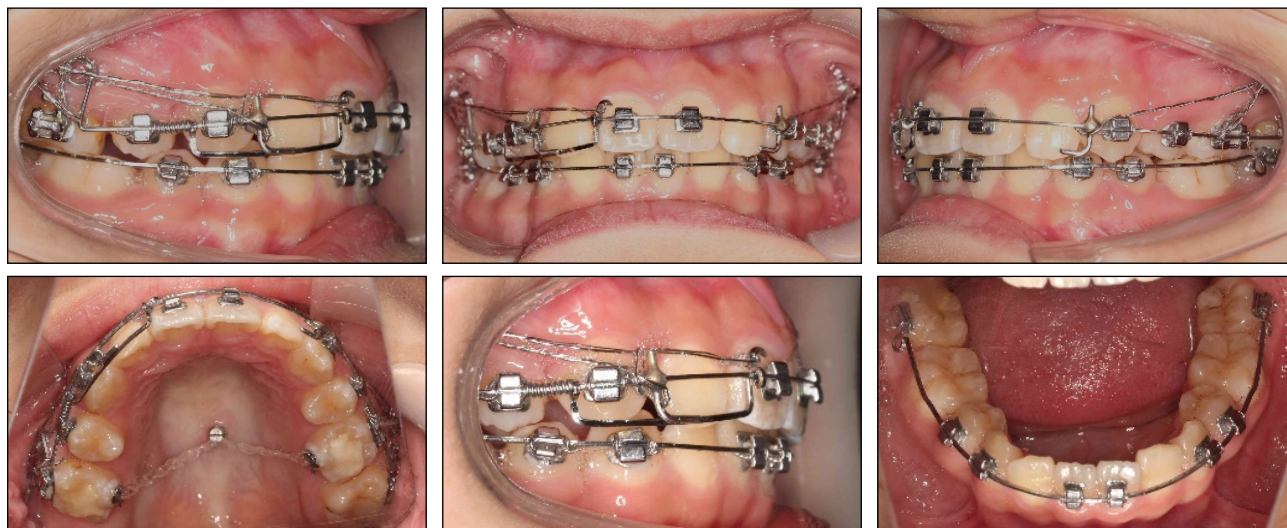


Figure 7. Intraoral photographs showing the mini-implants, helical bubble loops and slider bar.

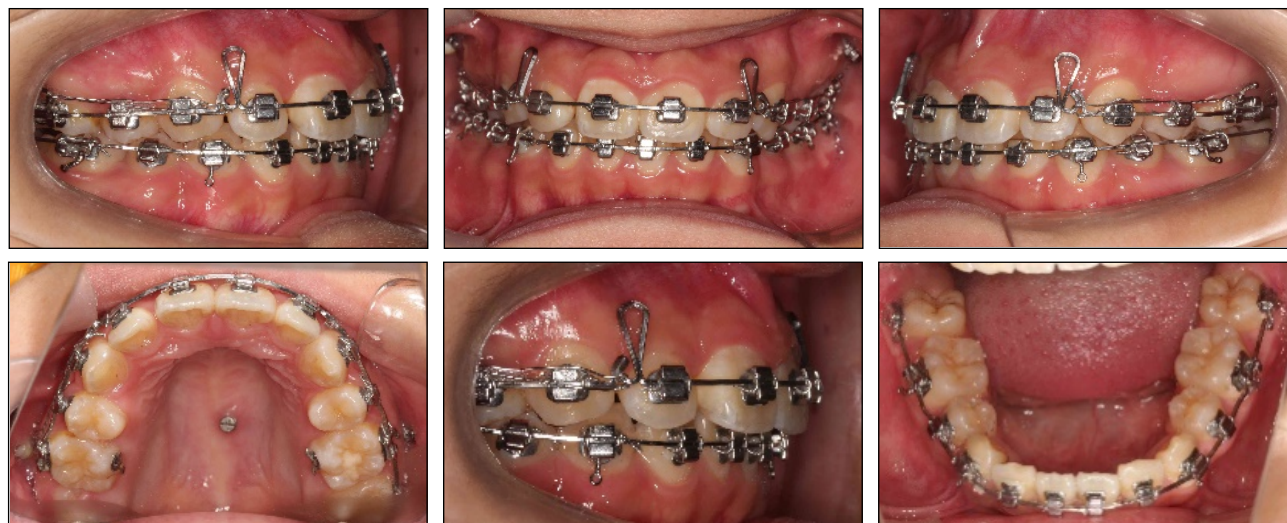


Figure 8. Intraoral photographs showing the shoehorn loops.

was inserted. Following six months of activation and review, the molars were uprighted.

After the initial preparation of both arches, alignment and levelling were achieved with a gradual progression of arch wires from 0.012-inch to 0.018 × 0.025-inch nickel titanium wires.

A 0.019 × 0.025-inch stainless steel arch wire with anterior palatal root torque and closing loops distal to the lateral incisors was placed for the retraction of the upper incisors (Figure 8).

Twenty months after treatment commencement, upper incisor retraction was completed, and 0.018-inch round stainless steel arch wires were placed to detail the occlusion. After a total 26 months of active treatment, all brackets were removed and the

patient was instructed to wear an upper and lower circumferential Hawley retainer for 24 hours a day.

Treatment results

The patient's TMD-associated pain was relieved and there was no temporomandibular sign of reoccurrence during the fixed appliance treatment period. Her ability to open her mouth widely increased to 37 mm.

Post-treatment records indicated a balanced facial profile with unstrained lip closure. The cephalometric superimpositions revealed the remodelling of the maxillary alveolar bone with the retraction of the upper incisors and a mild counter-clockwise rotation of the mandible. The FMA was reduced from 25.2° to 24.1°.

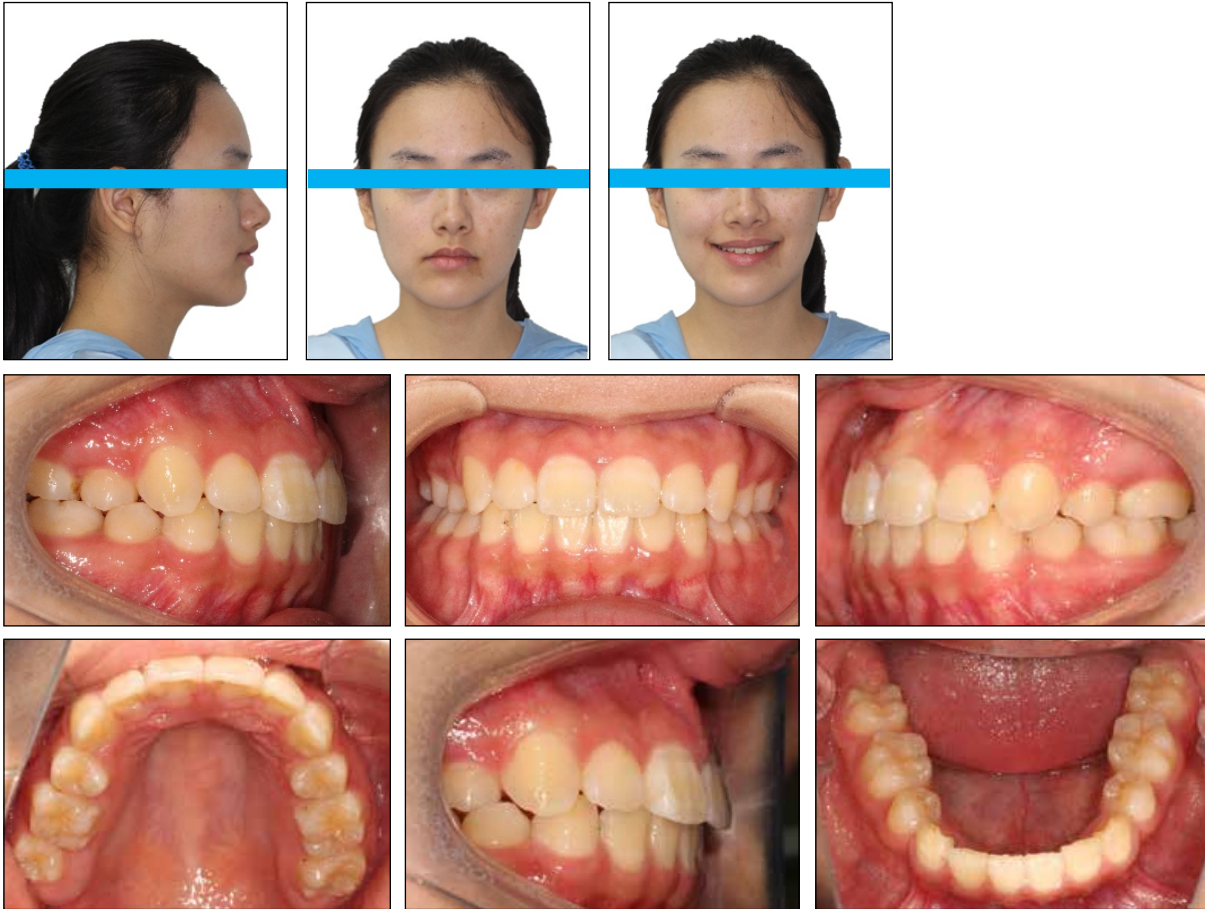


Figure 9. Post-treatment facial and intraoral photographs

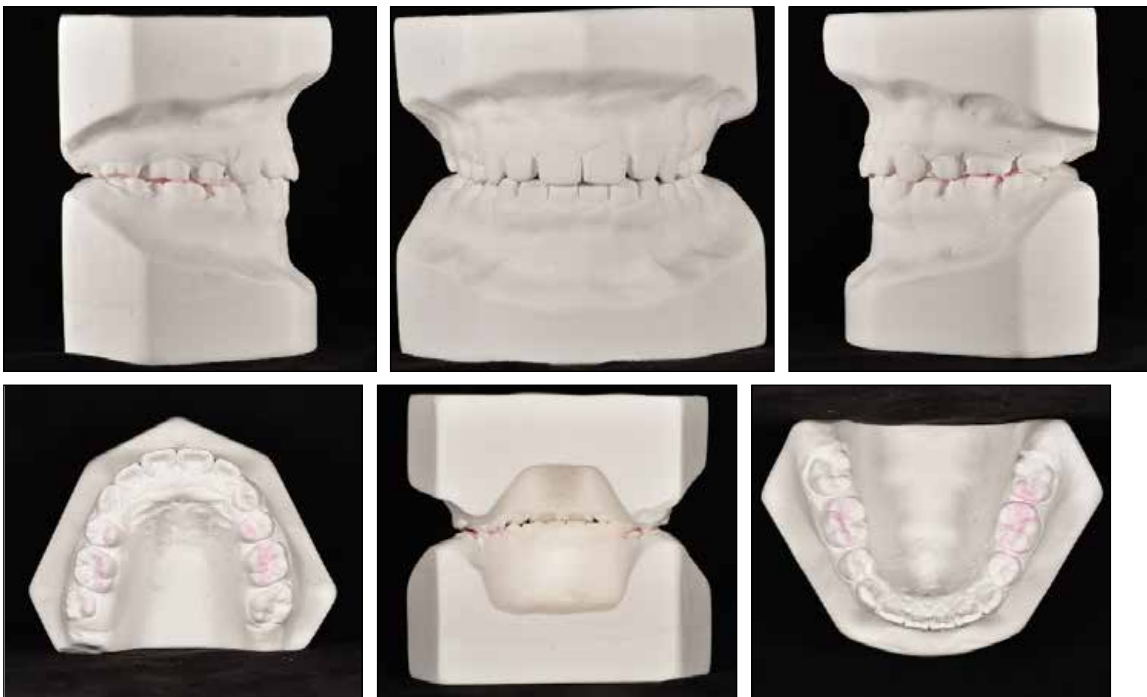


Figure 10. Post-treatment dental casts.



Figure 11. Post-treatment panoramic radiograph.



Figure 12. Post-treatment cephalometric radiograph and tracing.



Figure 13. Overall superimposition (registered on sella).

The final occlusion (Figure 9, 10) recorded Class I canine and molar relationships on both sides. The teeth were aligned in a good interdigitated occlusion. The maxillary incisors were retracted and the mandibular incisors were uprighted and intruded.

The post-treatment panoramic radiograph (Figure 11) showed acceptable root paralleling with no significant root resorption nor marginal bone loss, which should be carefully monitored in retreated cases.

The lateral cephalometric radiographs (Figure 12) and the superimpositions (Figure 13) confirmed that the soft tissue protrusion was reduced (Table I) and the nasolabial angle was increased. The decrease of the ANB angle was a result of the retraction of the maxillary anterior teeth and an increase of the SNB angle (Figure 13). The maxillary and mandibular incisors were significantly retracted ($U1 = 62.1^\circ$; $IMPA = 92.7^\circ$). The maxillary central incisors were retracted

about 2.7 mm at the incisal edge. The maxillary first molars were intruded 2.0 mm and distalised about 1.6 mm (Figure 14).

The patient was highly co-operative and wore her retainers as instructed. The final treatment results remained stable at a two-year follow-up review (Figure 15).

Discussion

Orthodontic treatment objectives have evolved from the correction of dental malocclusion to the improvement of facial aesthetics, oral health, and the creation of a functional occlusion with long-term stability.⁸ However, occasionally, earlier treatment may be unsuccessful and the results unsatisfactory. Because of the difficulties and complexities, it is risky for orthodontics to retreat patients who seek an improvement of their previous outcomes.⁹

Table 1. Skeletal and dental changes indicated by the cephalometric measurements.

Variable	Normal values	Pretreatment	Post-treatment	Change
FMIA	65.0±5.0°	60.8°	64.8°	4.0°
IMPA	88.0±6.0°	96.1°	92.7°	-3.4°
FMA	25.0±2.0°	25.2°	24.1°	-1.1°
SNA	82.0±3.0°	82.0°	81.3°	-0.7°
SNB	80.0±3.0°	76.1°	78.6°	2.5°
ANB	2.0±1.0°	5.9°	2.6°	-3.3°
OP	10.0±2.0°	4.0°	7.5°	3.5°
Z angle	75.0-78.0°	69.0°	77.5°	8.5°
WITS	0.0-4.0mm	5.1mm	-0.8mm	-5.9mm
LAFH	60.0±5.0mm	67.0mm	63.8mm	-3.2mm
RH	45.0±5.0mm	55.8mm	53.8mm	-2.0mm

Janiszewska-Olszowska et al. reported that patients requesting orthodontic retreatment have realistic perceptions of their aesthetic appearance and are strongly motivated to improve their dental appearance and facial profiles.¹⁰ Therefore, before commencement, a detailed oral examination, model measurement, radiographic and facial analysis must be carefully conducted along with a detailed assessment of the patient's chief complaint.¹¹⁻¹³

The present Class II case, which was previously treated by the extraction of the four first premolars and resulted in an increased overjet, unstable posterior occlusion and TMJ disorders, was successfully retreated after a thorough diagnosis and an appropriate treatment plan. During treatment, several orthodontic techniques were comprehensively applied and followed a classical edgewise technique, a mini-implant system, and a closing loop and slider bar technique. Anchorage control is invariably the key to success.¹⁴⁻¹⁶ Since the full dentition needed to be distally moved, any loss of anchorage would be disadvantageous. The introduction of mini-implants has allowed posterior teeth to be moved distally to create spaces for anterior tooth retraction. For postpubescent patients who have limited potential to advance the mandible, mini-implants may be used to intrude the entire upper dentition to induce a counter-clockwise rotation of the mandible with a resulting improvement in the Class II facial profile.^{7,17}

The mini-implant technique, combined with the slider bar and the helical bubble loop, facilitated the distalisation of the molars effectively and created the

necessary space for anterior tooth retraction.¹⁸ In patients undergoing retreatment, special attention should be given to the prevention of root resorption. The suggested rate for anterior tooth retraction is 1 mm every six weeks based on clinical experience.^{19, 20} Mini-implants with unilateral intermaxillary Class III elastics can produce midline adjustment while preventing the maxillary molars from extruding and the occlusal plane from tipping.

An additional challenge in the presented case was the maintenance of temporomandibular joint stability during the fixed appliance treatment phase. Previous TMD symptoms should not be viewed as a contraindication for retreatment provided that progress was well controlled and assessed.²¹ A light force was applied and TMD symptoms were carefully monitored during the entire procedure. It is advised that orthodontic treatment begins only after joint problems are properly diagnosed and managed.^{22,23}

Based on practical clinical experience, it has been determined that orthodontic retreatment is usually a result of incorrect previous diagnosis and treatment plan, improper orthodontic procedures, relapse, and/or communication issues between clinicians and patients. To reduce the likelihood of retreatment, the general and dental condition of the patients should be carefully evaluated before treatment. When oral diseases and adverse habits interfere with the normal growth of the dentofacial region, orthodontic treatment and intervention is indicated promptly. As an example, lingually inclined upper incisors may force the mandible into a backward

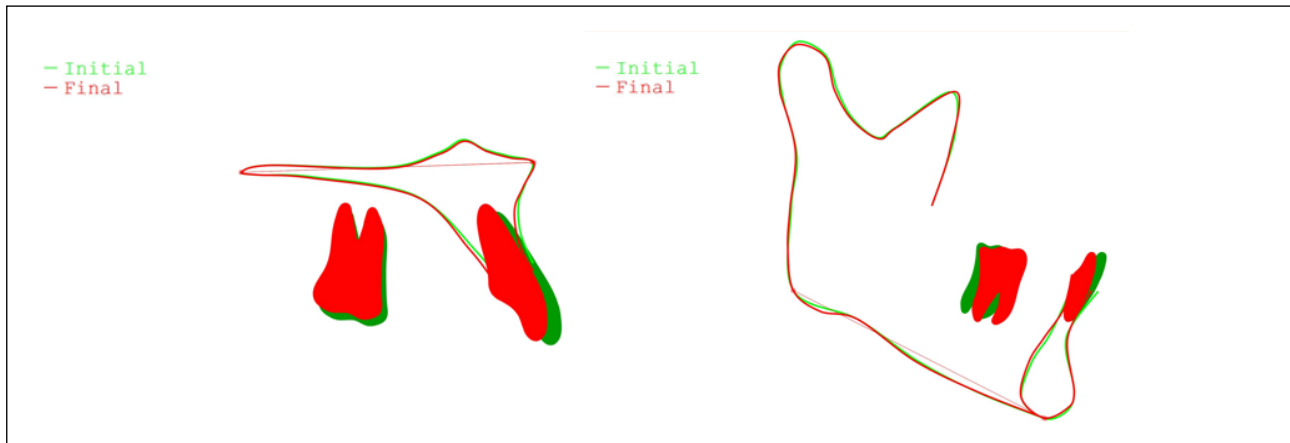


Figure 14. Maxillary (best fit) and mandibular (inner portion of the symphysis) superimpositions.

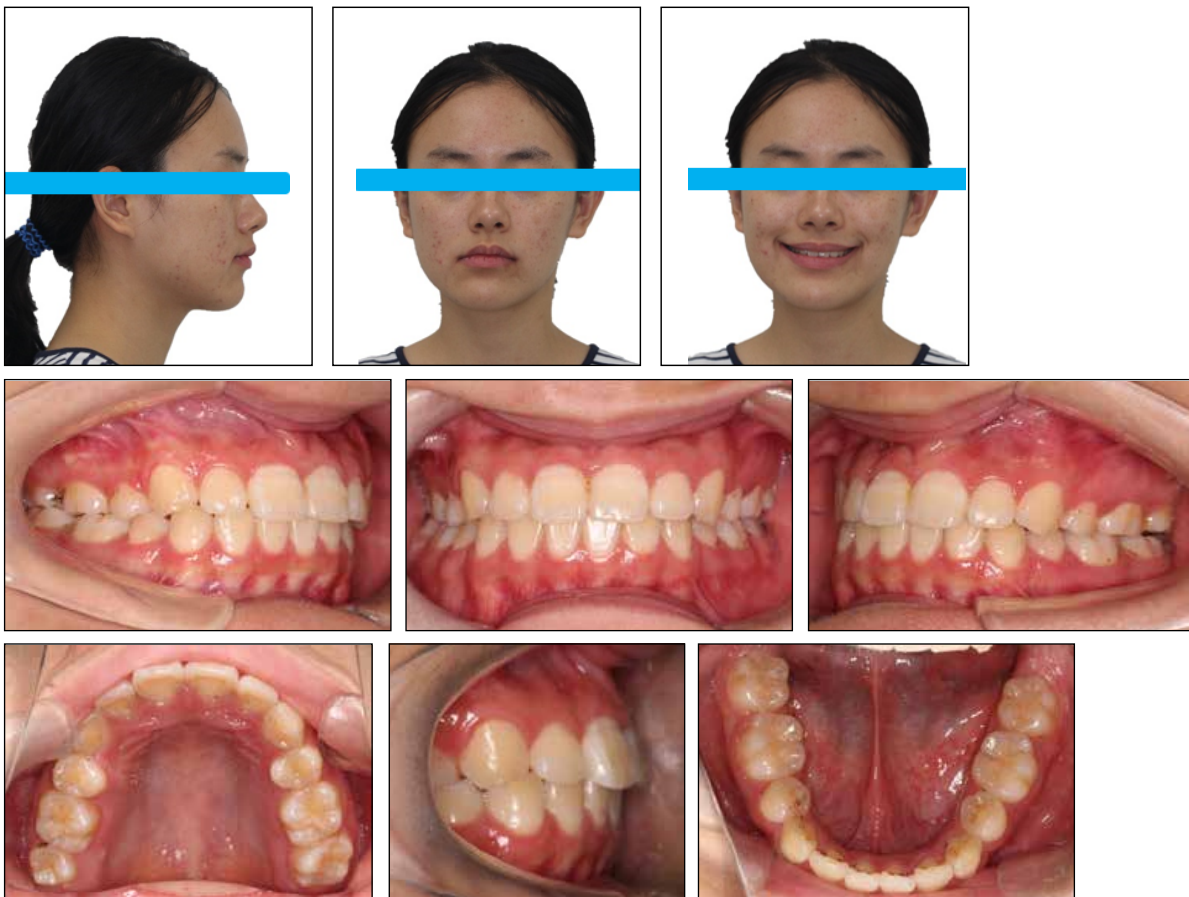


Figure 15. Two-years follow-up facial and intraoral photographs.

position, and therefore prevent its normal forward development. Early correction of upper incisor position will be advantageous. However, for patients with a potentially overdeveloped mandible, it will be better to observe and re-evaluate after growth has been completed.^{24,25} A competent clinician not only knows how to precisely place the brackets and bend

arch wires, but also has a clear insight into anchorage control and its dynamic requirement during appliance therapy. More importantly, space management and accurate three-dimensional control of each tooth should be based on the comprehensive analysis of facial and dental protrusion, dental crowding and the occlusal relationship.²⁶ Biomechanical principles are

the basis of treatment and, besides orthodontic tooth movement, an increased emphasis should be placed on dental, periodontal and temporomandibular joint health. After treatment, patients should be reminded about the importance of wearing retainers and regular review.

Some retreatment cases can be satisfactorily treated or have a level of improvement, while others are unable to be retreated because of poor periodontal condition or the high risk of root resorption.²⁷ In addition, patients who seek retreatment may be rejected. This may lead to lifelong regret and psychological trauma. In the present case, the patient was ultimately happy with her smile and profile after retreatment, which generated more confidence to face life.

However, there were also limitations as no further radiographic examination of the temporomandibular joint before and after treatment, and so there was little evidence to explain the improvement of her joint disorder. As the patient had an asymmetrical chin that deviated 1 mm to the right, the dental midline was not adjusted to maintain asymptomatic joints.

Conclusion

The key to camouflage orthodontic retreatment is to establish a considered treatment plan that meets the patient's concerns of facial aesthetics, oral health, and a functional occlusion with stability. In the presented case, the TMD symptoms were relieved at the outset with physiological therapy. With the assistance of mini-implants, the protrusive maxillary anterior teeth were retracted, the high mandibular plane angle was reduced and a harmonious facial profile was obtained. The patient was satisfied with her appearance and her temporomandibular symptoms were eliminated. The treatment outcomes remained stable after two years but further reviews will be necessary to evaluate the long-term stability.

Acknowledgment

The authors wish to thank the National Natural Science Foundation of China for supporting this work [grant number 815008131003912, 2016].

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