

Non-Extraction Treatment of a Class III/Class I Malocclusion with Anterior Crossbite

Abstract

History: No contributing medical factors were reported, but ectopic eruption of the maxillary central incisors was probably an etiologic factor for the anterior crossbite.

Diagnosis and Etiology: Ectopic eruption of the maxillary central incisors was deemed the proximal cause of this asymmetric malocclusion (Class III right, Class I left) with 1.5mm midline discrepancy and anterior crossbite. There was about a 1mm functional shift (forward and left), and the 3-ring diagnostic sequence indicated conservative management was feasible.

Treatment: Correct anterior crossbite with an anterior bite turbo and early light short elastics. Interproximal enamel reduction in the lower arch is needed. Retract the mandibular arch with mandibular buccal shelf (MBS) bone screw anchorage.

Results: The anterior crossbite was corrected in 4 months, but lower arch retraction and finishing required 21 months of active treatment. Upper lip protrusion and lower lip retrusion improved the facial profile. The Cast-Radiograph Evaluation (CRE) was 15, and the Pink & White Esthetic Score was 3.

Conclusions: Conservative anterior crossbite correction combined with retraction of the entire lower arch produced stable facial and dental outcomes four years after treatment. (*J Digital Orthod* 2020;58:46-64)

Key words:

Class III/Class I malocclusion, anterior crossbite, bite turbo, early light short elastics, interproximal reduction, MBS bone screws

Introduction

Asymmetric Class III malocclusion with anterior crossbite is a clinical challenge in adult patients. Complex diagnosis and treatment considerations may contribute to unnecessary invasive treatment such as extractions and/or orthognathic surgery. Differential diagnosis of the skeletal and dentoalveolar aspects of the malocclusion may support an efficient, conservative treatment plan.

In addition to orthodontics, skeletal Class III malocclusion with anterior crossbite may require extractions and/or orthognathic surgery. Some patients may present a pseudo-Class III problem because of an anterior functional shift that results in anterior crossbite in centric occlusion (C_0). If the intermaxillary skeletal relationships, facial profile and bilateral molar classification are acceptable in centric relation (C_R), the anterior crossbite can be effectively managed with conservative fixed appliance treatment.¹⁻³ However, Class III camouflage treatment may result in labial or lingual tipping of the maxillary and mandibular incisors, respectively. Controlling the axial inclination of the incisors is an important objective for conservative treatment of Class III malocclusion.

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The aim of this case report is to discuss the diagnostic and treatment sequence for conservative management of an asymmetric Class III/Class I malocclusion with an anterior crossbite and a protrusive lower lip.

Diagnosis and Etiology

This 34-year-old female was concerned with poor dentofacial esthetics due to a protrusive lower lip, anterior crossbite, and incisal wear facets. Ectopic eruption of the maxillary central incisors at about age 6 was deemed the probable etiology of the malocclusion. The facial profile was straight (Fig. 1). In the frontal plane,



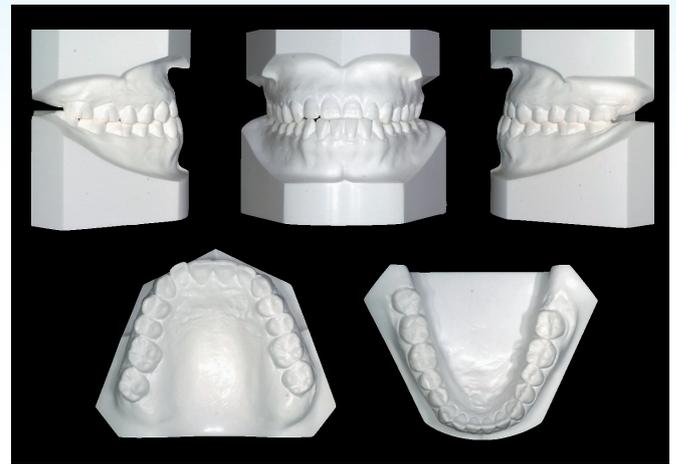
■ Fig. 1: Pre-treatment facial and intraoral photographs

the maxillary dental midline was coincident with the mid-facial plane, but the mandibular dental midline was shifted 1.5mm to the left. The anterior crossbite involved three maxillary incisors: both centrals and the left lateral incisor. Attrition of the maxillary central incisors was apparent when smiling (Fig. 2). There was a slight (~1.0mm) Cr to Co functional shift (*anterior and left*), but no signs nor symptoms of temporomandibular joint dysfunction. Maxillary and mandibular arches were square and tapered respectively. The molar relationships were end-on Class III on the right, and Class I on the left (Fig. 3). Overjet was -1mm in Co but 0 mm (*edge-to-edge*) in Cr. Overbite was 1-2mm in Co.

The pre-treatment cephalometric analysis in Co revealed a normal SNA (82°), but protrusive SNB



■ Fig. 2: Incisal attrition due to crossbite in the frontal and lateral views



■ Fig. 3: Pre-treatment study models (casts)

(83°). Vertical facial dimensions were increased, FMA (29°) and lower facial height (57%). Axial inclinations of the maxillary and mandibular incisors was decreased (Fig. 4, Table 1). The panoramic radiograph was unremarkable (Fig. 5). The American Board of Orthodontics (ABO) Discrepancy Index (DI) was 16 points, as shown in the supplementary Discrepancy Index Worksheet (Worksheet 1).



■ Fig. 4: Pre-treatment cephalometric radiograph



■ Fig. 5: Pre-treatment panoramic radiograph

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA° (82°)	82°	82°	0°
SNB° (80°)	83°	82.5°	0.5°
ANB° (2°)	-1°	-0.5°	0.5°
SN-MP° (32°)	36°	36°	0°
FMA° (25°)	29°	29°	0°
DENTAL ANALYSIS			
U1 To NA mm (4 mm)	4	6	2
U1 To SN° (110°)	105°	110.5°	5.5°
L1 To NB mm (4 mm)	4	3	1
L1 To MP° (90°)	81°	80.5°	0.5°
FACIAL ANALYSIS			
E-LINE UL (-1 mm)	-3.5	-2	1.5
E-LINE LL (0 mm)	1	0	1
%FH: Na-ANS-Gn (53%)	57%	56.5%	0.5%
Convexity: G-Sn-Pg' (13°)	0.5°	1°	0.5°

■ Table 1: Cephalometric summary

Treatment Objectives

1. Maintain skeletal dimensions in all three planes.
2. Use a full fixed appliance to level and align both arches.
3. Tip upper incisors anteriorly and retract the lower arch to correct overjet and overbite.
4. Resolve the functional shift to help correct the end-on Class III molar relationship on the right side, and mandibular midline deviation.
5. Protract upper and retract lower lips to improve the facial profile.
6. Reshape incisors and correct soft tissue margins as needed to improve dental esthetics.

Treatment Alternatives

Extraction space can be used to retract the mandibular anterior segment, or the entire mandibular arch can be retracted with skeletal anchorage.⁴ The first option was extraction of a mandibular incisor to facilitate crossbite correction, but that approach would complicate correction of both the Class III relationship and midline discrepancy. The second alternative was to extract the mandibular right second molar and close space between the third and first molars to correct the Class III molar relationship. However, asymmetric closure of a 10mm second molar space is challenging, and might result in lower arch asymmetry and an extended treatment time. The third alternative was to extract the mandibular right third molar and place mandibular buccal shelf bone

screws for anchorage to retract the entire lower arch. After a thorough discussion with the patient, the latter option was selected.

Treatment Progress

After the mandibular right third molar was extracted, a 0.022-in Damon Q® (Ormco, Brea, CA) fixed appliance was bonded on all permanent teeth. All archwires and auxiliaries were as specified by the same manufacturer. The maxillary archwire sequence was 0.014-in CuNiTi, 0.016-in CuNiTi, 0.014x0.025-in CuNiTi, 0.017x0.025-in TMA and 0.016x0.025-in SS. The corresponding mandibular sequence was 0.014-in CuNiTi, 0.014x0.025-in CuNiTi, and 0.016x0.025-in pre-torque CuNiTi (Table 2).

At the start of treatment, the maxillary arch was fitted with low torque brackets on the incisors to prevent excessive labial tipping. An anterior bite turbo was bonded on the incisal edges of the mandibular left lateral incisor and canine (Fig. 6). One month later the mandibular arch was bonded with

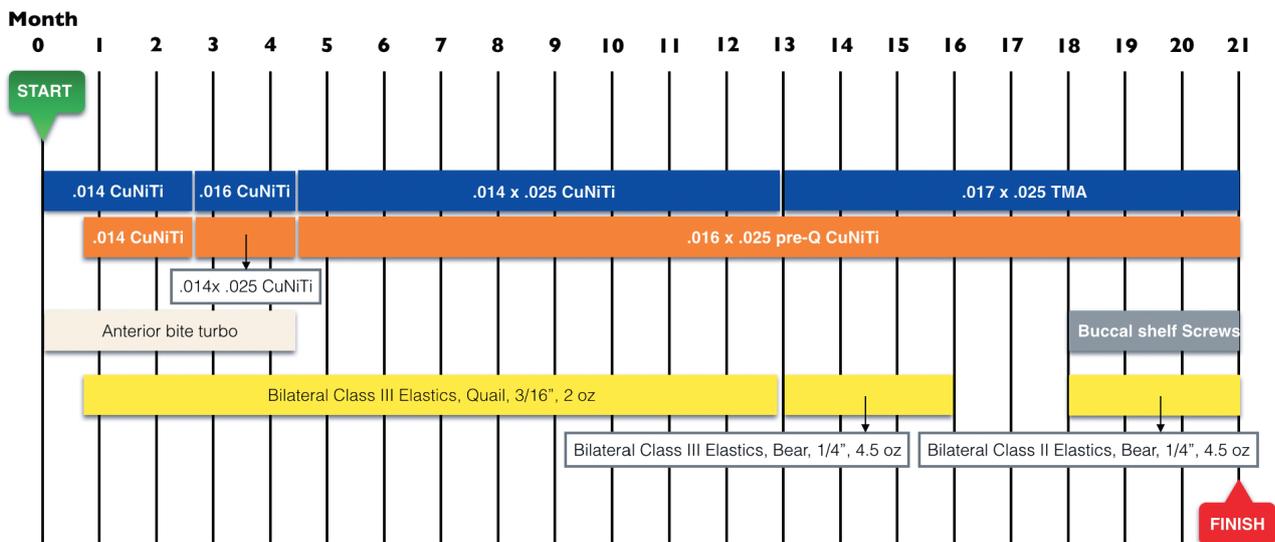


■ Fig. 6: Low-torque brackets were bonded on the upper anterior teeth. An anterior bite turbo was constructed with glass ionomer cement on the incisal edges of the lower left lateral incisor and canine.

Archwire Sequence Chart

Clinicians: Dr. Chris Chang
Patient: Miss Peng

- Maxillary Archwire
- Bite turbo
- Miniscrew
- Mandibular Archwire
- Elastics



■ Table 2: Archwire sequence of this case with the timing for using anterior bite turbo, elastics, and miniscrews

standard torque brackets. Bilateral Class III elastics (*Quail*, 3/16-in, 2 oz) were used from the lower first premolars to the upper first molars (*Fig. 7*).

In the fourth month, the anterior crossbite was corrected, the bite turbo was removed, and the maxillary archwire progressed to 0.014x0.025-in CuNiTi. To resist distal tipping of the lower incisors due to Class III elastics, a 0.016x0.025-in pre-torqued (+20°) CuNiTi mandibular archwire was placed (*Fig. 8*). In the ninth month, black triangles between lower incisors were corrected with IPR and space closure (*Fig. 9*).

In the thirteenth month, the maxillary archwire progressed to 0.017x0.025-in TMA, and the upper anterior teeth were ligated with stainless steel to prevent space opening (*Fig. 10*). Class III elastics (*Bear*,



Fig. 9:
In the 9th month of treatment, interproximal space was created in the incisal area with IPR.



Fig. 10:
In the 13th month, upper anterior teeth were stabilized with a figure-8 tie of stainless steel ligature.



Fig. 7: The anterior crossbite is improved with one month (1M) of treatment. See text for details.

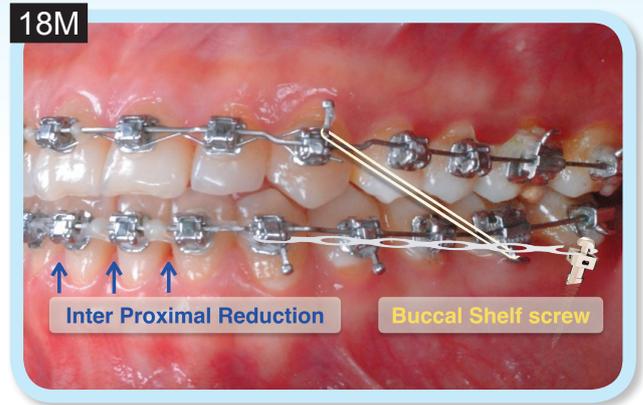


Fig. 8:
In the 4th month of treatment (4M), a 0.016x0.025-in pre-torqued (+20°) CuNiTi wire was inserted in the mandibular arch. Early-light short Class III elastics were attached from the lower first premolars to the upper first molars. See text for details.

1/4-in, 4.5 oz) were applied from the mandibular canines to the maxillary first molars.

In the eighteenth month, interproximal reduction was performed between the mandibular incisors. Two miniscrews (*OrthoBoneScrew*[®], OBS, 2x12mm, *iNewton Ltd.*, Hsinchu City, Taiwan) were inserted bilaterally in the buccal shelves to retract the mandibular dentition (Fig. 11). Class II elastics (*Bear*, 1/4-in 4.5 oz) were used to stabilize the overjet and overbite.

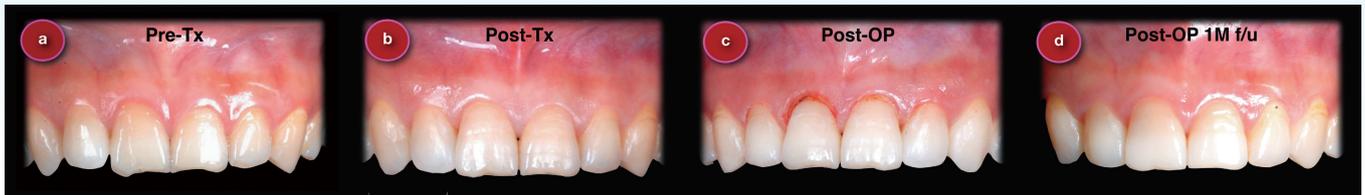
After 21 months of active treatment, all the appliances and OBSs were removed (Fig. 12). The



■ **Fig. 11:**
 In the 18th month, buccal shelf screws were placed bilaterally, IPR was performed in the lower incisor area, the lower arch was retracted with a chain of elastics, and Class II elastics retract the upper arch. See text for details.



■ **Fig. 12:** Post-treatment facial and intraoral photographs



■ Fig. 13:

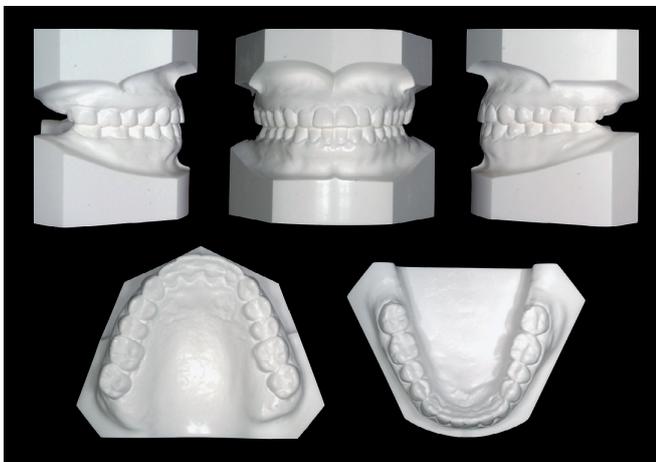
Upper anterior esthetics are shown pre-treatment (a), post-treatment after smoothing incisal edges (b), post-operative view after gingivoplasty of the right central incisor (c), and one month (1M) post-operative follow-up (d). See text for details.

abraded incisal edges of the maxillary incisors and maxillary canine cusp tips were rounded and polished (Fig. 13a-b). Gingivectomy was performed with a diode laser on the maxillary central and lateral incisors as needed (Fig. 13c-d).

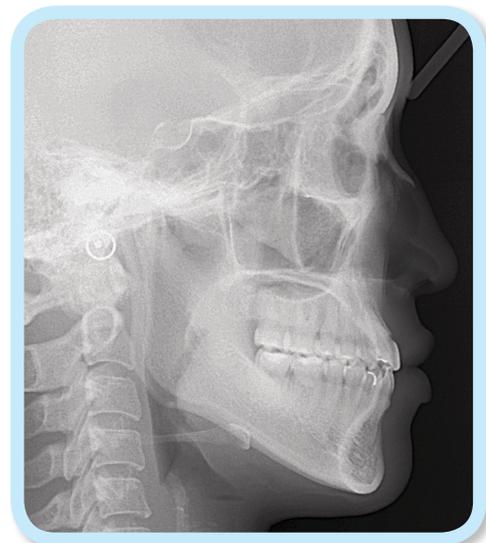
Fixed lingual retainers were bonded on maxillary incisors and the mandibular anterior segment. Clear overlays were delivered for both arches with instructions for full time wear for the first 6 months and nights only thereafter. Home care and retainer maintenance instructions were provided.



■ Fig. 15: Post-treatment panoramic radiograph



■ Fig. 14: Post-treatment study models (casts)



■ Fig. 16: Post-treatment cephalometric radiograph

Treatment Results

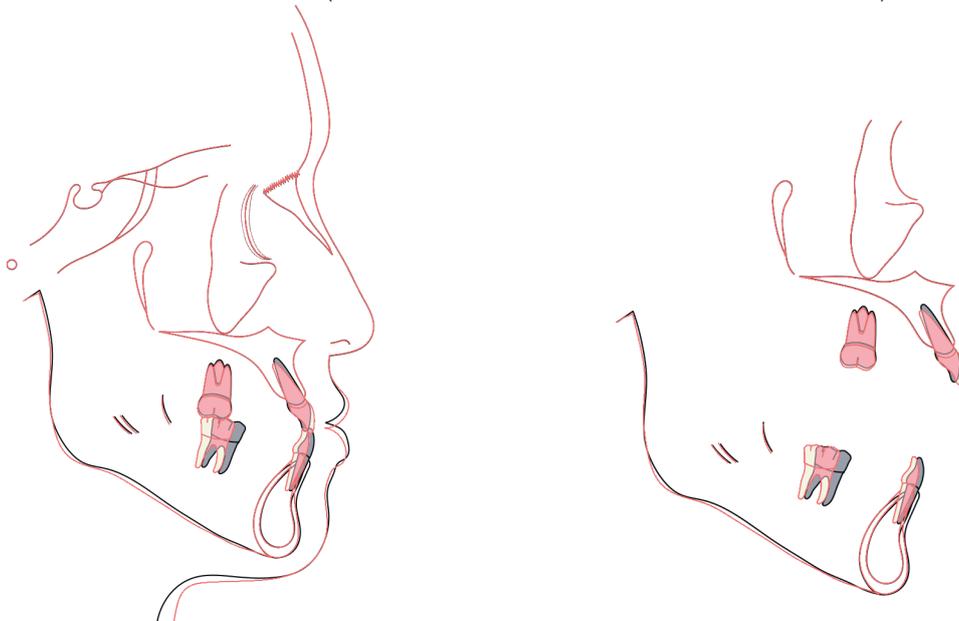
The patient was treated to the desired outcome as documented in Figs. 14-16. The post-treatment facial photographs (Fig. 12) document improved facial esthetics in profile associated with more harmonious balance between the upper and lower lips. The anterior crossbite was corrected and buccal relationships were Class I bilaterally. Post-treatment cephalometric analysis (Table 1) showed acceptable axial inclination of the upper (110.5°) and lower (80.5°) incisors. Superimposed cephalometric tracings document that the maxillary incisors were tipped labially and the mandibular arch was retracted (Fig. 17). The ABO Cast Radiograph Evaluation (CRE) score was 15 points (Worksheet 2), and the major residual discrepancy was marginal ridges (5 points). Dental esthetics are excellent as documented by the Pink and White dental esthetic index of 3 (Worksheet

3). Overall, the patient was well satisfied with the outcomes. Stability of the correction is documented with 4-year follow-up records (Fig. 18).

Discussion

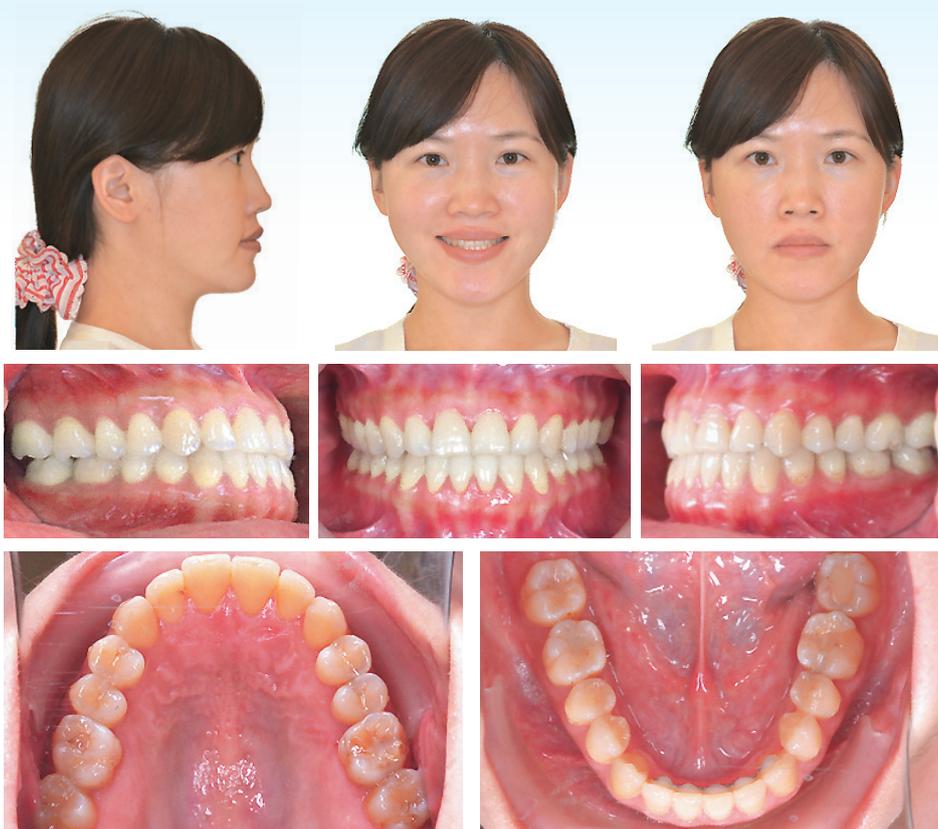
Dr. Lin's 3-Ring Diagnosis

Anterior crossbite with asymmetric Class III molar relationship suggests the need for complex, invasive treatment. Differential assessment with Dr. Lin's three-ring diagnosis method is an effective procedure for distinguishing which patients can be managed conservatively from those who require extractions and/or orthognathic surgery. Without a comprehensive diagnosis, most Class III malocclusions may be destined for unnecessary or over-invasive treatments, such as extractions,



■ Fig. 17:

Superimposed cephalometric tracings document labial tipping of the upper incisors, increased upper lip protrusion, and retraction of the mandibular dentition after treatment (red). See text for details.

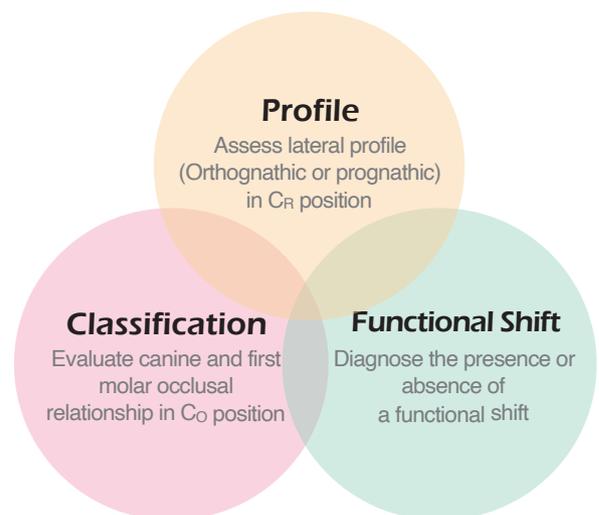


■ Fig. 18: Facial and intraoral photos 4-years post-treatment

rapid maxillary expansion and face mask (RME/FM), or orthognathic surgery. The three-ring diagnosis is an effective method for identifying Class III malocclusions that are likely to respond well to conservative orthodontic therapy (Fig. 19):¹⁻³

(1) Profile:

Despite a protrusive lower lip, facial profile was orthognathic in both the Co and Cr positions. This relationship suggests the patient will have a good response to dentoalveolar treatment without extractions or orthognathic surgery.¹⁻³



■ Fig. 19: Dr. Lin's 3-ring diagnosis for Class III malocclusion

(2) Classification:

Buccal relationships were Class III right and Class I left. The anterior crossbite in Co was associated with a small (<1mm) anterior and lateral (left) Co → Cr shift from an edge to edge relationship in Cr. Considering the modest intermaxillary skeletal discrepancy (ANB -1°) and functional shift, the asymmetric Class III relationship was deemed a dental Class III and not a skeletal malocclusion.

(3) Functional Shift:

The patient’s midline discrepancy, interdigitation asymmetry, and anterior crossbite were improved in Cr confirming there were both sagittal and frontal components to the functional shift (Fig. 20). These data suggest the asymmetric Class III with anterior crossbite was related to occlusal interference, which is a favorable scenario for conservative dentoalveolar treatment.

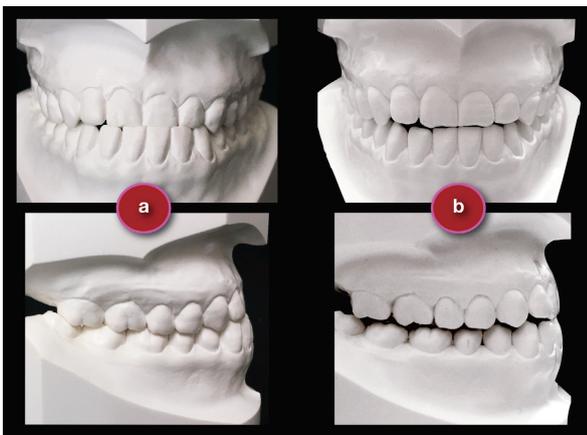


Fig. 20: Pre-treatment frontal and lateral views of the anterior crossbite (a) are compared to the same casts positioned in a Class I relationship (b). Note the correction of the midline discrepancy and the anterior crossbite when the molar relationship is Class I bilaterally. See text for details.

Four Key Points of Treatment

Conservative treatment was predictable based on three aspects of the planned mechanics: (1) proper torque-selection for brackets, (2) an anterior bite turbo with light-force Class III elastics, (3) IPR in the lower anterior region, and (4) lower arch retraction with buccal-shelf bone screws.

(1) Torque Selection & Class III Elastics:

Bracket torque selection (Table 3) and/or pretorqued archwires are very important for controlling the axial

Expected Side Effects of Class III Camouflage Treatment		Torque Selection of Damon Q System		
Maxillary Anterior Teeth	Proclination (Extraction)	Standard Torque U1 15	U2 6	High Torque U3 11
	Proclination (Non-extraction)	Low Torque U1 2	U2 -5	Low Torque U3 -9
Mandibular Anterior Teeth	Retroclination (Non-extraction)	Standard Torque L1 -3	L2 -3	Standard Torque L3 7
	Excessive retroclination (Extraction)	Low Torque Upside-down bonding L1 11	L2 11	High Torque L3 13

Table 3: Torque selection to compensate the side effects in Class III camouflage treatment with Damon Q system

inclination of incisors during camouflage treatment of Class III malocclusion.⁵⁻⁷ Low-torque brackets were selected for the upper incisors to generate resistance to labial tipping. Standard torque brackets combined with a 0.016 x 0.025-in pre-torqued (+20°) CuNiTi wire were chosen to prevent excessive lingual tipping of the mandibular incisors (Fig. 21) during correction of anterior crossbite (Fig. 22).



Fig. 21: Illustration of camouflage treatment mechanics shows incisal crown tipping (yellow arrows) due to Class III elastics. The tipping is resisted in the upper arch with low torque brackets (green curved arrow), and a pre-torqued CuNiTi archwire in the lower arch (red curved arrow). See text for details.

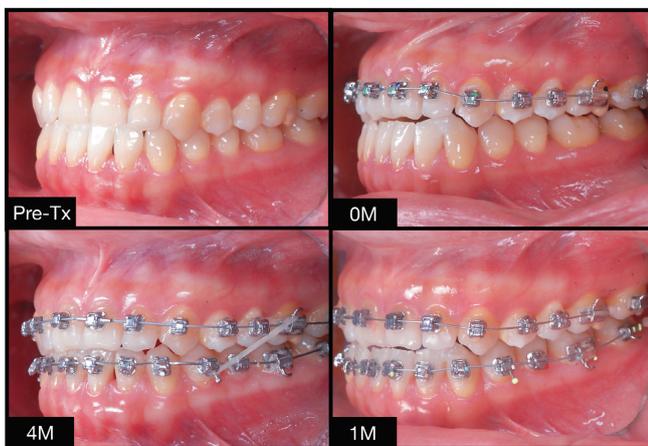


Fig. 22: The first four months (4M) of anterior crossbite treatment is shown in clockwise order: pre-treatment (Pre-Tx), start (0M), one month (1M), and 4M with Class III elastics shown. See text for details.

(2) Anterior Bite Turbo:

There are numerous methods for modifying occlusion to help correct moderate anterior crossbites. Biting on a wooden tongue blade is a simple approach, but many patients fail to adequately cooperate and the range of the mechanics is limited.⁸ Upper removable or lower fixed acrylic bite plates are also common methods, but both require impressions and laboratory procedures which increase the cost and number of appointments.^{9,10} A composite-resin inclined plane can be constructed on the lower incisors, but it is a bulky appliance (3-4mm thick) that provides about a 45° slope extending from the lingual to the labial surface (Fig. 23). This method for single tooth crossbite correction is safe and easy to apply, comfortable, and esthetically acceptable.^{11,12}

All of the occlusion modification methods reviewed can be used as auxiliaries with fixed appliances, but a more convenient approach is an anterior bite turbo that unlocks the occlusion to permit tooth movement with archwire action and intermaxillary elastics (Fig. 22). The present bite turbo was an



Fig. 23: A composite-resin inclined plane is shown in another patient that tips the upper left central incisor in a labial direction. The treatment is described in reference 12 of this article.¹²

occlusal prematurity constructed with glass ionomer cement on the incisal edge of the lower left lateral incisor and canine (Fig. 6). The bite opening effect (Fig. 7) permits the light force Class III elastics and archwire action to correct the anterior crossbite in less than 4 months (Fig. 22).

(3) Interproximal Reduction vs. Extractions:

Numerous case reports and reviews support extractions and differential space closure as an effective option for management of adult Class III malocclusions.¹³⁻¹⁶ The choice of extraction sites depends on the severity and symmetry of the sagittal discrepancy and crossbite(s). Extraction of one mandibular incisor is effective if there is excessive lower incisor mesiodistal arch length (*Bolton discrepancy*) and/or severe lower anterior crowding.^{13,14} First or second molar extraction may be preferred when the third molar(s) are erupted and healthy.^{15,16} Asymmetric buccal segments (*Class III and Class I*) can be managed by differential premolar extractions, i.e. first premolar on one side and second premolar on the other.

If the anterior Bolton excess in the lower arch is less than 2mm, interproximal reduction (*IPR*) of the mandibular incisors is a viable option instead of mandibular incisor extraction.^{14,17,18} Mandibular incisal IPR should be limited to about 0.5mm on each surface, and the enamel removed should not exceed 50% of the total enamel thickness. Generally, IPR should focus on the areas of the mandibular teeth with greater enamel thickness: distal surfaces of the lateral incisors and the mesial and distal



■ Fig. 24:

A series of frontal photographs shows the treatment sequence to correct lower incisor black triangles (4M) with IPR at nine months (9M). Closure to the IPR generated space produces the final result seen after treatment at twenty-one months (21M).

surfaces of the canines.¹⁸ Furthermore, IPR is useful for eliminating black triangles (Fig. 24).

(4) Skeletal Anchorage:

Extra-alveolar bone screws in the mandibular buccal shelf region (*external oblique ridge area*) offer maximum anchorage for retracting the entire mandibular arch to resolve a variety of Class III malocclusions (Fig. 25).^{7,19} These temporary anchorage devices have a high success rate (92.8%),

and are effective anchorage for conservative correction of Class III malocclusion.^{4,20}

To correct the intermaxillary relationship (*Bolton discrepancy*) of the anterior segments, IPR of the

mandibular incisors was performed twice. The initial IPR was combined with Class III elastics and an anterior bite turbo, and the final IPR was in conjunction with buccal shelf OBSs and Class II elastics in the finishing stage (*Table 4*). Collectively, the conservative mechanics and two steps in IPR achieved the desired result in 21 months (*Fig. 26*).



Fig. 25:
A mandibular buccal shelf bone screw is inserted buccal to the roots of the lower molar(s).

Conclusions

- (1) A thorough differential diagnosis of adult Class III malocclusion is indicated to determine if conservative fixed appliance treatment is feasible.
- (2) Bracket torque selection is an effective technique for controlling the labiolingual inclination of the dentition.

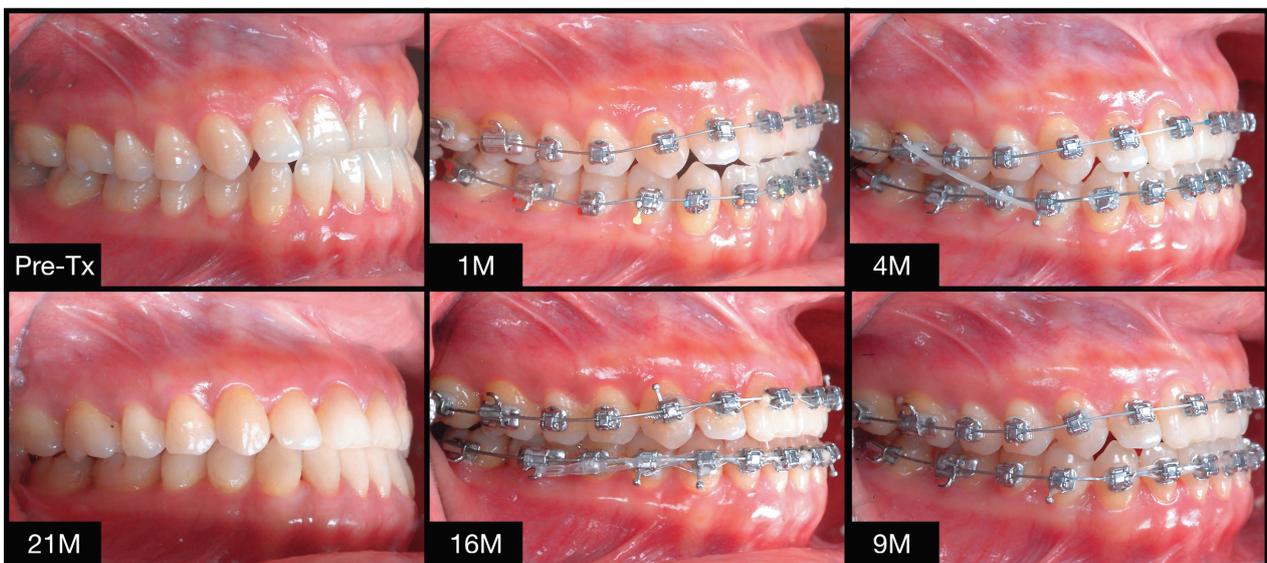


Fig. 26:
A progressive clockwise series of right buccal photographs shows correction of the Class III molar relationship: pre-treatment (Pre-Tx), one month (1M), four months (4M), nine months (9M), sixteen months (16M), and twenty-one months (21M) which is the post-treatment result.

	Management	Function	Treatment Object
Initial stage	Anterior bite turbo	vertical stop	correct anterior crossbite
	<u>Interproximal reduction</u>	correct the excessive tooth size of mandibular anteriors	increase the overjet
	Class III elastics	protract upper anteriors and retract the lower anteriors	both above
Finishing stage	Buccal shelf screw	supply maximum anchorage to retract lower anteriors, upright lower molars, and retrocline flared upper anteriors	correct Class III canine and molar relationships
	<u>Interproximal reduction</u>	supply space for mandibular anteriors retraction	correct Class III canine relationship
	Class II elastics	retrocline the flared maxillary anteriors	stable the overjet and overbite

■ Table 4: The management in initial and finishing stage to treat this case

- (3) An anterior bite turbo(s) and early light short elastics are simple and rapid treatment for anterior crossbite.
- (4) Interproximal reduction of enamel thickness creates space to alleviate crowding, decrease incisal axial inclination, and/or correct a Bolton discrepancy in the anterior segments.
- (5) Extra-alveolar OBS anchorage is effective for retraction of the lower arch.



Acknowledgment

Thanks to Dr. Chris Lin, and Dr. Ming-Jen Chang for the instructions of this case. Thanks to Mr. Paul Head for proofreading this article. And special thanks to my family for supporting me on my way studying Orthodontics.

References

1. Lin JJ, Liaw JL, Chang CH, Roberts WE. Class III correction, in orthodontics. Taipei, Taiwan: Yong Chieh Enterprise, Co, Ltd; 2013.
2. Lin JJ. Creative orthodontics: Blending the Damon system & TADs to manage difficult malocclusion. 2nd edition. Taipei, Taiwan: Yong Chieh Enterprise, Co, Ltd; 2010.
3. Lin JJ. The most effective and simplest ways of treating severe Class III, without extraction or surgery. *Int J Ortho Implantol* 2014;33:4-18.
4. Huang C, Chang CH, Roberts WE. 3D cortical bone anatomy of the mandibular buccal shelf: a CBCT study to define sites for extra-alveolar bone screws to treat Class III malocclusion. *Int J Orthod Implantol* 2016;41:74-82.
5. Thomas WW. Torque for optimal inclination. *Clin Impressions* 2009;17:21-27.
6. Tseng LY, Chang CH, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. *Am J Orthod Dentofacial Orthop* 2016;149:555-566.
7. Jing Y, Han XL, Guo YW, Li JY, Bai D. Nonsurgical correction of a Class III malocclusion in an adult by miniscrew-assisted mandibular dentition distalization. *Am J Orthod Dentofacial Orthop* 2013;143:877-887.
8. Lee BD. Correction of crossbite. *Dent Clin North Am* 1978;22:647-668.
9. Jacobs SG. Teeth in crossbite: the role of removable appliances. *Aust Dent J* 1989;34:20-28.
10. Croll TP, Riesenber RE. Anterior crossbite correction in the primary dentition using fixed inclined plane I. *Quintessence Int* 1988;1:546-552.
11. Sari S, Gokalp H, Aras S. Correction of anterior dental crossbite with composite as an inclined plane. *Int J Paediatr Dent* 2001;11:201-208.
12. Arikan V, Sari S. Using Composite resin inclined plane for the repositioning of a laterally luxated primary incisor: a case report. *Eur J Den* 2011;5:117-120.
13. Wissam D, Julie C, Morris HW. Nonsurgical treatment of an adult with a Class III malocclusion. *Am J Orthod Dentofacial Orthop* 2007;132:243-251.
14. Kumaresan J, Kumar TS, Kumar S. Skeletal class III camouflage by mandibular incisor extraction: A case report. *Asian Pacific Orthodontic Society Trends in Orthodontics* 2014;4:40-44.
15. Jiuxiang L, Yan G. Lower second molar extraction in correction of severe skeletal Class III malocclusion. *Angle Orthod* 2006;76:217-225.
16. Ruellas AC, Baratieri C, Roma MB, Izquierdo Ade M, Boaventura L, Rodrigues CS, Telles V. Angle Class III malocclusion treated with mandibular first molar extractions. *Am J Orthod Dentofacial Orthop* 2012;142(3):384-392.
17. Kokich VG, Shapiro PA. Lower incisor extraction in orthodontic treatment: Four clinical reports. *Angle Orthod* 1984;54:139-53.
18. Almeida NV, Silveira GS, Pereira DMT, Mattos CT, Mucha JN. Interproximal wear versus incisors extraction to solve anterior lower crowding: A systematic review. *Dental Press J Orthod* 2015;20:66-73.
19. Laura P, Aimara AS, Luis THG. Dentoalveolar class III treatment using retromolar miniscrew anchorage. *Progress in Orthodontics* 2013;14:7-12.
20. Chang CH, Liu SY, Roberts WE. Primary failure rate for 1680 extra-alveolar mandibular buccal shelf mini-screws placed in movable mucosa or attached gingiva. *Angle Orthod* 2015;85:905-910.

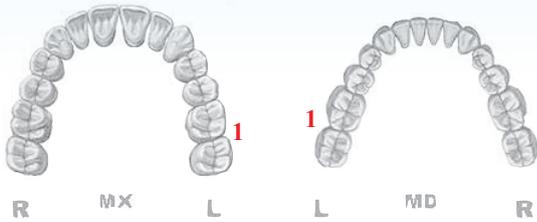


Cast-Radiograph Evaluation

Total Score: 15

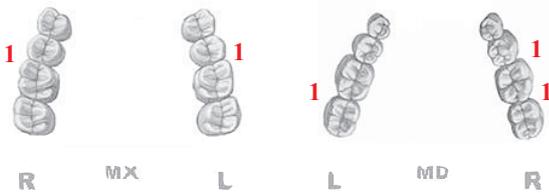
Alignment/Rotations

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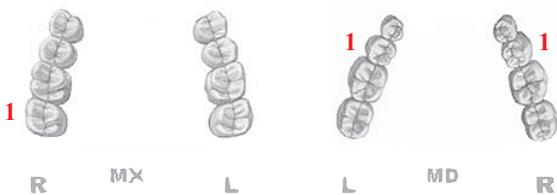
Marginal Ridges

5



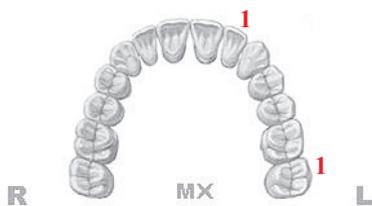
Buccolingual Inclination

3



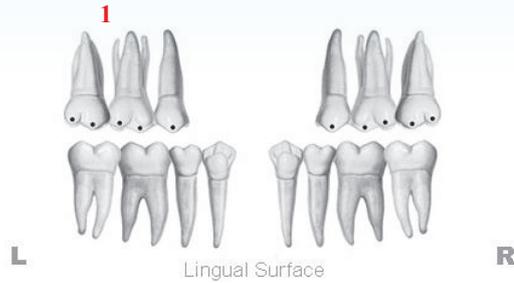
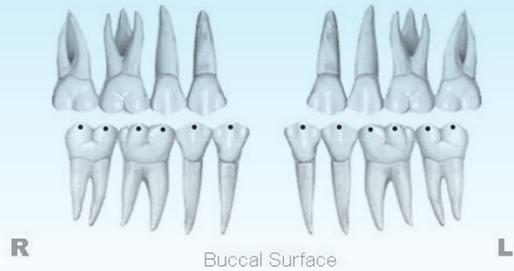
Overjet

2



Occlusal Contacts

2



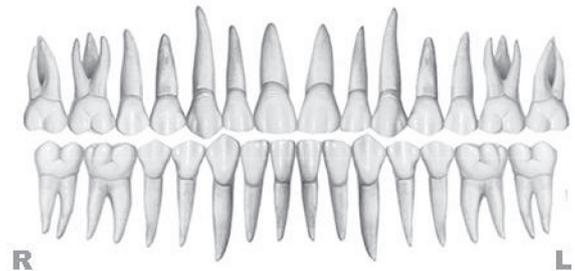
Occlusal Relationships

0



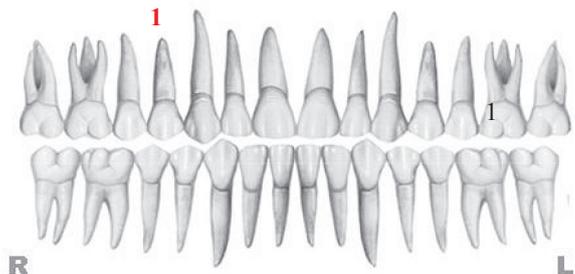
Interproximal Contacts

0



Root Angulation

1

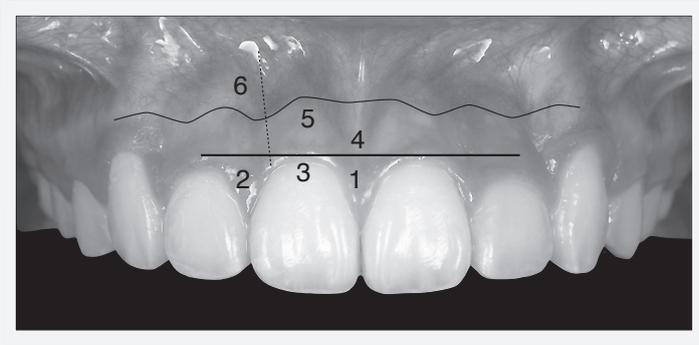


INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 3

1. Pink Esthetic Score

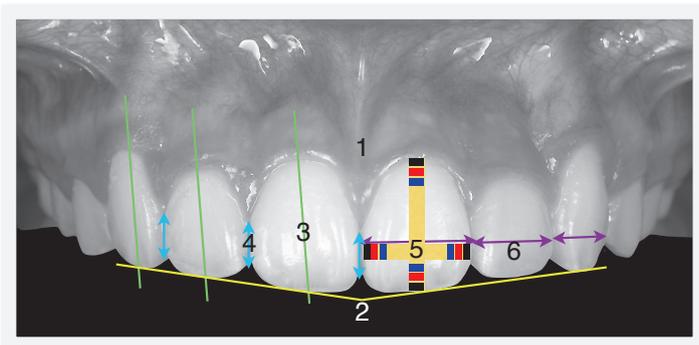


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

Total = 0

1. M & D Papilla	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

2. White Esthetic Score (for Micro-esthetics)



1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2

Total = 3

1. Midline	0	1	2
2. Incisor Curve	0	1	2
3. Axial Inclination (5°, 8°, 10°)	0	1	2
4. Contact Area (50%, 40%, 30%)	0	1	2
5. Tooth Proportion (1:0.8)	0	1	2
6. Tooth to Tooth Proportion	0	1	2