

# Treatment of Bimaxillary Protrusion and Facial Asymmetry with Extractions and Interradicular TADs

## History And Etiology

A 21 year old male, with a family history of Class III malocclusion, sought consultation for protrusion and imbalance of the lower face. Despite an apparent Class III skeletal pattern (*Table 1*), clinical examination revealed a Class I dental relationship, complicated by anterior openbite tendency, midline deviation, facial asymmetry, and bimaxillary protrusion (*Figs.1-3*). Note that the right buccal segment appears to be Class III due to the angulation of the photograph (*Fig. 2*), but the direct buccal view of the articulated casts (*Fig. 3*) shows that the relationship is actually Class I. This discrepancy demonstrates that casts are more reliable than intraoral photographs for diagnosis of intermaxillary occlusion in the sagittal plane.

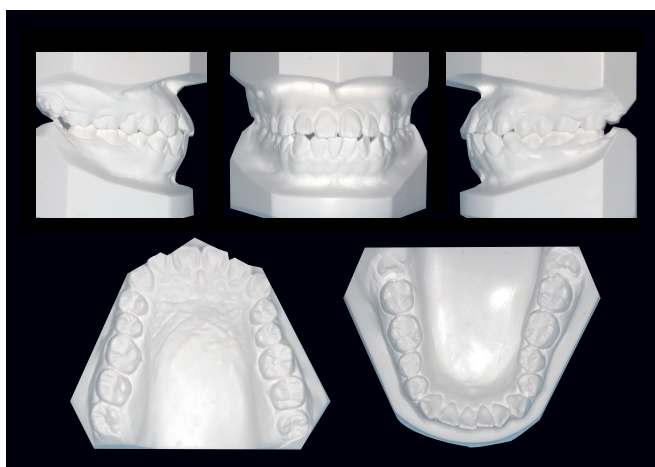
The soft tissue type for this patient was thick, suggesting that maximal retraction of dentition was necessary to achieve an esthetic profile. For maximum retraction of the maxillary incisors, extraction of all four first premolars was indicated. However, maxillary buccal segments have less anchorage value than those in the mandible,<sup>1</sup> so temporary anchorage devices (*TADs*) were required in both arches to maintain the Class I occlusion while correcting the bimaxillary protrusion to improve the profile. The expected results and limitations of treatment were discussed with the patient and his parents. It was assumed that the patient's



■ Fig. 1: Pretreatment facial photographs

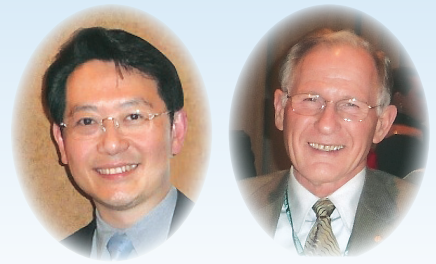


■ Fig. 2: Pretreatment intraoral photographs



■ Fig. 3: Pretreatment study models

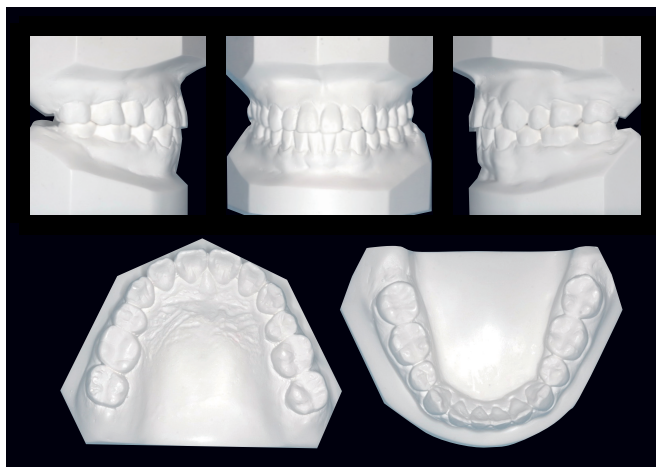
Johnny JL Liaw, Director, Beauty Forever Dental Clinic (left)  
W. Eugene Robert, Consultant,  
*International Journal of Orthodontics & Implantology* (right)



■ Fig. 4: Posttreatment facial photographs



■ Fig. 5: Posttreatment intraoral photographs



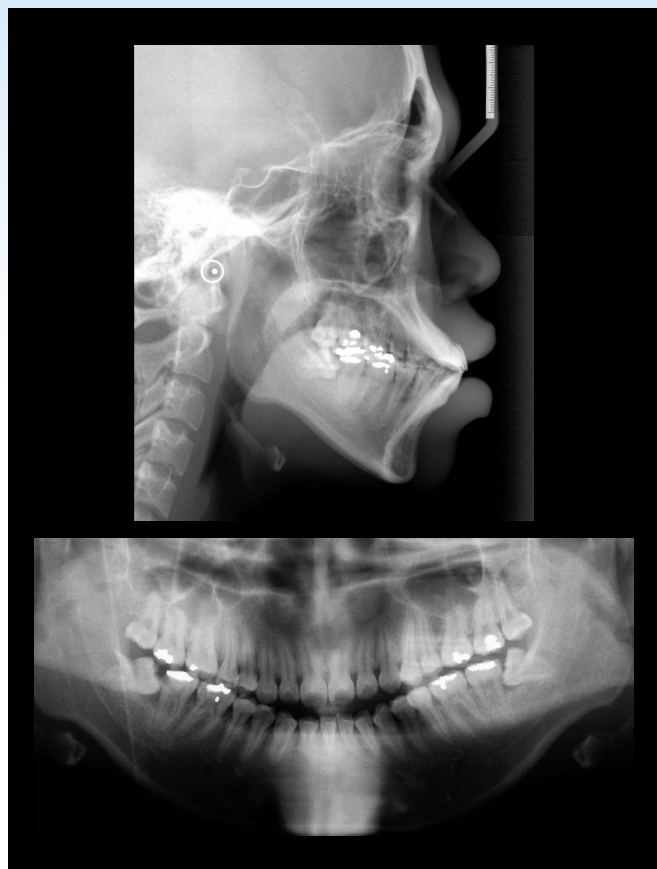
■ Fig. 6: Posttreatment study models

growth was complete, but it would be carefully monitored because of the family history of Class III malocclusions.

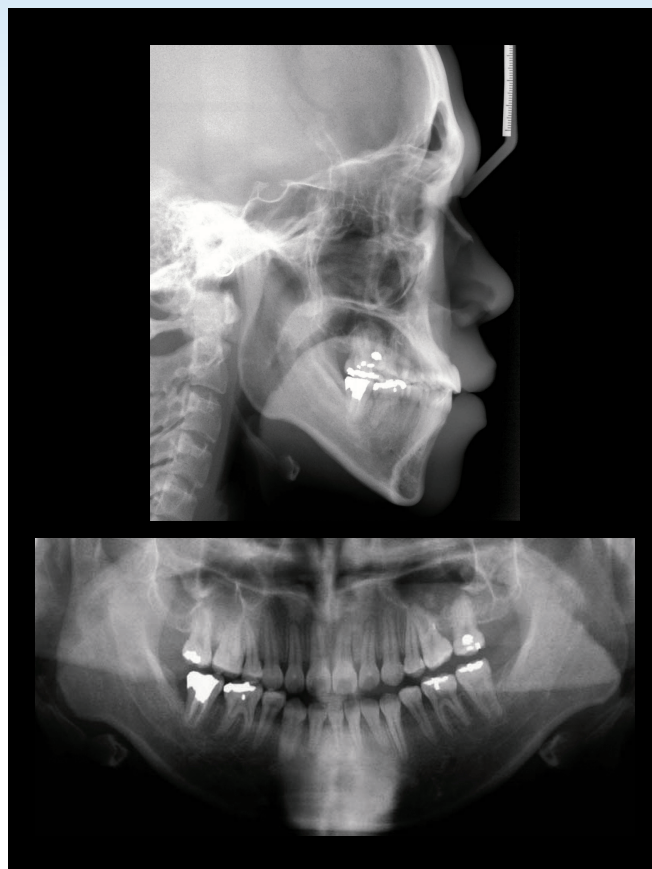
The patient was treated to an optimal result as documented in Figs. 4-6. The cephalometric and panoramic radiographs document the pre-treatment condition and the post-treatment results (Figs. 7-8). The cephalometric tracings before and after treatment are superimposed in Fig. 9. Cephalometric measurements (Table 1) document the Class III skeletal pattern of the patient.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	80°	79°	1°
SNB°	81°	82°	1°
ANB°	-1°	-3°	2°
SN-MP°	37.5°	35.5°	2°
FMA°	32.5°	30.5°	2°
DENTAL ANALYSIS			
U1 TO NA mm	21 mm	14 mm	7 mm
U1 TO SN°	128°	122°	6°
L1 TO NB mm	15 mm	21 mm	6 mm
L1 TO MP°	100°	80°	20°
FACIAL ANALYSIS			
E-LINE UL	2 mm	0 mm	2 mm
E-LINE LL	10 mm	3 mm	7 mm

■ Table. 1: Cephalometric summary



■ Fig. 7: Pretreatment pano and ceph radiographs



■ Fig. 8: Posttreatment pano and ceph radiographs



■ Fig. 9:  
Superimposed tracings showed maximal retraction on both arches and total arch distalization in the lower arch after complete space closure.



## Diagnosis

### Skeletal:

- Skeletal Class III (  $SNA\ 80^\circ$ ,  $SNB\ 81^\circ$ ,  $ANB\ -1^\circ$  )
- High mandibular plane angle ( $SN-MP\ 37.5^\circ$ ,  $FMA\ 32.5^\circ$ )
- Mild facial asymmetry: chin deviated to the left

### Dental:

- Bilateral Class I buccal segments
- Increased axial inclination (*flaring*) of maxillary incisors
- The OJ was 0.5mm; OB was <0.5mm and there was an anterior openbite tendency
- Symmetrical square shape archform in both arches
- 4mm space deficiency in the upper arch
- 6mm space deficiency in the lower arch
- Upper dental midline was coincident with facial midline.
- Lower dental midline was shifted to the right by 2mm.
- All four third molars were present, both lower third molars were mesio-angular impacted.

### Facial:

- Convex profile
- Bimaxillary protrusion

The ABO Discrepancy Index (DI) score was 8 points as shown in the subsequent worksheet. Although the DI for this case is less than 10, the required amount of incisor retraction for this patient was quite a challenge.

## Specific Objectives Of Treatment

### Maxilla (*all three planes*):

- A - P: Maximal retraction of the alveolar process
- Vertical: Intrude anterior alveolar process

- Transverse: Maintain

### Mandible (*all three planes*):

- A - P: Maximal retraction of the anterior alveolar process
- Vertical: Maintain
- Transverse: Maintain

### Maxillary Dentition:

- A - P: Maximal retraction of the incisors
- Vertical: Maintain
- Transverse: Maintain

### Mandibular Dentition:

- A - P: Maximal retraction
- Vertical: Maintain
- Transverse: Maintain

### Facial Esthetics:

- Maximal retraction of the lips for profile improvement

## Treatment Plan

The treatment plan for this patient was extraction of all four first premolars, and maximal retraction of the anterior segments with TADs anchorage in both arches to: 1. reduce the bimaxillary protrusion, 2. correct molar Class III relationship and 3. midline discrepancy. The upper and lower TADs were installed early in the treatment, but were used alternately based on the treatment goals of various stages of treatment. Initially, the lower TADs were used to retract lower anterior teeth to obtain positive overjet. Upper and lower TADs were used to retract the arches simultaneously to reduce the protrusion. When all the spaces were closed, the distal forces were applied asymmetrically using the upper left and lower right TADs as anchorage, to correct the dental midline discrepancy. Asymmetrical intermaxillary elastics were required to supplement the anchorage.



## Appliances And Treatment Progress

A modified Alexander prescription was used. The slot sizes of the anterior teeth (*canine to canine*) were .018", while the slot sizes of the posterior teeth were .022". The initial archwires for both arches were .016" NiTi. The second archwires were .016x.022" SS for both arches. Two miniscrews (1.2mm in diameter, 9mm in length, *Absoanchor, Korea*) were installed between the roots of the lower second premolars and first molars bilaterally before the start of lower space closure (*Fig. 10*). NiTi tension coil springs were attached from the miniscrews to bilateral lower lateral incisors, while lower anterior teeth were tied together with figure-8- fixation, to close the extraction space. One month later, two miniscrews were installed on the upper posterior area between the roots of the first and second molars. Upper and lower space closure proceeded simultaneously (*Fig. 11*). The extraction spaces on the upper arch were closed in 7 months, and an additional 9 months was required for the lower arch to complete space closure.

After all the spaces were closed, the upper and lower dental midline were not coincident. The upper left and lower right NiTi coil springs were retained to use for midline correction (*Fig. 12*). The asymmetrical application of the miniscrew anchorage in conjunction with asymmetrical intermaxillary elastics (*Fig. 13*) corrected the dental midlines eight months later. Interproximal reduction was also performed on the lower anterior teeth during this period to reduce black triangles. The treatment was finished and all

the appliances were removed after 30 months of active treatment.

## Results Achieved

### Maxilla (*all three planes*):

- A - P: Retraction of the anterior alveolar process
- Vertical: Intruded the anterior alveolar process
- Transverse: Maintain

### Mandible (*all three planes*):

- A - P: Retraction of the anterior alveolar process
- Vertical: Maintain
- Transverse: Maintain

### Maxillary Dentition:

- A - P: Retraction of incisors
- Vertical: Intrude anterior segment
- Transverse: Maintain

### Mandibular Dentition:

- A - P: Retraction
- Vertical: Maintain
- Transverse: Maintain

### Facial Esthetics:

- Improved due to correction of bimaxillary protrusion

## Retention

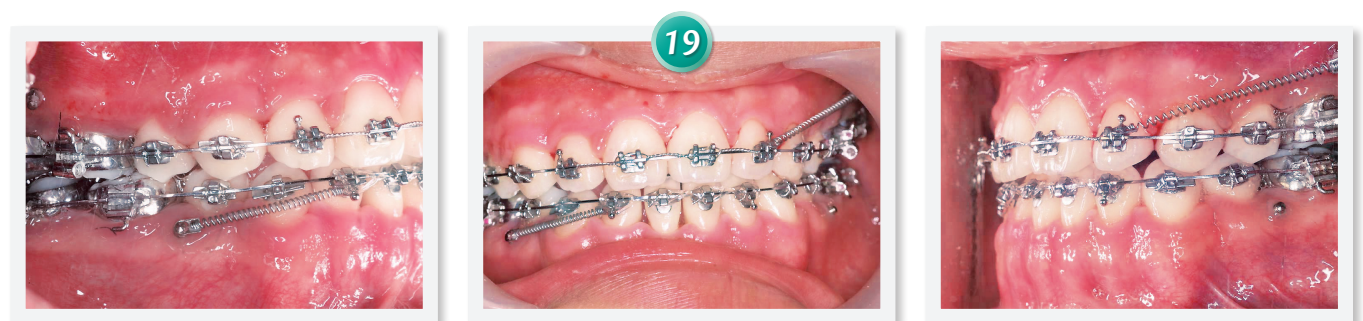
Upper and lower clear removable retainers were delivered, and the patient was instructed to wear the retainers full time for first 6 months, and nights only thereafter. In addition, the patient was instructed in proper home hygiene and maintenance of the



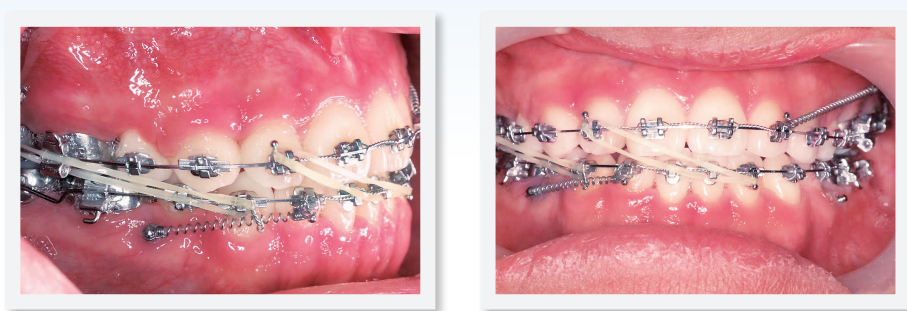
■ Fig. 10: Two miniscrews were installed between lower second premolars and lower first molars for maximal retraction of lower incisors.



■ Fig. 11: Space closure with miniscrew anchorage were proceeded on both arches for maxmal retraction.



■ Fig. 12:  
After all the spaces were closed, the upper and lower dental midlines were not coincident. The force system was changed to be asymmetrical for midline correction.



■ Fig. 13:

Besides asymmetrical application of miniscrew anchorage, asymmetrical interarch elastics were also used to correct dental midline discrepancy.

retainers. Subsequently, Hawley retainers were delivered for nocturnal wear in both arches for long-term retention.

### Final Evaluation Of Treatment

The ABO Cast-Radiograph Evaluation score was 7 points, with most of the points reflecting problems in root angulation. Discrepancies in root angulation were noted in both arches, particularly the lower right first molar and upper left first molar. Cephalometric superimpositions showed maximal anchorage on the upper arch and distal tipping of mandibular molars to increase the amount of lower incisor retraction.

Overall, this severe protrusion case was treated in 30 months to an appropriate facial and dental result. The 5.5 years follow-up records (Figs. 14-15) show a stable occlusion and harmonious facial profile.



■ Fig. 14:

5.5 years post-treatment facial photographs



■ Fig. 15:

5.5 years post-treatment intraoral photographs



## Discussion

Bimaxillary protrusion is common in Asian patients of all skeletal types. For skeletal Class I cases, the required amount of incisor retraction is expected to be the same for both arches. However, the anchorage value for the upper molars is less than that for lower molars because of the weaker bone density in the maxilla compared to the mandible.<sup>1</sup> Moreover, the geometry of the root morphologies of upper molars is more prone to lose anchorage by rotating around the palatal root. On the other hand, the difference between size and torque demand on the upper incisors and lower incisors makes the anchorage requirement higher in the upper arch than in the lower arch. Hence, miniscrews are often needed in the upper posterior area to reinforce anchorage on the upper arch.

For Class II cases, the required anchorage, critical for Class II correction and reduction of protrusion, is even higher in the upper arch. As for Class III cases, the limiting factor is usually the amount of retraction in the lower arch because of the limited thickness of the alveolar process in the symphyseal area. If the amount of retraction of the lower dentition is not adequate, the upper molars are doomed to move forward to achieve a molar Class I relationship. Therefore, anchorage reinforcement in the lower arch is critical for the profile improvement of the Class III protrusion cases.

Profile changes are also influenced by soft tissue

thickness.<sup>2</sup> The thicker the soft tissues, the less the profile is flattened after extraction treatment. The factors influencing retraction of upper lip include retraction of U1 incisal edge during treatment, pretreatment soft tissue thickness at subnasale, pretreatment upper lip thickness and vertical growth of nose during treatment. The amount of upper lip retraction is related to:

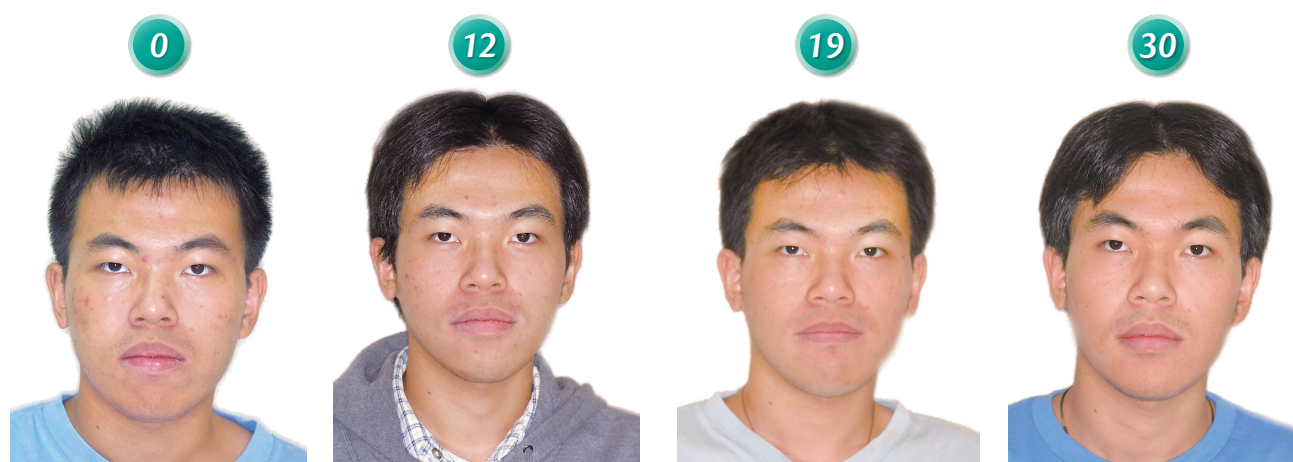
1. maxillary incisal edge retraction,
2. thickness of soft tissue at “subnasale” before treatment (*thinner tissue retracts more*),
3. thickness of the upper lip before treatment (*thinner lips retract more*), and
4. amount of nasal growth during the treatment period (*lips appear flatter as the nose increase in prominence*).

The soft tissue is quite thick for this patient, so the amount of profile change is decreased relative to incisor retraction. In order to correct the lip protrusion, more incisor retraction is needed. Mini-implant anchorage is a good tool for maximal retraction of the incisors in both arches.

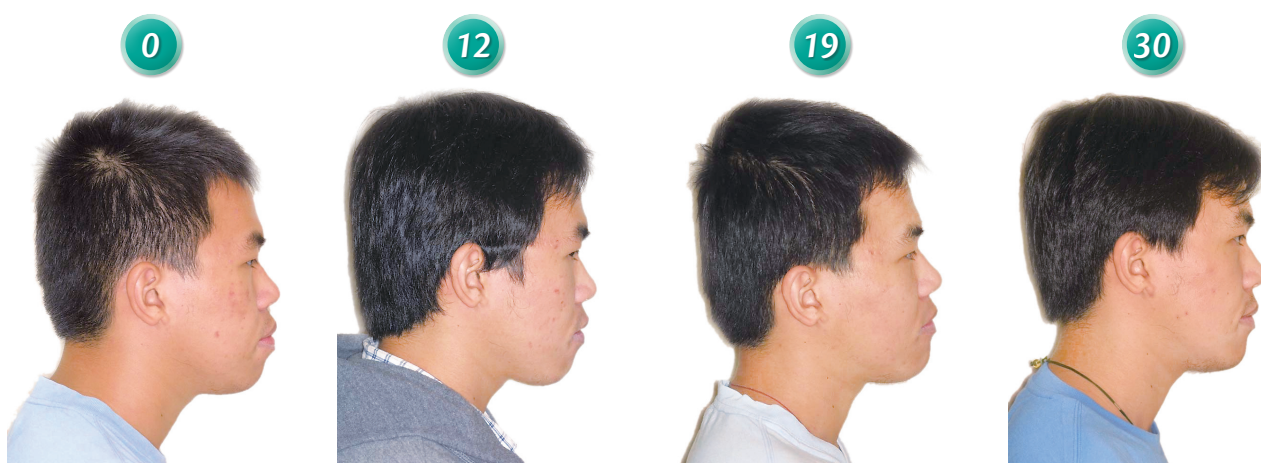
Sugawara's study<sup>3</sup> stated that the average amount of lower molar retraction with miniplate anchorage is 3.5mms at crown level and 1.8mms at root level. The amount of lower molar retraction in this

case was around 4mm, which resulted in nearly 6mm of the lower incisor retraction. This was the key element of the profile improvement in this case. The efficacy of miniscrew anchorage is the same as miniplate anchorage in terms of profile retraction in protrusion cases. The current position of miniscrews might limit further distal movement of lower molars. Extra-alveolar miniscrews buccal to the dental arches would allow for retraction of the

entire dental arches. This approach avoids the risk of root contact with miniscrews during active tooth movement. However, it is important for clinicians to recognize the limitations of the mechanics employed. Although maximal retraction is desired for many protrusion cases, the profile change should be evaluated periodically during treatment. If no further improvement occurs over a 6 month period, it is usually wise to terminate treatment (Figs. 16, 17).



■ Fig. 16: Progressive records of frontal profile



■ Fig. 17: Progressive records of lateral photographs

Dental midline deviation can be corrected after space closure with asymmetrical applications of miniscrew anchorage.<sup>4</sup> However, correction of the midline as the spaces are closed is the best approach. When there is no space for differential tooth movement, the arches may be skewed or tipped by continuing midline correction mechanics. Although the skeletal asymmetry was not improved, a camouflaged dental compensation was achieved efficiently with the help of miniscrew anchorage. With the asymmetric distal force applied to the upper left and lower right miniscrews, in conjunction with asymmetrical interarch elastics, the midline discrepancy was corrected 6 months later. However, these mechanics resulted in distal tipping of both molars (Fig. 8).

## Conclusion

Maximal retraction of both arches, with extractions and TADs for supplementing anchorage, provided good profile improvement for bimaxillary protrusion. Continued asymmetrical forces with the TADs and intermaxillary elastics corrected the midline discrepancy, but compromised the axial inclination of molars in the anchorage segments.

## Acknowledgment

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## References

1. Sandusky Jr. WC. Orthodontic anchorage. *Am J Orthod* 1951;37(11):858-866.
2. Yamada K, Kuroda S, Deguchi T, Takano-Yamamoto T,

Yamashiro T. Distal movement of maxillary molars using miniscrew anchorage in the buccal interradicular region. *Angle Orthod* 2009;79(1):78-84.

3. 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.
4. Weisner SM. Treatment of a skeletal Class III malocclusion with mandibular asymmetry using a single miniscrew. *J Clin Orthod* 2009;43(5):335-41.





# Discrepancy Index Worksheet

TOTAL D.I. SCORE

10

**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

0

**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

4

**OCCLUSION**

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side <u>2</u> pts.
Full Class II or III	=	4 pts. per side <u>    </u> pts.
Beyond Class II or III	=	1 pt. per mm. <u>    </u> pts. additional

Total

2

**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. =     

SN-MP

 $\geq 38^\circ$  = 2 pts.Each degree  $> 38^\circ$  1 x 2 pts. = 2 $\leq 26^\circ$  = 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

4

**OTHER**

(See Instructions)

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

Identify:

Total

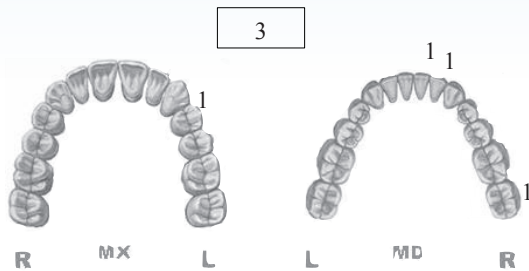
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## Cast-Radiograph Evaluation

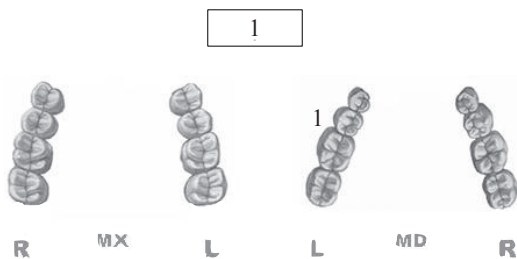
Case # 3 Patient

Total Score: **7**

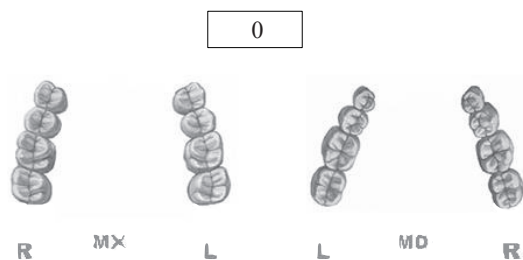
### Alignment/Rotations



### Marginal Ridges



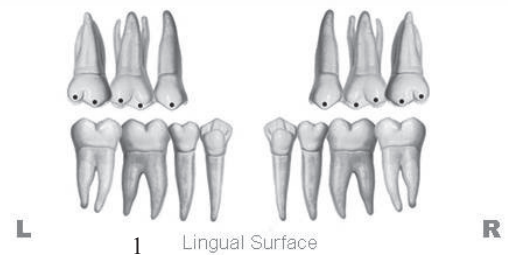
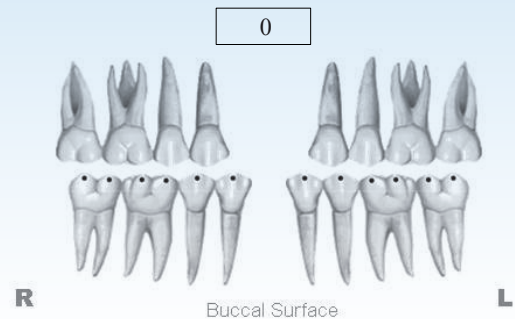
### Buccolingual Inclination



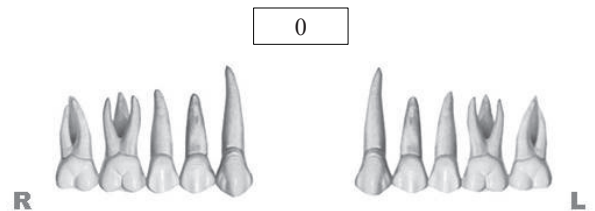
### Overjet



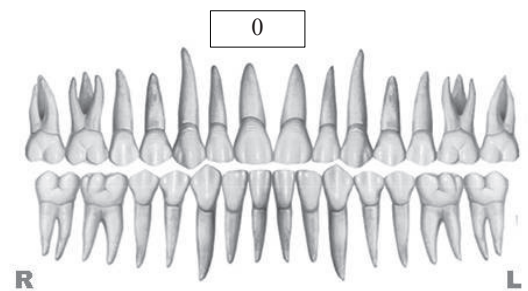
### Occlusal Contacts



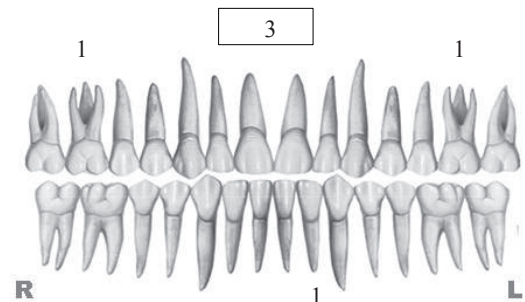
### Occlusal Relationships



### Interproximal Contacts



### Root Angulation



**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.