Compromised Treatment for a Class III Asymmetry Case

History And Etiology

An 18 year-old female patient, accompanied by her mother, presented for orthodontic treatment with chief complaints of anterior crossbite and mandibular prognathism. Since the patient did not speak Chinese, all communication was interpreted by her Taiwanese mother for the patient and her Japanese father. The family lived in Japan, but the mother wanted her daughter to receive orthodontic treatment in Taiwan, because they were not satisfied with the opinions of Japanese orthodontists, who felt that orthognathic surgery was the only viable option.

The patient was referred by her elder sister, a practicing dentist in Taiwan, who was familiar with the author's method for treating skeletal Class III malocclusions, without extraction and/or orthognathic surgery. Clinical examination revealed midface deficiency (*concavity*), mandibular prognathism, chin deviation to the right, acute nasolabial angle, and perioral protrusion of both lips. The upper dental midline was coincident with the facial midline, but the lower dental midline was shifted 2.5mm to the right. The maxillary central incisors were in end-to-end occlusion, while the adjacent lateral incisors and the right canine were in crossbite. Arch length discrepancies were 9 and 10mm for the lower and upper arches, respectively.

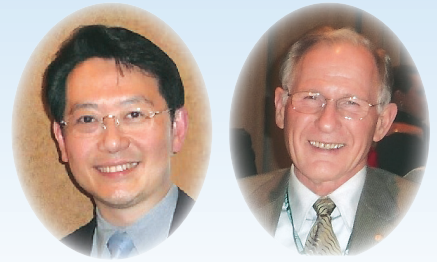■ *Fig. 1: Pretreatment facial photographs*

■ *Fig. 2: Pretreatment intraoral photographs*

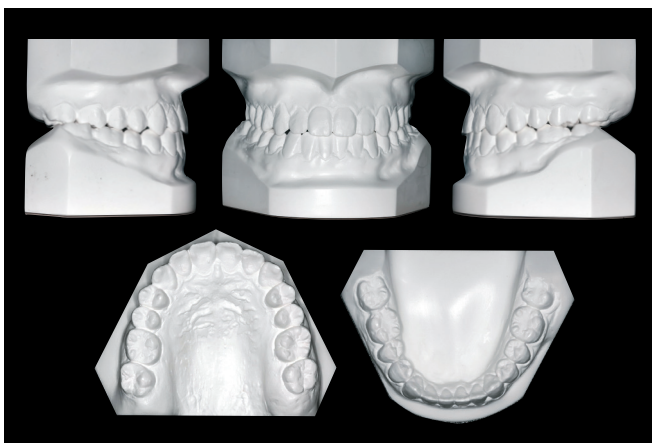■ *Fig. 3: Pretreatment study models*

Johnny JL Liaw, Director, Beauty Forever Dental Clinic (left)
W. Eugene Roberts, Consultant,
International Journal of Orthodontics & Implantology (right)

■ *Fig. 4: Posttreatment facial photographs*

■ *Fig. 5: Posttreatment intraoral photographs*

■ *Fig. 6: Posttreatment study models*

Class III molar and canine relationships were noted bilaterally (*Figs. 1-3*).

The molar discrepancy was more than a full cusp Class III bilaterally, which exceeded the author's previous experience with mandibular arch retraction. Although the treatment outcome was unpredictable, the patient was highly motivated. After a thorough discussion of treatment options, the patient preferred non-extraction treatment and total arch distalization via temporary anchorage devices (*TADs*).

The patient was treated to an acceptable result as documented in Figs. 4-6. The cephalometric and panoramic radiographs document the pre-treatment condition and the post-treatment results (*Figs. 7-8*). The cephalometric tracings before and after treatment are superimposed in Fig. 9, and the cephalometric measurements are provided in Table 1.
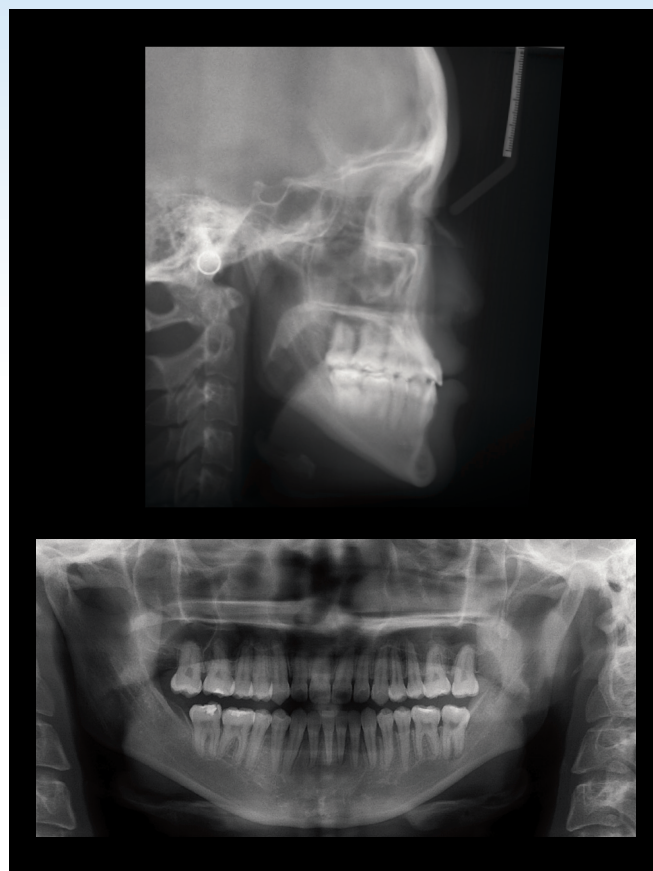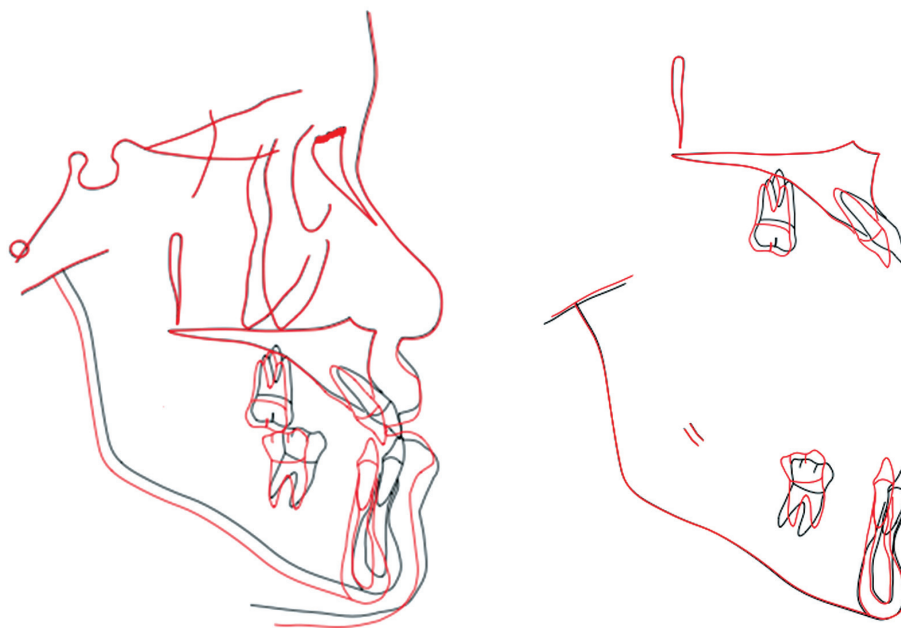
Diagnosis

Skeletal:

- Class III skeletal pattern (*SNA 86°, SNB 89°, ANB -3°*)
- Mandibular plane angle (*SN-MP 33°, FMA 24.5°*)

■ Fig. 7: Pretreatment pano and ceph radiographs

■ Fig. 8: Posttreatment pano and ceph radiographs

■ Fig. 9:

Superimposed tracings showed total arch distalization of both arches. More retraction was noted on the lower arch. The incisors became more upright after treatment. Total arch distalization with TADs on both arches resulted in backward rotation of mandible, which was beneficial for the post-treatment profile of Class III cases.

• Facial asymmetry: mandible was deviated to the right ~3mm

Dental:

• Bilateral Class III molar relationship (*~10mm*)

• Class III canine relationships (*1mm right, 5mm left*)

• Both upper lateral incisors and the right canine were in crossbite

• The OJ was 0mm for the central incisors and -2mm for the lateral incisors

• The OB was zero for the central incisors, and 2-3mm for the lateral incisors

• Space deficiency: 8mm in the upper arch and 9mm space in the lower arch

• Midlines: Upper dental midline was on the facial midline, lower dental midline was shifted 3mm to the right

• All third molars were erupted except for the maxillary right third molar

• Archforms: symmetrical ovoid in the maxilla; asymmetrical tapering ovoid in the mandible

Facial:

• Straight profile with prognathic mandible

• Midface deficiency

• Acute nasolabial angle

• Perioral, bimaxillary lip protrusion

• Prominent chin

The ABO Discrepancy Index (*DI*) was 36 as shown in the subsequent worksheet.

Specific Objectives Of Treatment

Maxilla (*all three planes*):

• A – P: Maintain

• Vertical: Maintain

• Transverse: Maintain

Mandible (*all three planes*):

• A – P: Retract

• Vertical: Open slightly

• Transverse: Maintain

Maxillary Dentition:

• A – P: Retract incisors

• Vertical: Slight increase

• Transverse: Expansion

Mandibular Dentition:

• A – P: Total arch retraction

• Vertical: Slight increase

• Transverse: Constriction

Facial Esthetics:

• Mandibular lip retraction

Treatment Plan

The first treatment option was orthognathic surgery, combined with orthodontic treatment,[1] following extraction of two upper first premolars and removal of all four wisdom teeth. The patient and her mother declined this option despite the advice that the orthognathic surgical approach would probably produce the most esthetic facial result.

The second treatment alternative was extraction of upper second premolars and lower first premolars as well as removal of four wisdom teeth. The objectives of this treatment plan would be to correct Class III molar relationships, alleviate crowding and reduce perioral protrusion. However, the disadvantages of this approach would be a midface deficiency, concave profile, a more prominent chin point, and severely retroclined lower incisors. In addition, the correction of the 10mm Class III molar relationship bilaterally would present a major anchorage challenge. TADs in the lower posterior areas would be necessary for maximal retraction of the lower dentition.

The third consideration was to extract two lower second premolars and two upper wisdom teeth, and then finish in a Class III molar relationship.[2] This alternative would avoid a dished-in midface profile, as a consequence of upper premolars extraction, and it would be easier to control mandibular posterior anchorage. The major difficulty of this treatment approach would be the torque control of lower incisors during space closure. The clinician considered this alternative to be the best nonsurgical option, but the patient and her mother were concerned about extracting permanent teeth.

The fourth option was removal of all four third molars, followed by total arch retraction.[3] Four miniscrews in the posterior areas of both arches are used to correct the molar relationships and dental midline discrepancy, without producing bimaxillary protrusion. However, as was carefully explained during the consultation, the severity of the Class III molar relationships was beyond the author's previous experience with the method. After a thorough discussion of the pros and cons of each approach, the fourth treatment alternative was selected. The plan was to re-evaluate nonextraction treatment with TAD anchorage after 8 to 10 months of treatment, to determine if extraction of lower second premolars was necessary, for optimal retraction of the upper and lower incisors.

Appliances And Treatment Progress

A modified Alexander fixed appliance prescription was used. The slot size from canine to canine was .018" and .022" slots were used for the posterior teeth. The initial archwire for the upper arch was .016" NiTi. Two miniscrews (*OrthoBoneScrew, Newton's A, Inc. 2x12mm*) were installed in the upper posterior area (*infrazygomatic crests bilaterally*) on the same day as the initial bracket bonding. Bilateral elastic chains were attached from the miniscrews to the maxillary canines for retraction to create spaces for the anterior segment alignment. About two weeks later, lower brackets were bonded, and two miniscrews were installed on the mandibular buccal shelves. An elastic chain was applied for lower left canine retraction (*Fig. 10*). A NiTi open coil spring was inserted, between the lower right first molar and first premolar, to create space for the blocked-out second premolar. A lower right elastic chain was applied to retract the first molar (*Fig. 10*). After initial space opening for the right second premolar, an elastic chain was then attached to the lower right canine (*Fig. 11*).

The anterior crossbite was corrected in 9.5 months (*Fig. 12*), but as expected, the profile was more protrusive (*Fig. 13*). Both arches were retracted, as the lower right second premolar space was opened (*Fig.*
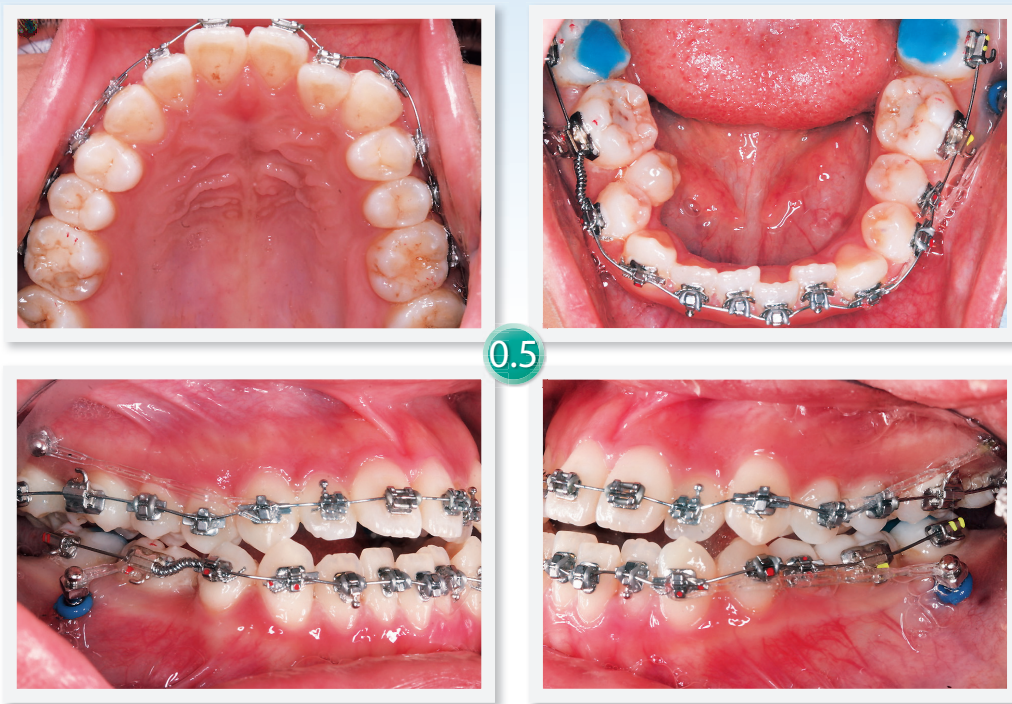
Fig. 10:

Initial setups of the orthodontic appliances. A segment of NiTi open coil spring was compressed between lower right first premolar and first molar. Elastic chain from lower right miniscrew to lower right first molar was to apply distal and buccal force to the lower right first molar. Elastic chains were attached from the miniscrews to canines to alleviate anterior crowding in all the other three quadrants.
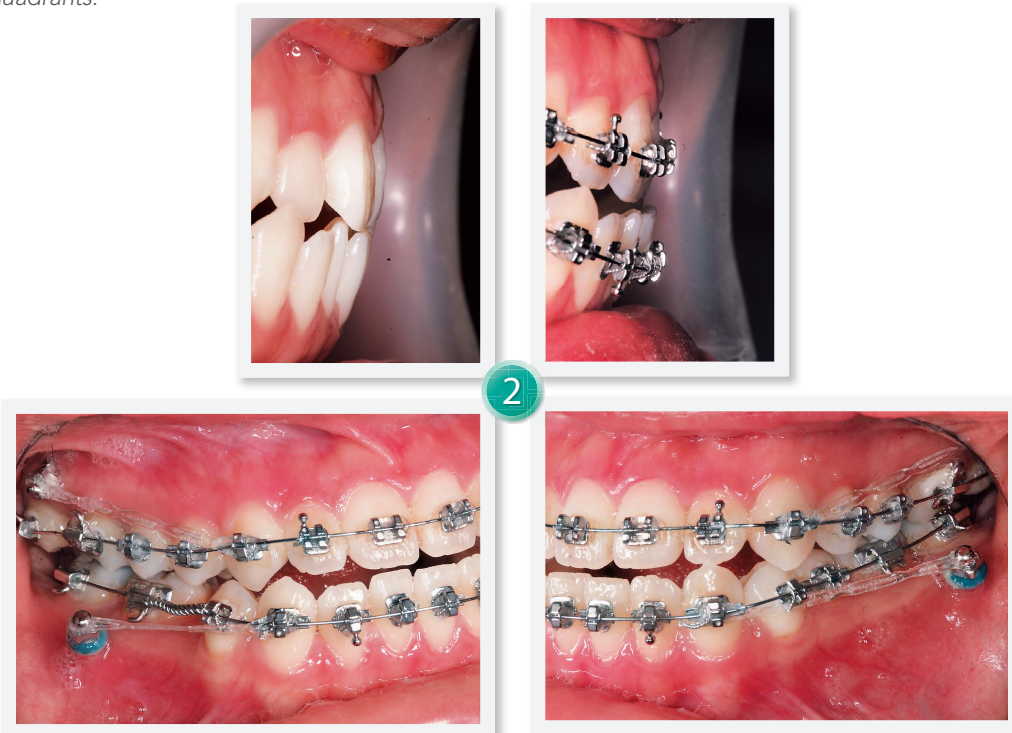
Fig. 11:

Anterior crossbite was noted after two months of treatment. The elastics on the lower right quadrant was shifted to attach on the lower right canine to avoid further development of negative overjet.

■ *Fig. 12:*

The anterior crossbite was corrected at 9.5 months into treatment.

■ *Fig. 13:*

The lateral profile became more protrusive after 9.5 months treatment.

14). After 11.5 months of treatment the right lower second premolar was bonded and engaged with the archwire (*Fig. 15*). The elastic chains, anchored with the TADs, continued to retract both arches (*Fig. 16*). Differential activation of the elastic chains was used for midline correction. Two months later, the midline was corrected and the protrusive profile had been reduced (*Fig. 17*). After 22 months (*Fig. 18*), the mandibular second molars were maximally retracted, relative to the soft tissue covering the ascending rami of the mandible. No more space was available for lower arch retraction. Cross elastics were used in the right premolar area to correct the excessive buccal overjet. One month later, the elastics were changed to box elastics for occlusal settling (*Fig. 19*). Following final detailing, the appliances were removed, after 31 months of active treatment (*Fig. 20*).

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	86°	86°	0°
SNB°	89°	87°	2°
ANB°	-3°	-1°	2°
SN-MP°	33.5°	35.5°	2°
FMA°	24.5°	26.5°	2°
DENTAL ANALYSIS			
U1 TO NA mm	10.5 mm	5 mm	5.5 mm
U1 TO SN°	122°	113°	9°
L1 TO NB mm	6 mm	1.5 mm	4.5 mm
L1 TO MP°	83°	68°	15°
FACIAL ANALYSIS			
E-LINE UL	-4.5 mm	-3mm	1.5 mm
E-LINE LL	1mm	0 mm	1mm

■ Table. 1: Cephalometric summary

9.5

■ *Fig. 14: Elastics from miniscrew to miniscrew were used to retract both dentitions for reducing the protrusion.*

11.5

■ *Fig. 15:*

The locked-in lower right second premolar was bonded after sufficient space was created after 11.5 months of treatment. A elastic chain from lower right miniscrew to lower right second premolar was used for further distalization of lower right buccal segment.

Fig. 16:

After complete alignment of both arches, the lower elastic chains from miniscrew to miniscrew were used to further retract the lower dentition for Class III correction. Another component of the force system was the asymmetrical applications of TADs on lower right and upper left for midline correction.

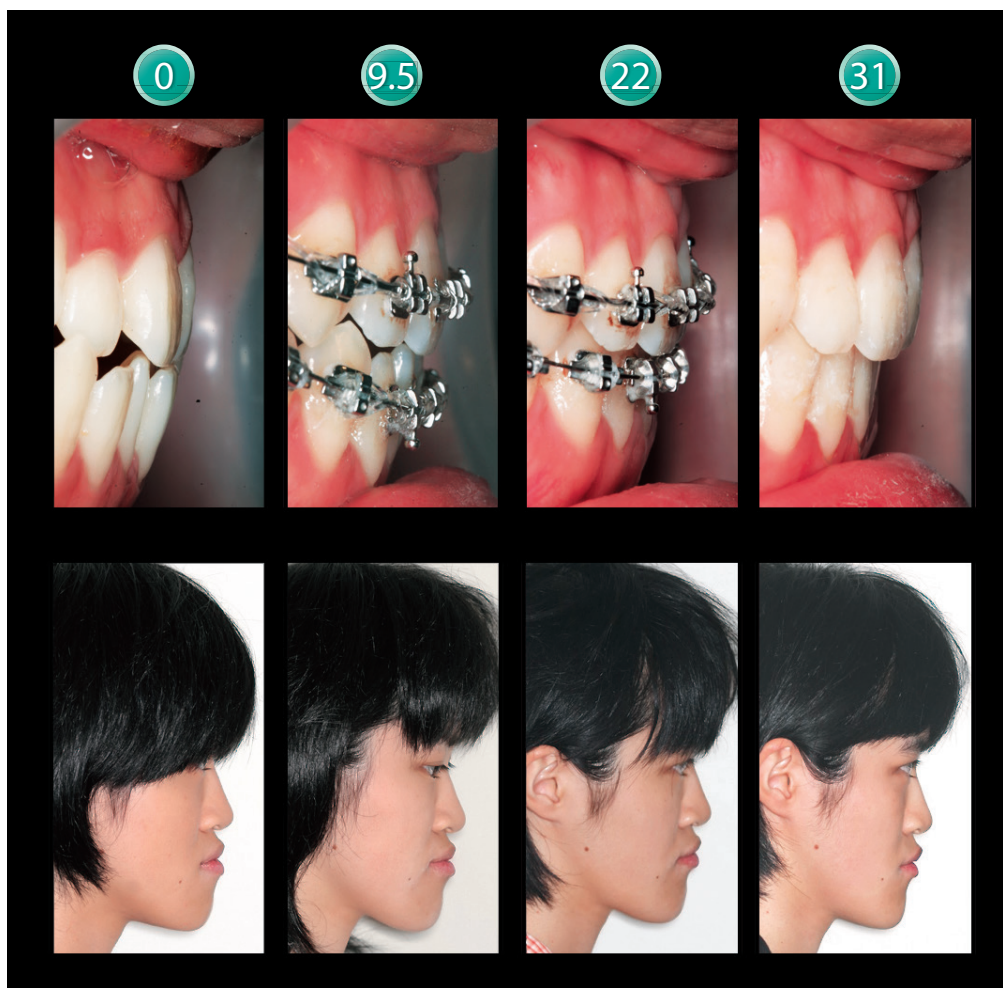**Fig. 17:** The midline and the buccal interdigitation improved a lot .

Fig. 18: The terminal second molars of the lower arch were approaching the posterior boundaries of the denture bearing areas.
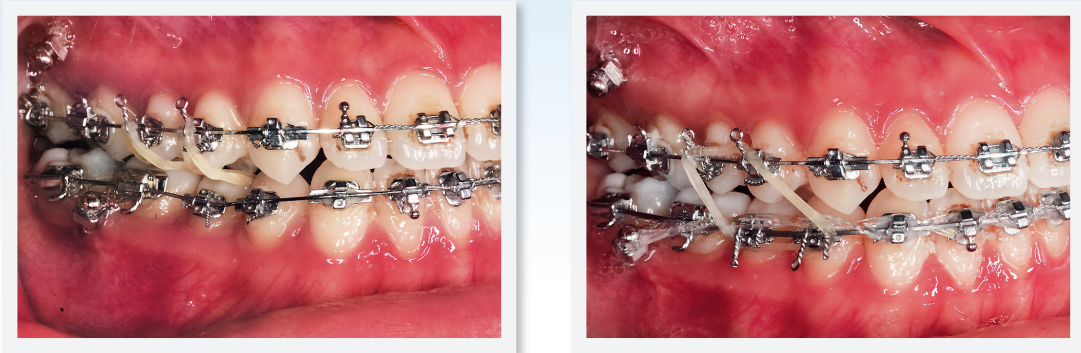
■ *Fig. 19:*

Right criss-cross elastics were used to correct the increased buccal overjet over premolar area and right box ealstics were used to settle the final occlusion.

■ *Fig. 20:*

Even with the anchorage reinforcement of TADs, the profile still became more protrusive during alignment.

The protrusion was reduced back to the original profile after total arch distalization with TADs.

Results Achieved

Maxilla (*all three planes*):

- A – P: Maintain
- Vertical: Maintain
- Transverse: Maintain

Mandible (*all three planes*):

- A – P: Retraction as the mandible rotated posteriorly
- Vertical: Opened ~3mm as the mandible rotated posteriorly
- Transverse: Maintain

Maxillary Dentition:

- A – P: Retract incisors
- Vertical: Slight extrusion of the molars
- Transverse: Expansion

Mandibular Dentition:

- A – P: Retraction of the entire arch
- Vertical: 2-3mm extrusion of the entire arch
- Transverse: Constriction

Facial Esthetics:

- Retraction of the mandibular lip

Retention

Upper and lower clear retainers were delivered, and the patient was instructed to wear them full time for the first 6 months and night time only thereafter. In addition, the patient was trained in proper home hygiene and maintenance of the retainers.

Final Evaluation of Treatment

The Cast-Radiograph Evaluation score was 39 points, with most of the points reflecting problems in incomplete correction of Class III relationships and marginal ridge alignment. The incomplete correction of Class III dental relationships was mainly because of the limit of the mandibular denture bearing area. The mandibular second molars were tipped distally because the archwire failed to deliver an adequate distal root moment. The problem could have been prevented by using an archwire with a root tip back bend between the first and second molars. Further retraction of the mandibular arch was not feasible because of the limit of the ascending ramus, bilaterally. The discrepancies in marginal ridges resulted from the distal forces on both arches to retract the buccal segments, which resulted in distal tipping of posterior teeth. Cephalometric superimpositions (*Fig. 9*) demonstrated total arch retraction of both arches. Retraction of the entire mandibular arch with TAD anchorage resulted in distal tipping of the entire arch, because the line of force for the elastic chains is occlusal to the center of resistance of the buccal segments. These mechanics result in a crown-distal moment on the entire mandibular arch. During full arch retraction the mandibular teeth extrude, due to the inclined plane effect of the tapered alveolus for each tooth. The mandibular arch extrusion was beneficial for opening the bite and posteriorly rotating the mandible to retract the chin and improve the concave profile. Overall, this challenging skeletal malocclusion was treated to a clinically acceptable facial and dental results. The treatment results are short of a board quality finish, so this treatment

approach was defined as a compromised outcome. None the less, this case report is a valuable addition to the literature, because it demonstrates the limit of mandibular arch retraction to correct skeletal Class III malocclusion. In retrospect, more care in applying root distal moments for the mandibular buccal segments during full arch retraction would have considerably improved the final occlusal outcome.

Discussion

One of the most important keys to successful Class III treatment is differential diagnosis, based on: the skeletal discrepancy between the maxilla and mandible, the extent of dental Class III relationship, divergency, dental compensations, transverse dimension, asymmetry, family history and growth potential. In considering the positive factors for a Class III malocclusion,[4] less severe Class III skeletal and dental relationships generally offer the best prognosis.

The facial profile is usually the most important factor in deciding if orthognathic surgery is necessary for optimal correction of the malocclsuion. The second most important factor for treatment planning is the extent of facial asymmetry, because orthodontics alone may be inefficient.[5] If the lateral profile is concave and/or there is extensive facial asymmetry, orthognathic surgery may be essential for an optimal outcome. Extraction treatment is often indicated for Class III malocclusions with lip protrusion and/ or crowding.[6] One of the most common extraction patterns is upper second premolars and lower first premolars. For very protrusive Class III patients, extraction of all four first premolars remains the

treatment of choice, but it may be necessary to reinforce lower posterior anchorage with TADs.

Bilateral extraction of mandibular premolars is often the preferred option for patients with a markedly deficient midface and full cusp or more Class III molar relationships.[2] However, this approach is not ideal because the occlusion must be finished in Class III molar relationships. If lower first molars are restoratively compromised, they can be extracted instead of the premolars, which permits the occlusion to be corrected to a Class I relationship. However, the latter approach may complicate correction of the anterior crossbite and/or result in excessive overjet during space closure. Upper posterior TADs or Class II elastics may be needed. Care should be taken not to over-retract the lower incisors to avoid root dehiscences on the lingual surfaces.

A nonextraction approach with TAD anchorage to retract the entire dentition[3] is a viable alternative, which can prevent bimaxillary protrusion after teeth are aligned (*Fig. 20*), but the method does have anatomical limitations. For maxillary dental arch retraction, Sugawara[7] suggests that the average amount of upper molar distalization is 3.78mm at the crown level and 3.2mm at the root level. However, attempts to translate mandibular molars distally have been less successful: 3.5mm at crown level and 1.8mms at root apex level.[8] Thus, there is more of a tendency for mandibular molars to tip rather than to be translated distally.

The marked crowding in each arch precluded conventional non-extraction treatment because it

would have produce excessive expansion of the arch and/or proclination of incisors. Such compromises may predispose a patient to relapse. With extra-alveolar TAD anchorage, the corrected dentition can be aligned over the apical base of bone, but anatomical limitations, in the length of the alveolar process, may prevent complete Class III dental correction. In this event, a careful evaluation is indicated to determine if the expected results will be acceptable. Although the molar relationships could not be corrected to Class I, overjet, overbite and the canine relationships were corrected to near Class I, and the intercuspation of the buccal segments was acceptable. The facial profile remained the same, which was deemed acceptable by the patient and her parents, when they initially choose the compromise treatment option.

Because of the limitations in the amount of molar retraction, that can be achieved with TAD anchorage, clinicians should inform patients with severe Class III malocclusions that a re-evaluation will be conducted at 8 to 10 months, after the start of the treatment, to decide on the final treatment plan. If the initial nonextraction treatment is unsatisfactory, the treatment plan can be modified into an extraction approach. Furthermore, there may be complaints of discomfort as periodontal tissue builds-up distally to the terminal molars, and periodontal surgery may be necessary to reduce the amount of gingival tissue in the direction of tooth movement.

Conclusion

Total arch retraction with extra-alveolar TAD anchorage provides a valuable nonextraction treatment option for Class III patients with severe

crowding and midface deficiency. However, the posterior boundaries of denture bearing area might not allow complete correction to ideal Class I molar relationships. Although the treatment resulted in a compromise, the author would like to share this clinical experience, as a viable option for Class III patients who decline extractions and/or orthognathic surgery.

Acknowledgment

References

1. Warren DW. Keys to treatment plans for Class III patients with skeletal discrepancies. J Clin Orthod 1990;24(6): 370-4.

2. Clifton OW. Lower first premolar extraction: a viable alternative? Am J Orthod Dentofacial Orthop 1986;90(2): 158-63.

3. Chung KR, Kim SH, Kang YG, Nelson G. Orthodontic miniplate with tube as an efficient tool for borderline cases. Am J Orthod Dentofacial Orthop 2009;139(4): 551-62.

4. Campbell PM. The dilemma of Class III treatment. Early or late? Angle Orthod 1983;53(3): 175-91.

5. Anhoury PS. Nonsurgical treatment of an adult with mandibular asymmetry and unilateral posterior crossbite. Am J Orthod Dentofacial Orthop 2009;135(1): 118-26.

6. Campbell MA, Jacobson A. Class III crowding: the extraction dilemma. Am J Orthod Dentofacial Orthop 1987;92(5): 365-74.

7. Sugawara J, Kanzaki R, Takahashi I, Nagasaka H, Nanda R. Distal movement of maxillary molars in nongrowing patients with the skeletal anchorage system. Am J Orthod Dentofacial Orthop 2006;129(6):723-33.

8. Sugawara J, Daimaruya T, Umemori M, Nagasaka H, Takahashi I, Kawamura H, Mitani H. Distal movement of mandibular molars in adult patients with the skeletal anchorage system. Am J Orthod Dentofacial Orthop 2004;125 (2):130-8.

Discrepancy Index Worksheet

TOTAL D.I. SCORE | 36 |

OVERJET

0 mm. (edge-to-edge)	=	
1 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
7.1 – 9 mm.	=	4 pts.
> 9 mm.	=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth   =

Total   = | 9 |

OVERBITE

0 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
Impinging (100%)	=	5 pts.

Total   = | 0 |

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth
then 1 pt. per additional full mm. per tooth

Total   = | 0 |

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total   = | 0 |

CROWDING (only one arch)

1 – 3 mm.	=	1 pt.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total   = | 7 |

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side ____ pts.
Full Class II or III	=	4 pts. per side 8 pts.
Beyond Class II or III	=	1 pt. per mm. ____ pts. additional

Total   = | 8 |

LINGUAL POSTERIOR X-BITE

1 pt. per tooth   Total   = | 1 |

BUCCAL POSTERIOR X-BITE

2 pts. per tooth   Total   = | 2 |

CEPHALOMETRICS   (See Instructions)

ANB ≥ 6° or ≤ -2°   =   4 pts.

  Each degree < -2° _____ x 1 pt. = _____

  Each degree > 6° _____ x 1 pt. = _____

SN-MP

  ≥ 38°   =   2 pts.
  Each degree > 38° _____ x 2 pts. = _____

  ≤ 26°   =   1 pt.
  Each degree < 26° _____ x 1 pt. = _____

1 to MP ≥ 99°   =   1 pt.
  Each degree > 99° _____ x 1 pt. = 4

Total   = | 4 |

OTHER   (See Instructions)

Supernumerary teeth	_____ x 1 pt. =	_____
Ankylosis of perm. teeth	_____ x 2 pts. =	_____
Anomalous morphology	_____ x 2 pts. =	_____
Impaction (except 3rd molars)	_____ x 2 pts. =	_____
Midline discrepancy (≥3mm)	@ 2 pts. =	2
Missing teeth (except 3rd molars)	_____ x 1 pts. =	_____
Missing teeth, congenital	_____ x 2 pts. =	_____
Spacing (4 or more, per arch)	_____ x 2 pts. =	_____
Spacing (Mx cent. diastema ≥ 2mm)	@ 2 pts. =	_____
Tooth transposition	_____ x 2 pts. =	_____
Skeletal asymmetry (nonsurgical tx)	@ 3 pts. =	3
Addl. treatment complexities	_____ x 2 pts. =	_____

Identify:

Total   = | 5 |

Cast-Radiograph Evaluation

Occlusal Contacts

Case #   3   **Patient**

Total Score: 39

Alignment/Rotations

7

Marginal Ridges

13

Occlusal Relationships

9
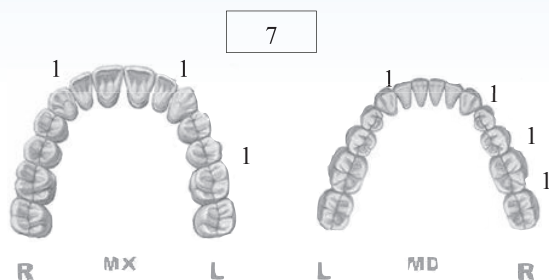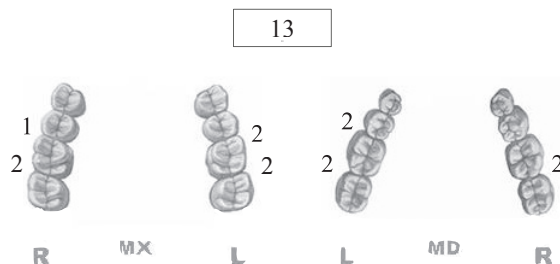
Buccolingual Inclination

5
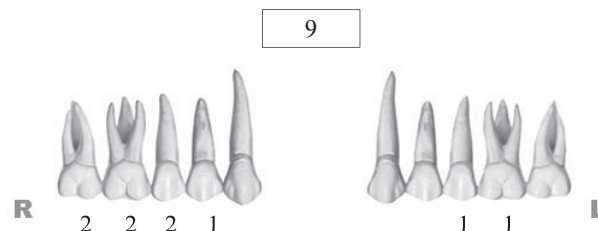
Interproximal Contacts

0

Overjet

0

Root Angulation

1
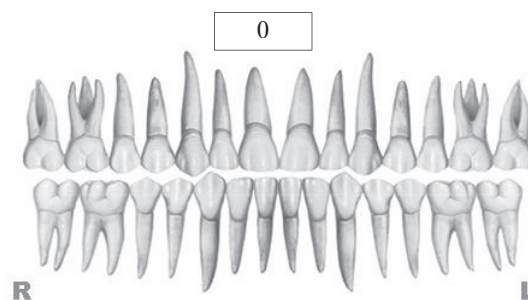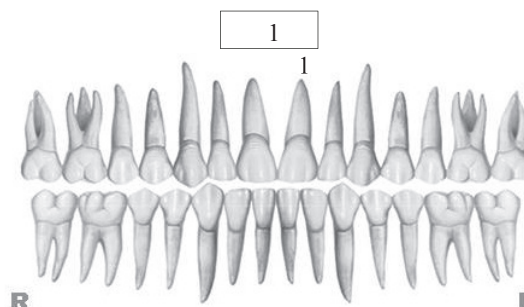
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.