

Conservative Management of Class I Crowded Malocclusion Complicated by Severe Maxillary Protrusion, Facial Convexity and Deepbite

Abstract

A 20-year-9-month old male presented with a Class I malocclusion complicated with severe crowding in the lower arch (-7mm), Class II skeletal pattern (SNA 88.5°, ANB 8.8°), steep mandibular plane (FMA 29.4°), convex profile (G-Sn-Pg' 20°), and anterior deepbite (5.5mm). Despite the severe skeletal discrepancy, the patient had good facial balance, so conservative treatment with no extractions or orthognathic surgery was indicated. The nonextraction treatment plan relied on infrazygomatic (IZC) miniscrew anchorage to retract both arches and rotate the mandible anteriorly, to decrease the vertical dimension of occlusion (VDO) and increase lower lip protrusion. Space to correct the severe crowding was accomplished with posterior arch expansion, retraction of upper and lower molars, and increased axial inclination of the lower incisors. In brief, this severe skeletal malocclusion (DI 24) was corrected in 15 months to an overall excellent outcome (CRE 16), but it was necessary to flare the lower incisors, and accept a Class II buccal occlusion on the right side, to avoid facial compromise. Step-by-step procedures are provided for the efficient camouflage approach used to resolve this severe, compensated malocclusion in an efficient manner. (Int J Orthod Implantol 2016;44:4-16)

Key words:

Class I, crowding, protrusive maxilla, deepbite, non-extraction conservative treatment, TADs (temporary anchorage devices), IZC (infrazygomatic crest) miniscrews, compromise treatment, camouflage

History

A young adult male (20y9m) presented with severe crowding, deep overbite, lingual crossbite of the upper left lateral incisor, and buccal crossbite of the lower right canine (Figs. 1-3). Despite the skeletal discrepancy, convex profile, and severe space deficiency, the patient's facial proportions were acceptable, so conservative treatment with no extractions or orthognathic surgery was indicated. Extra-alveolar bone screw anchorage, bilateral infrazygomatic (IZC) miniscrews, was used to retract both arches and rotate the mandible anteriorly, to partially correct the intermaxillary skeletal discrepancy. Fifteen months of active treatment with a passive self-ligating (PSL) appliance (Damon Q®,Ormco, Glendora, CA) produced an excellent alignment (CRE 16) for a severe Class II skeletal malocclusion (DI 24) (Figs. 4-6). Treatment documentation is provided by cephalometric and panoramic radiographs before and after treatment in (Figs. 7 and 8), in addition to superimposed cephalometric tracings (Fig. 9).

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■ **Fig. 1:**

Pre-treatment facial photographs show a convex profile, good facial proportions, and a chin point deviated slightly to right.



■ **Fig. 4:**

Post-treatment facial photographs document maintenance of the profile with a slight increase in lower lip prominence.



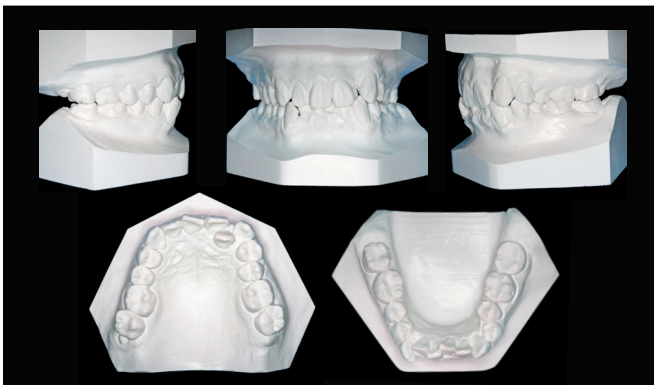
■ **Fig. 2:**

Pre-treatment intraoral photographs reveal a bilateral Class I occlusion with coincident upper dental and facial midlines, but the lower dental midline was 3mm to the right. Overjet was 1mm and overbite was maximal (5.5mm or 80%) in the left lateral incisor area.

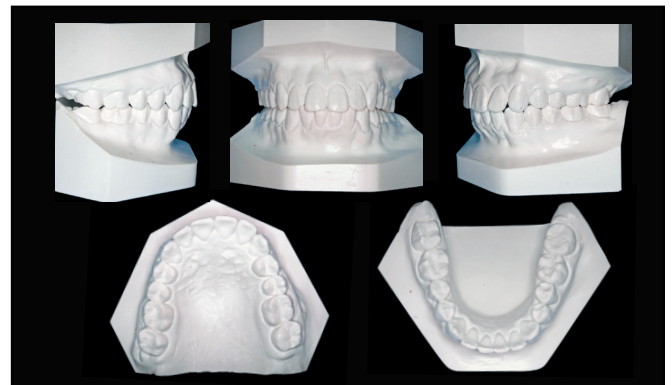


■ **Fig. 5:**

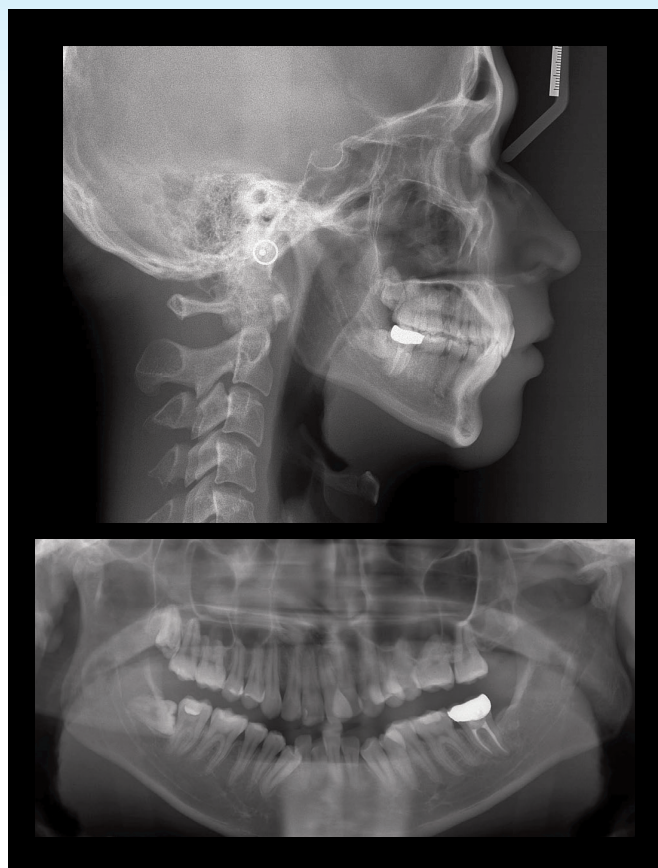
Post-treatment intraoral photographs show a near ideal dental alignment except for a Class II buccal segment on the right.



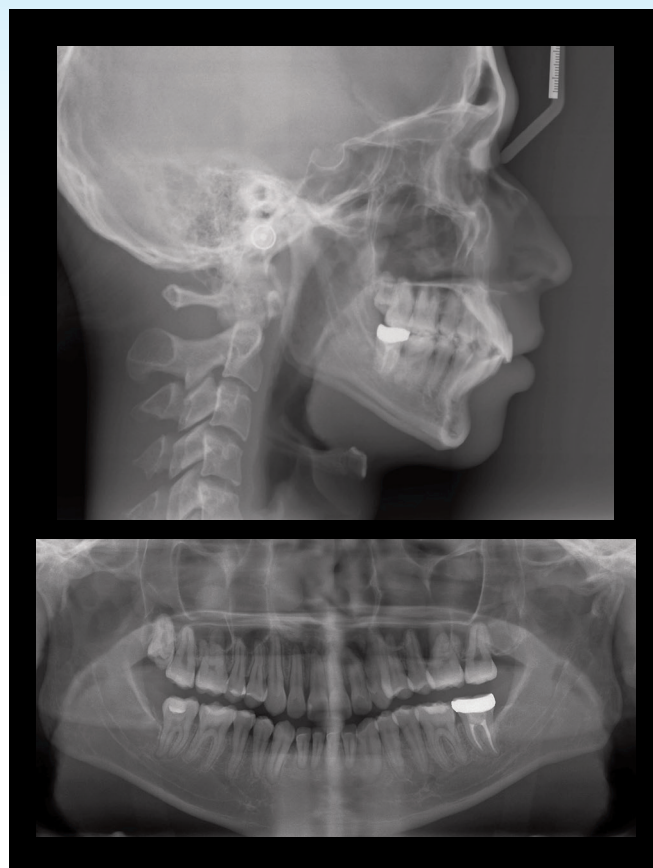
■ **Fig. 3:** Pre-treatment study models (casts)



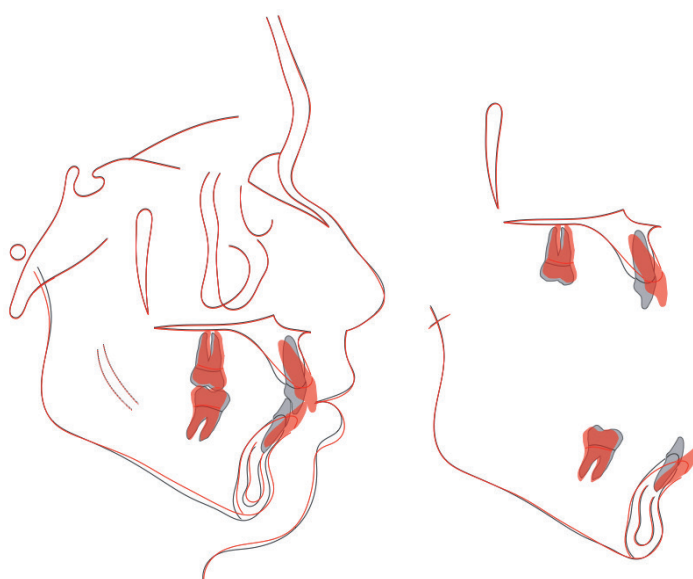
■ **Fig. 6:** Post-treatment study models (casts)



■ **Fig. 7:**
Pre-treatment cephalometric (above) and panoramic (below) radiographs



■ **Fig. 8:**
Post-treatment cephalometric (above) and panoramic (below) radiographs



■ **Fig. 9:** Superimpositions of cephalometric tracings (Blue: initial, Red: final)

Diagnosis and Etiology

Pre-treatment facial photographs reveal a tapered lower facial form with a convex profile (Fig. 1). Although the facial and maxillary dental midlines were coincident, the left central incisor was tilted to the left, and the chin point was deviated slightly to the right. Pre-treatment intraoral photographs and study casts revealed Class I buccal segments, bilaterally. Crowding was 4mm in the upper arch and 7mm in the lower arch (Figs. 2 and 3). The lower dental midline was deviated about 3mm to the right, and the overbite was 5.5mm (80%). Cephalometric analysis (Table 2) revealed a Class II skeletal pattern with an increased facial height: 8.8° ANB, 35.1° SN-MP, 29.4° FMA. Dental compensation (82.3° U1-SN, 92.5° L1-MP) resulted in Class I canine and molar relationships despite the severe Class II skeletal discrepancy. Because of an acceptable facial form, conservative treatment was indicted, utilizing extra-

alveolar miniscrews for anchorage to retract the arches and close the vertical dimension of occlusion (VDO), i.e. decrease lower facial height.

Objectives

Maxilla (all three planes):

- A - P: *Maintain*
- Vertical: *Maintain*
- Transverse: *Maintain*

Mandible (all three planes):

- A - P: *Maintain*
- Vertical: *Decrease*
- Transverse: *Maintain*

Maxillary Dentition:

- A - P: *Labially tip the incisors*
- Vertical: *Maintain*
- Transverse: *Expand*

Mandibular Dentition:

- A - P: *Labially tip the incisors*
- Vertical: *Maintain*
- Transverse: *Expand*

Facial Esthetics:

- Increase lip protrusion

Treatment Plan

Non-extraction treatment was planned to utilize a PSL appliance, IZC miniscrew anchorage, and Class III elastics to gain space and relieve crowding. The overall objective was to align the dentition, while simultaneously maintaining facial balance.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	88.5°	89.1°	0.6°
SNB°	79.7°	80.6°	0.9°
ANB°	8.8°	8.5°	-0.3°
SN-MP°	35.1°	34.3°	-0.8°
FMA°	29.4°	28.6°	-0.8°
DENTAL ANALYSIS			
U1 TO NA mm	-3.3 mm	1.7 mm	5 mm
U1 TO SN°	82.3°	102.2°	19.9°
L1 TO NB mm	7.6 mm	11.2 mm	3.6 mm
L1 TO MP°	92.5°	110.6°	18.1°
FACIAL ANALYSIS			
E-LINE UL	-1.2 mm	-0.6 mm	0.6 mm
E-LINE LL	0.1 mm	3.2 mm	3.1 mm

■ Table 1: Cephalometric summary

Appliances and Treatment Progress

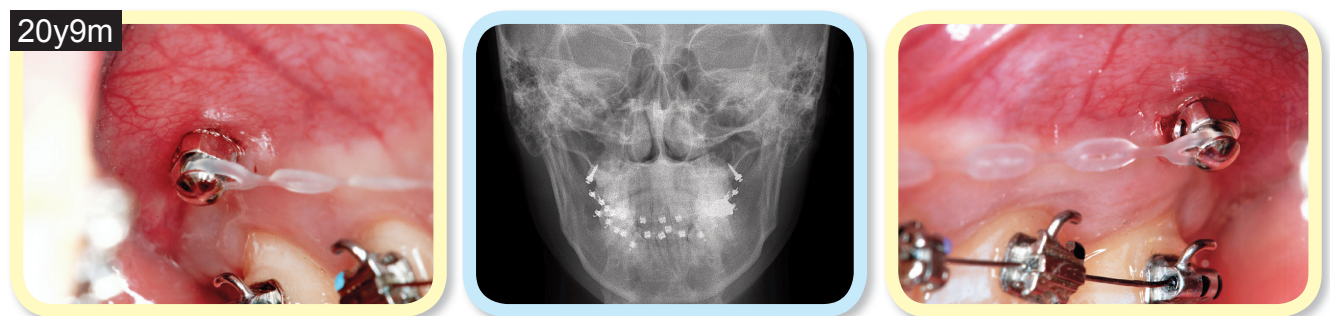
The lower right 3rd molar was extracted before initiating orthodontic treatment. A full fixed .022" slot Damon Q® PSL appliance (Ormco, Glendora, CA) was installed with standard torque brackets for both arches (Fig. 10). All archwires, elastics and fixed appliance accessories were supplied by the same manufacturer. The initial archwires were .013" CuNiTi. Two 2x8mm stainless steel (SS) IZC miniscrews were installed to retract the upper canines (Figs. 10 and 11). GIBTs (Glass Ionomer Bite Turbos) were installed on the occlusal surface of the lower first molars to prevent interference of the lower incisor brackets in function. A segment of open coil spring was used to increase space to accommodate the upper left lateral incisor (Fig. 10).

In the 2nd month of treatment (20y10m), short Class III elastics were attached from the lingual surface of the upper first molar to the labial surface of the lower canine bilaterally, to retract and tip back the lower dentition, while expanding the upper inter-molar width (Fig. 12). After 5 months of treatment, sufficient space was created and the blocked-in upper left lateral incisor was bonded with a standard torque bracket. The bite turbos were augmented to prevent occlusal interference as the upper left lateral incisor was aligned.



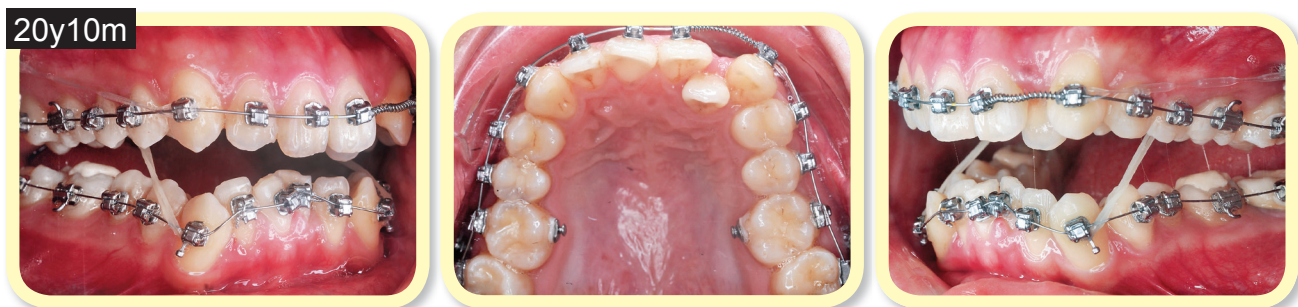
■ Fig. 10:

Active treatment commenced at 20y9m of age with a full fixed PSL appliance supplemented with IZC anchorage, and bite turbos on the occlusal surface of the lower first molars to eliminate occlusal interference on lower incisor brackets.



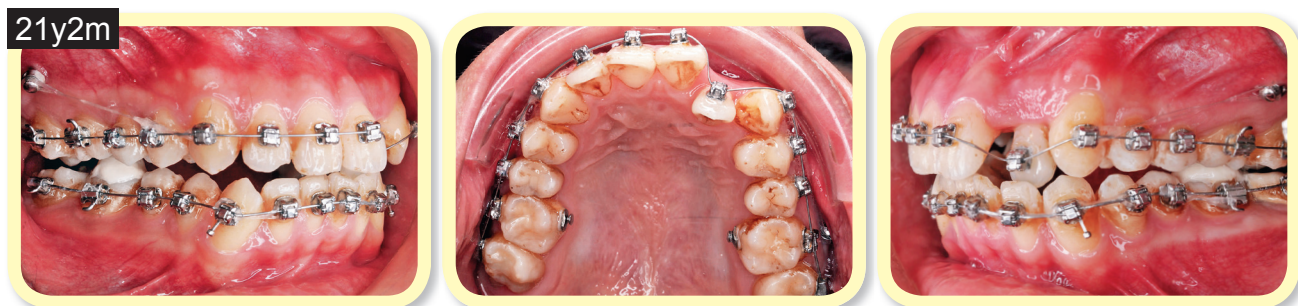
■ Fig. 11: Bilateral IZC miniscrews (2x8mm, SS) were utilized to retract maxillary canines.

At 6 months into treatment (21y2m), mesial tilting of the left miniscrew was noted, but there was no pain or mobility, so the bone screw continued to serve as effective anchorage throughout treatment (Fig. 13). The upper left lateral incisor was corrected at 21y3m, after 3 months of archwire traction (Fig. 14). Repositioning of brackets (Fig. 15) and archwire detailing was accomplished in the 11th month of treatment (21y8m). All fixed appliances were removed after 15 months of active treatment (Figs. 4-6).



■ Fig. 12:

In the 2nd month of treatment (20y10m), Class III elastics were extended from the lingual surface of the upper first molar to the labial surface of lower canine, bilaterally.



■ Fig. 13:

After 5 months of treatment (21y2m), enough space was created for the upper left lateral incisor. It was bonded with a standard torque PSL bracket, and the posterior bite turbos were augmented to eliminate incisal interference during alignment.



■ Fig. 14: After 3 months of active treatment (21y5m), both crossbites of anterior teeth were corrected.



■ Fig. 15:

At 11 months of treatment (21y8m), detailing was accomplished with bracket repositioning and archwire adjustments.

Results Achieved

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 post-treatment results, respectively (Figs. 7 and 8). Superimposition of cephalometric tracings (Fig. 9), and the summary of cephalometric measurements are provided in Table 1. ABO Cast-Radiograph Evaluation (CRE) was 16 as shown in the subsequent worksheet.

Maxilla (all three planes):

- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Mandible (all three planes):

- A - P: More anterior position as the mandible rotated forward
- Vertical: Decreased as the mandible rotated counter-clockwise
- Transverse: Maintained

Maxillary Dentition:

- A - P: Incisors tipped labially
- Vertical: Both upper molars and incisors intruded
- Transverse: Expanded

Mandibular Dentition:

- A - P: Incisors tipped labially
- Vertical: Lower molars were tipped distally and intruded; lower incisors were tipped labially and slightly intruded
- Transverse: Expanded

Facial Esthetics:

- Lower lip slightly more protrusive and everted
- Maintained facial profile

Retention

Upper Hawley and lower spring retainers were delivered, with instructions for full time wear the first 6 months, and nights only thereafter. Because of the labial tipping of the lower incisors, the patient was informed that long-term retention was essential. In addition, the patient was instructed in the proper home hygiene and maintenance of the retainers.

Final Evaluation of Treatment

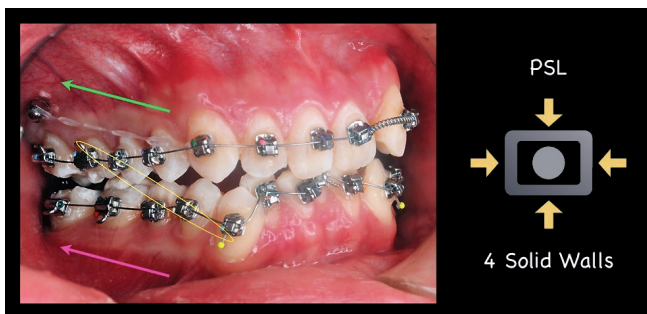
Overall, the patient was satisfied with the treatment outcome. Both arches were well-aligned in only 15 months, and the facial esthetics were maintained. A slightly more protrusive and everted lower lip was consistent with the acceptable post-treatment profile (Fig. 4). The slight change in the position of the molars in both arches (Fig. 9) is deceptive relative to the effectiveness of the arch retraction mechanics (Fig. 16). Since the length of an arch decreases as it is expanded, maintaining the sagittal position of the molars actually reflects several mm of bilateral molar retraction, compared to the mesial molar movement that normally occurs with arch expansion.

The CRE score was excellent (16 points), but there were numerous marginal ridge discrepancies, and the occlusal relationships on the right side were Class II. For details, refer to the CRE worksheet at the end of this report. Carefully analyzing the dental alignment relative to the superimposition of

the cephalometric tracings (Fig. 9) is important for understanding the pros and cons of the mechanics.

Discussion

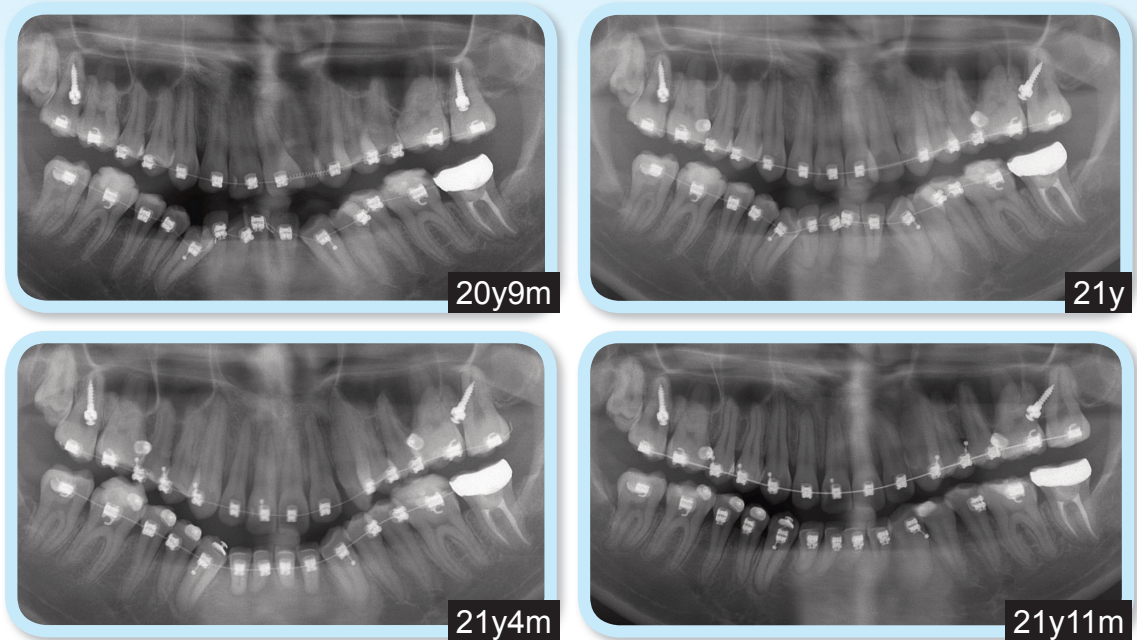
When treating severe arch-length deficiency, space is most commonly derived from arch expansion, labial tipping of anterior teeth, molar retraction or tip back, interproximal enamel reduction (IPR), and premolar or molar extractions.¹ Facial esthetics is a critical consideration when considering extractions to alleviate crowding. The current adult male was satisfied with his facial features, so he preferred a conservative dental correction with no extractions. His chief complaint was an irregular smile due to crowding, deepbite, posteriorly tipped upper incisors, and crossbite of the upper left lateral incisor. The treatment objective was to correct dental alignment, without compromising facial form. IZC miniscrew anchorage was selected to retract and expand both arches to relieve severe crowding.^{2,3} Light (2oz) Class III elastics were applied from the beginning of the treatment to accelerate correction of lower anterior crowding (Fig. 16).⁴ Miniscrews appear to be rigid clinically, but they still may move relatively to the apical base of bone, as evidenced by the mesial tilting of the upper left miniscrew (Figs. 11-13). Since the tilted miniscrew was not mobile or painful, the skeletal anchorage it provided was continued until the end of treatment (Fig. 17).



■ Fig. 16:

A schematic drawing (right) demonstrates the 4 solid wall mechanism (tube structure) for PSL brackets that permits efficient dental retraction along an archwire. The photograph on the left shows the mechanics for retracting both arches with IZC bone screw anchorage: 1. chain of elastics retracting the maxillary canines, and 2. Class III elastics.

Anterior crowding was resolved by a staged approach in the lower arch (Fig. 18). At the beginning of treatment, the archwire was not fully engaged in the PSL brackets of the most lingually positioned lower incisors; the latter were attached to the archwire via ligation



■ Fig. 17:

Compared to the vertical position when it was placed (20y9m), mesial tipping of the upper left IZC miniscrew was noted after 3 months of active treatment (21y). The tilted miniscrew was neither mobile nor painful, so it continued to serve as adequate anchorage throughout active treatment (21y4m and 21y11m).



■ Fig. 18:

A staged approach was utilized to relieve crowding in the lower dentition. When the initial archwire was placed (20y9m), the most irregular (lingually positioned) incisors were not fully engaged in the slot, by using a drop-in hook to apply traction. A light force open coil spring was used (21y) for only 1 month to gain space for full engagement on lower left central incisor (21y1m).

through the holes of drop-in hooks. A light force, open coil spring was used for 1 month to gain space for full archwire engagement of the lower left central incisor (Fig. 18, 21y). Open coil spring use in the anterior segment must be minimized to avoid flaring and labial tipping of the lower incisors. In the upper arch, the incisors were tipped lingually ($U1-SN: 82.3^\circ$), so extended use of an open coil spring (5mo) to open space for the upper left lateral incisor was acceptable. When evaluating the final treatment result, the upper left lateral incisor required more labial root torque. In retrospect, that problem is best managed by bonding a standard torque bracket upside down or using a lower torque bracket.

The lower right third molar was extracted prior to distal tipping and retraction of the lower molars. Cephalometric superimpositions (Fig. 9) show that IZC miniscrew anchorage retracted the lower molars, but it was less effective in the upper arch, resulting in a Class II buccal segment on the right side (Fig. 6). In retrospect, that negative outcome may have been controlled by: 1. extraction of the upper right 3rd molar prior to treatment, and 2. attaching the Class III elastic to the IZC miniscrew rather the 1st molar (Fig. 12). However, the Class II occlusion on the right side was part of the compromise that was necessary to compensate for the severe skeletal discrepancy (ANB 8.5°).

A major lesson taught by this case report is the importance of the DI score for revealing the complexity of a malocclusion prior to instituting irreversible procedures such as extractions. The surprisingly severe complexity (DI=24) of this seemingly routine Class I crowded malocclusion was due to maxillary protrusion 88.5°, ANB angle of 8.8°, deepbite, and dental compensation with two anterior teeth in crossbite. Extractions in the lower arch were not a good option because of the risk for retracting the lower incisors and flattening the lips. Upper arch only extraction has major deficiencies: 1. fails to address the severe crowding in the lower arch so posterior expansion and flaring of the incisors would be necessary, and 2. closing premolar space would probably result in severe labial inclination of the upper incisors, which would create a significant esthetic problem. The present nonextraction approach with IZC miniscrew anchorage produced

good dental and facial results (Figs. 4-6). However, the severe Class II skeletal discrepancy was only partially compensated by decreasing the FMA about 1°, so the outcome for the lower incisors was excessive tipping (L1-MP 110.6°). In retrospect, more buccal segment intrusion with IZC anchorage may have produced additional forward rotation of the mandible, but that would be difficult to accomplish because of the deepbite. Although long-term, essentially permanent retention of the lower arch is required, the dental compensation achieved (U1-SN:102.2°; L1-MP: 110.6°) was the best compromise for the current patient.

Incisor angulation is an important factor in achieving ideal interdigitation.⁵ Enamel stripping of the lower anteriors to obtain overjet for correction of the buccal segments with of Class II elastic is a common finishing approach.^{6,7} However, this was not a viable option for the current patient because Class II elastics typically open the bite and rotate the mandible posteriorly. Accepting the Class II buccal segment on the right side was the best option (Figs. 5 and 6).

Deep overbite is usually treated with incisor intrusion and/or slight opening of the bite by extrusion of the buccal segments. However, when it is necessary to close the VDO with posterior bite turbos to help correct a Class II skeletal discrepancy, deepbite is a substantial complicating factor. For the present patient, the best option for correcting the deepbite was to flare the incisors (Fig. 9), and accept the Class II buccal segment on the right side (Figs. 5 and 6).

Conclusions

A non-extraction treatment plan for a Class I occlusion, with severe crowding and a skeletal discrepancy, was the best option because of the convex profile and long face. *"Extraction for the face, not for the space"* was the guiding philosophy. This severe skeletal malocclusion (*DI 24*) was corrected to an overall excellent outcome (*CRE 16*), but it was necessary to compromise with lower incisor flaring and a Class II buccal segment on the right side. As discussed, this approach was clearly the best option for this complex malocclusion.

Acknowledgement

Thanks to Dr. Leslie Yen-Peng Chen for his generous sharing of the idea to utilize IZC screws not only for upper retractions, but also lower retractions. The non-extraction approach has been utilized and solved many cases, which should've been treated with extraction, in my office ever since.

References

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 24

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 = 8

OVERBITE

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

Total = 3

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 _____pts.
Beyond Class II or III	=	1 pt. per mm. _____pts. additional

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB $\geq 6^\circ$ or $\leq -2^\circ$ = 4 pts.

Each degree $< -2^\circ$ _____ x 1 pt. = _____

Each degree $> 6^\circ$ _____ x 1 pt. = 2

SN-MP

$\geq 38^\circ$ = 2 pts.

Each degree $> 38^\circ$ _____ x 2 pts. = _____

$\leq 26^\circ$ = 1 pt.

Each degree $< 26^\circ$ _____ x 1 pt. = _____

1 to MP $\geq 99^\circ$ = 1 pt.

Each degree $> 99^\circ$ _____ x 1 pt. = _____

Total = 6

OTHER (See Instructions)

Supernumerary teeth	_____ x 1 pt. = _____
Ankylosis of perm. teeth	_____ x 2 pts. = _____
Anomalous morphology	_____ x 2 pts. = _____
Impaction (except 3 rd molars)	_____ x 2 pts. = _____
Midline discrepancy (≥ 3 mm)	@ 2 pts. = _____
Missing teeth (except 3 rd molars)	_____ x 1 pt. = _____
Missing teeth, congenital	_____ x 2 pts. = _____
Spacing (4 or more, per arch)	_____ x 2 pts. = _____
Spacing (Mx cent. diastema ≥ 2 mm)	@ 2 pts. = _____
Tooth transposition	_____ x 2 pts. = _____
Skeletal asymmetry (nonsurgical tx)	0 @ 3 pts. = 0
Addl. treatment complexities	0 x 2 pts. = 0

Identify:

Total = 0

Cast-Radiograph Evaluation

Total CRE Score

16

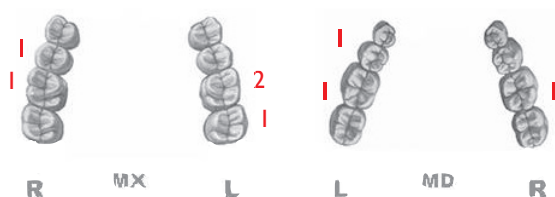
Alignment/Rotations

1



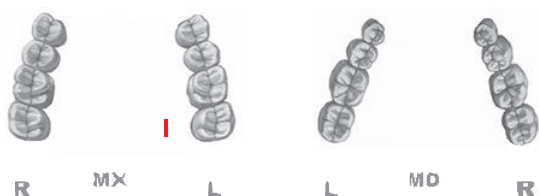
Marginal Ridges

8



Buccolingual Inclination

1



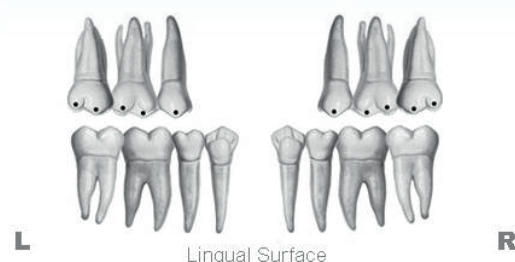
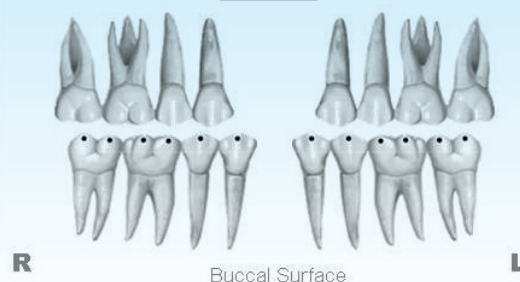
Overjet

0



Occlusal Contacts

0



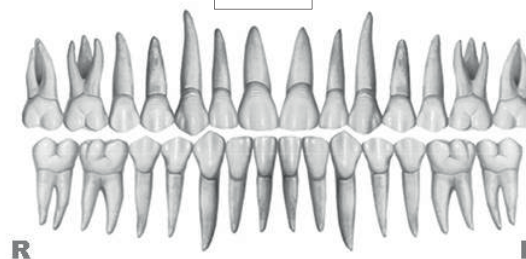
Occlusal Relationships

5



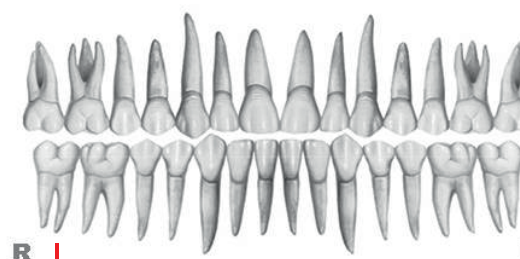
Interproximal Contacts

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.