

# Asymmetric Maxilla with a Functional Shift and Labially Blocked-Out Maxillary Canines

## Summary

The Discrepancy Index (DI) was 17 for a 12y9m male with bilateral blocked-out upper cuspids, unilateral anterior crossbite, right Class II molar relationship, and a mandibular dental midline deviated 4mm to the right. A non-extraction treatment with intermaxillary elastics for 21 months resulted in a good dental outcome: cast-radiograph evaluation (CRE) of 26 with a pink and white dental esthetics score (P&W) of 3. The patient failed to grow as expected to compensate for extrusion of mandibular, so the mandible rotated posteriorly, but lip competence was maintained. Although miniscrew osseous anchorage was recommended to correct the side effects of Class II elastics, the patient declined because the convex profile was acceptable. However, from an orthodontics perspective it would have been preferable to retract the maxillary dentition with extra-alveolar (E-A) miniscrews to prevent bite opening and lower incisor flaring. This case teaches three important lessons: 1. obtain permission before treatment to use miniscrews if indicated, and 2. nonextraction treatment of high angle patients with Class II elastics may result in stability problems, and 3. progress records are recommended before the finishing stage to plan the final detailing. (Int J of Othod Implantol 2014;36:26-48)

### Key words:

blocked-out, crossbite, functional shift, midline discrepancy, Class II malocclusion, non-extraction, miniscrew, extra-alveolar anchorage

## History and Etiology

A 12-year-and-9-month-old boy was referred by his dentist for orthodontic consultation (Fig. 1). His chief complaints were a severely crowded upper dentition and high cuspids (Figs. 2-3). There was no contributing medical or dental history, and the patient failed to report any habits contributing to his malocclusion. The mandibular midline was shifted 4 mm to the right in relation to the facial midline (Figs. 4-5). The clinical examination revealed a relatively long face, tapered facial form, steep mandibular plane angle, decreased maxillary width, and a tooth-size to arch-length discrepancy. The dentofacial pattern suggests the malocclusion was primarily environmental due to an inadequate history of masticatory loading and decreased biting strength. The narrow maxillary arch was associated with an inadequate perimeter to accommodate the entire dentition, resulting in blocked-out canines and a functional shift due to a palatally displaced right lateral incisor.

The patient and his parents wanted to avoid extractions and use of miniscrews. For a high angle patient with an anterior openbite tendency, conservative treatment with intermaxillary elastics may result in a skeletal compromise unless the patient has a favorable growth pattern. Because of the patient/parent preference

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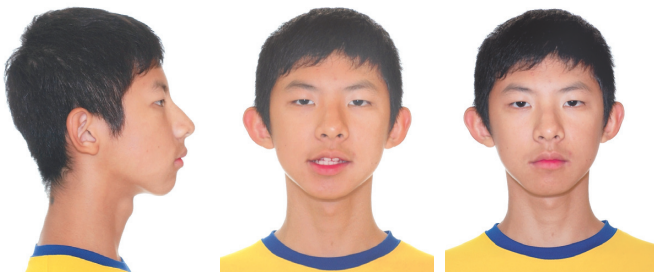
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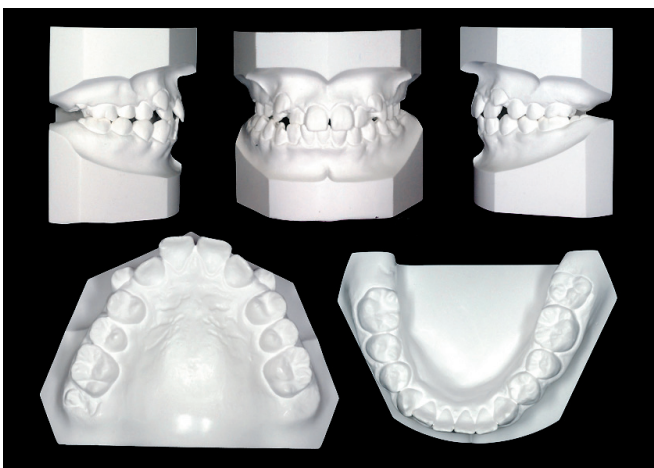


**Fig. 1:** Pre-treatment facial photographs



**Fig.2:**

Pre-treatment intraoral photographs document bilateral blocked-out upper cuspids, upper right lateral incisor crossbite and lower midline shift to right side.



**Fig.3:**

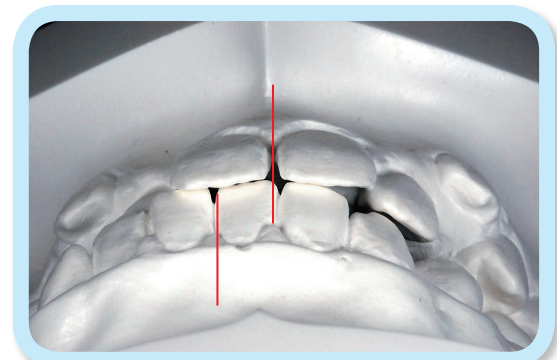
Pre-treatment study models (casts) reveal molar relationship was Class II on right side and Class I on left side.

and the age of the patient indicated good growth potential, conservative treatment was indicated, but it should be carefully monitored. A full set of diagnostic records were collected at 14 months into treatment to assess progress (Figs. 22-30). After 21 months of active treatment, all fixed appliances were removed and post-treatment records were collected (Figs. 31-34).



**Fig. 4:**

Mandibular dental midline shifted to right side of maxillary and facial midlines



**Fig. 5:** Midline shift and upper right lateral incisor crossbite

## Diagnosis

The pre-treatment photographs, radiographic records and study models were obtained 08-13-2010: age: 12y11m

### Skeletal:

- Class II Pattern (SNA 83°, SNB 78°, ANB 5°)
- High mandibular plane angle (SN-MP 36°, FMA 31°)

### Dental:

- Angle Classification: *Subdivision (asymmetry) Class II right, Class I left*
- Midlines: *Mandibular dental midline was 4 mm to the right of the facial and maxillary midlines*
- Tooth Size Arch Length Discrepancy:  
Maxillary: 13 mm,  
Mandibular: 2 mm
- Blocked-out maxillary canines (#6 & #11)
- Cross bite: *Upper right (UR) lateral incisor, both premolars and the second molar (#4, 5 and 7)*
- Partially impacted: *Lower right (LR) second molar (#31) Slight flaring of the lower incisors*
- ABO Discrepancy Index : 17 as documented in the subsequent work sheet

### Facial:

- Convex profile

### Radiographic\Panoramic:

- Partially impacted LR #31; all four 3<sup>rd</sup> molars were present (Fig. 36)

## Specific Objectives of Treatment

### Maxilla (all three planes):

- A - P: *Allow for expression of normal growth*

- Vertical: *Allow for expression of normal growth*
- Transverse: *Allow for expression of normal growth*

### Mandible (all three planes):

- A - P: *Allow for expression of normal growth*
- Vertical: *Allow for expression of normal growth*
- Transverse: *Allow for expression of normal growth*

### Maxillary Dentition

- A - P :  
Molars: *Retract on the right side*  
Incisors: *Maintain*
- Vertical :  
Molars: *Maintain*  
Incisors: *Maintain*
- Inter-molar Width: *Increase*
- Inter-canine Width: *Decrease*
- Buccolingual Inclination: *Maintain*

### Mandibular Dentition

- A - P :  
Molars: *Maintain*  
Incisors: *Maintain*
- Vertical :  
Molars: *Maintain*  
Incisors: *Maintain*
- Inter-molar Width: *Maintain*
- Inter-canine Width: *Maintain*
- Buccolingual Inclination: *Maintain*

### Facial Esthetics: *Maintain*

### Other :

- Correct mandible functional shift and midline deviation due to crossbite of #7

## Treatment Plan

With the reservations previously noted, a non-extraction treatment is indicated. Full fixed appliance with anterior bite turbos on both upper central incisors to correct the anterior cross bite and functional shift. Use unilateral Class II early light short elastics (ELSE)(*Quail 3/16" 2 oz, right side*) to correct right Class II buccal segment. Interproximal reduction of lower dentition as needed to provide space for the partially impacted lower right 2<sup>nd</sup> molar. Progress records midterm to reassess the conservative approach. Apply up and down elastics and detail the final occlusion. Retain the corrected dentition with fixed retainers and clear overlay retainers. Remove all 3<sup>rd</sup> molars at the age of ~18.

## Appliances and Treatment Procedures

A .022" slot Damon Q bracket system (*Ormco, Glendora, CA*) with low torque maxillary incisor brackets to control flaring for the correction of crowding.<sup>1,2</sup> The Damon four archwire sequence was followed.<sup>3</sup> The initial upper archwire was .014" CuNiTi fitted with open coil springs between the lateral incisors and first premolars to create spaces for the blocked-out upper canines (*Fig. 6*). An anterior bite turbo was placed on the lower right lateral incisor to temporarily open the vertical dimension of occlusion (VDO) to correct the cross bite (*Fig. 7*). One month later, space was adequate to align the upper canines and the crossbite was corrected. The bite turbo was removed and standard torque brackets were bonded on the upper cuspids and the lower dentition. Initial archwires were .014" CuNiTi. Two drop-in hooks were fitted in the vertical slots of the upper canines to secure Class II early light short elastics (*Quail 3/16" 2 oz*) as shown in *Figs. 8 and 9*. Four months later, the brackets on both upper

canines were repositioned to approximate the long axis of the tooth. In the 6<sup>th</sup> month, both canines reached the occlusal plane (*Fig. 10*) but the lower midline was still deviated 2 mm to the right. Two drop-in hooks were fitted in the vertical slots of the lower canines to secure parallel elastics (*Ostrich 3/4" 2 oz*) to correct the midline (*Fig. 11*).

In the 7<sup>th</sup> month, rectangular .014"x.025" CuNiTi archwires were placed. Two types of elastics were used: 1. bilateral Class II elastics (*Fox 1/4" 3.5 oz*), and 2. midline elastics (*Dolphin 5/16" 3 oz, followed by Fox 1/4" 3.5 oz*) from #11-22 and positioned under the brackets of #24-27 (*Figs. 12-14*). The brackets on teeth #4, 10, and 21-23 were repositioned.

### Initial Light-Wire Phase: 0~6<sup>th</sup> month .014" CuNiTi:



■ **Fig. 6:**  
Open coil springs between upper lateral incisors and first premolars



■ **Fig. 7:**  
An anterior bite turbo bonded on lower right lateral incisor



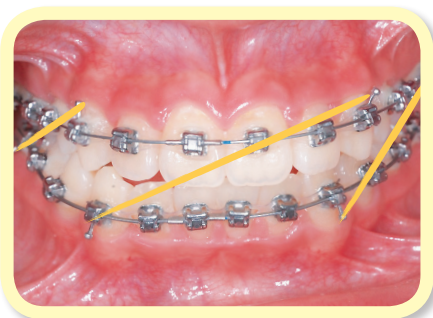
■ Fig. 8: ELSE (Quail 3/16" 2 oz) on right side (2<sup>nd</sup> month)



■ Fig. 9: ELSE (Quail 3/16" 2 oz) on left side (2<sup>nd</sup> month)



■ Fig. 10: Cuspids reached occlusal plane (6<sup>th</sup> month)



■ Fig. 11:  
Parallel elastics (Ostrich 3/4" 2 oz) were used to correct midline discrepancy (6<sup>th</sup> month)

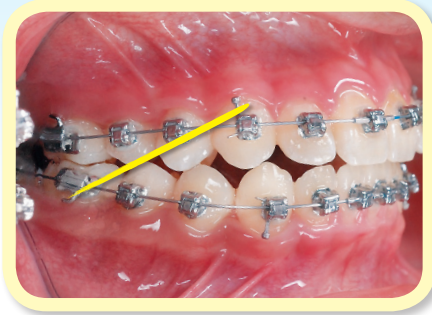
At 13 months, .017"x .025" TMA archwires were engaged. Anterior up and down elastics (Giraffe 3/4" 3.5 oz) and L-shaped elastics (Fox 1/4" 3.5 oz) were applied as shown in Figs. 15-17. Late in treatment, vertical elastics (Figs. 18-20) were used to seat the occlusion, as will be subsequently described.

In the 14<sup>th</sup> month of active treatment, the progress records were collected (Figs. 21-24). The dental casts and radiographs were assessed using the Cast Radiograph Evaluation (CRE) developed by the American Board of Orthodontics (ABO) (Figs. 25-30) and the score was 56, as documented in the subsequent form. At this stage, the patient and his parents were advised that OrthoBoneScrews® (Newton's A, Hsinchu, Taiwan) in the infrazygomatic crests (IZC) were indicated to control the posterior rotation of the mandible and incisal flaring, but the preference was to continue using intermaxillary elastics.

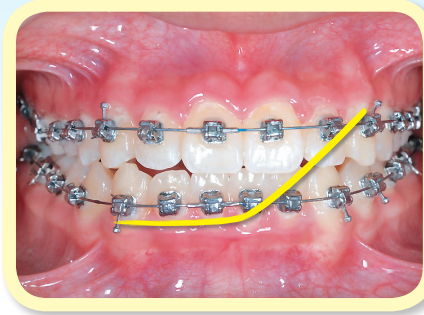
In the 17<sup>th</sup> month, a .019 x.025" stainless steel (SS) archwire was placed in the upper arch. One month later, a .016x.025" SS archwire was placed on the lower arch. SS ligature wires were tied in a figure of 8 pattern to maintain the firm contacts of the anterior teeth in both arches. Since the use of miniscrews on the IZCs was declined, the upper arch was expanded and the upper anterior teeth were retracted to resolve open-bite and flaring problems.

In the final stages of the treatment, detailing was accomplished with first and third order bends. To improve the posterior occlusion, the maxillary arch wire was cut distal to the canines and modified vertical elastics were applied: Giraffe 3/4" 3.5 oz in the anterior segment and Chipmunk 1/8" 3.5 oz in

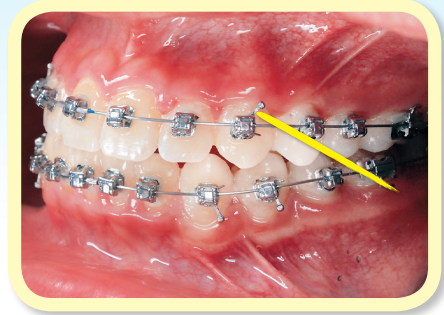
### High-Tech Edgewise : 7<sup>th</sup>~12<sup>th</sup> month .014x.025" CuNiTi



■ Fig. 12:  
Class II elastics (Fox 1/4" 3.5 oz) on right side

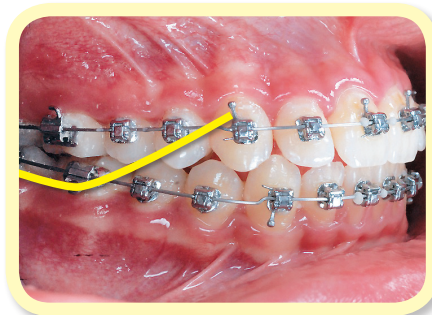


■ Fig. 13:  
Elastics (Dolphin 5/16" 3 oz) to correct midline discrepancy

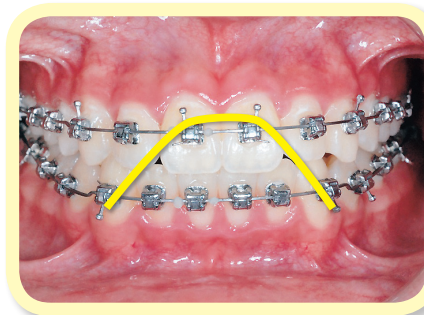


■ Fig. 14:  
Class II elastics (Fox 1/4" 3.5 oz) on left side

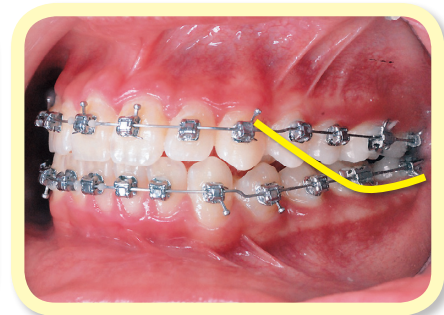
### High-Tech Edgewise : 13<sup>th</sup>~16<sup>th</sup> month .017x.025 TMA



■ Fig. 15:  
L-shaped elastics (Fox 1/4" 3.5 oz) on right side to correct molar relationship

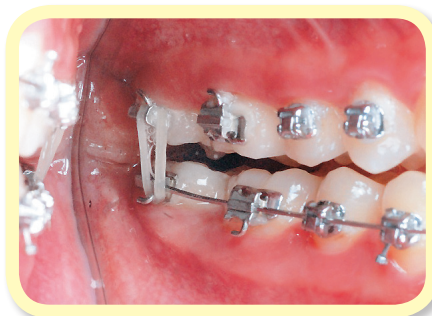


■ Fig. 16:  
Anterior up and down elastics (Giraffe 3/4" 3.5 oz) to close anterior open contact



■ Fig. 17:  
L-shaped elastics (Fox 1/4" 3.5 oz) on left side to correct molar relationship

### Major Mechanics & Finishing : 17<sup>th</sup>~21<sup>st</sup> month .016/.019x.025 SS



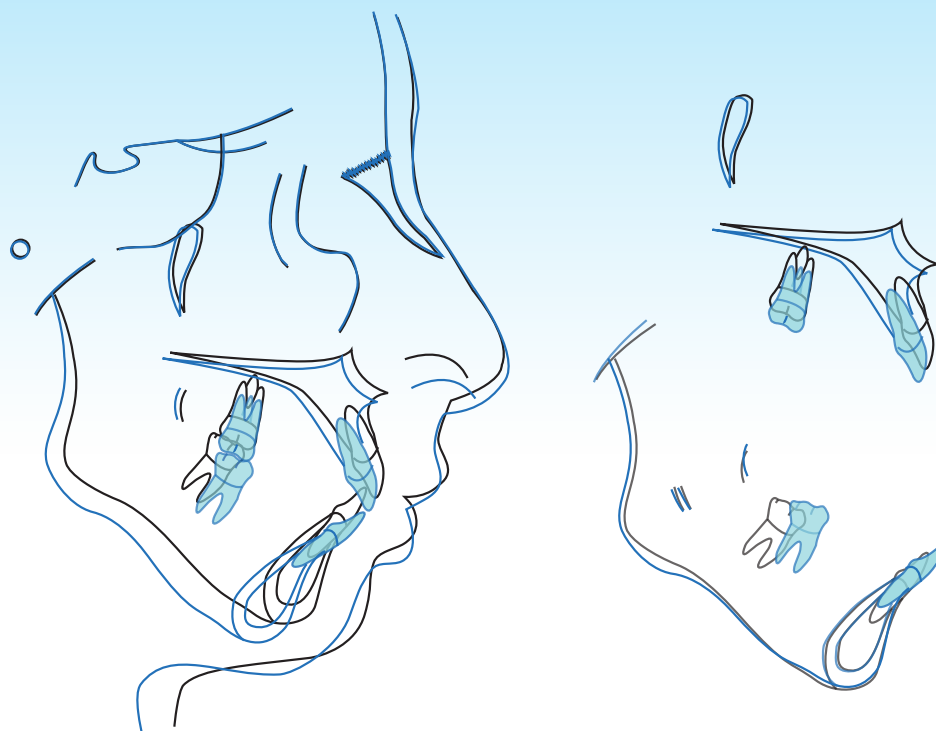
■ Fig. 18:  
Posterior up and down elastics (Chipmunk 1/8" 3.5 oz) between right second molars



■ Fig. 19:  
Anterior up and down elastics (Giraffe 3/4" 3.5 oz) to close anterior open contact



■ Fig. 20:  
The maxillary arch wire was cut distally to the cuspids. Vertical elastics (Giraffe 3/4" 3.5 oz) were applied to achieve optimal intermaxillary contacts.

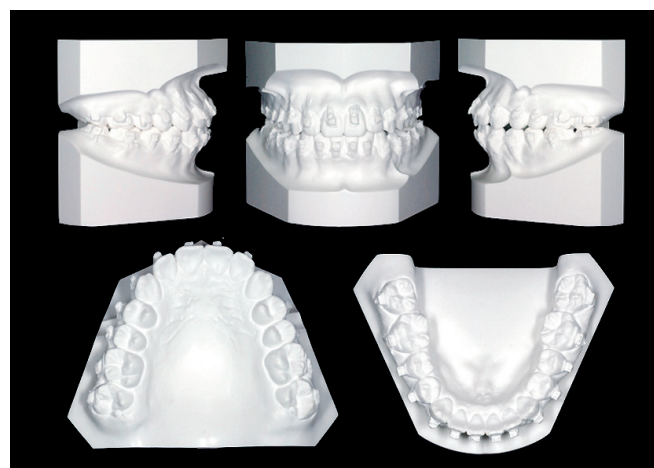


■ Fig. 21:

Superimposed cephalometric tracings show dentofacial changes over 14 months of treatment. All teeth in both arches were extruded and the mandibular incisors were flared. The mandible rotated posteriorly and the face was more convex, but the lips remained competent.



■ Fig.22: Progress facial photographs at 14 months



■ Fig.24: Progress study models (casts) at 14 months

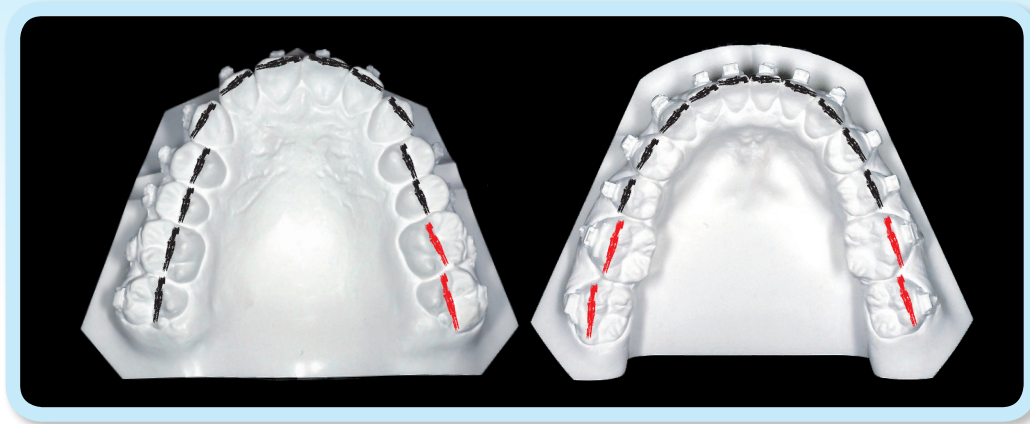


■ Fig.23: Progress intraoral photographs at 14 months

the posterior segments<sup>4-6</sup> (Figs. 18-20). Once optimal interdigitation and intermaxillary contacts were achieved, all fixed appliances were removed.

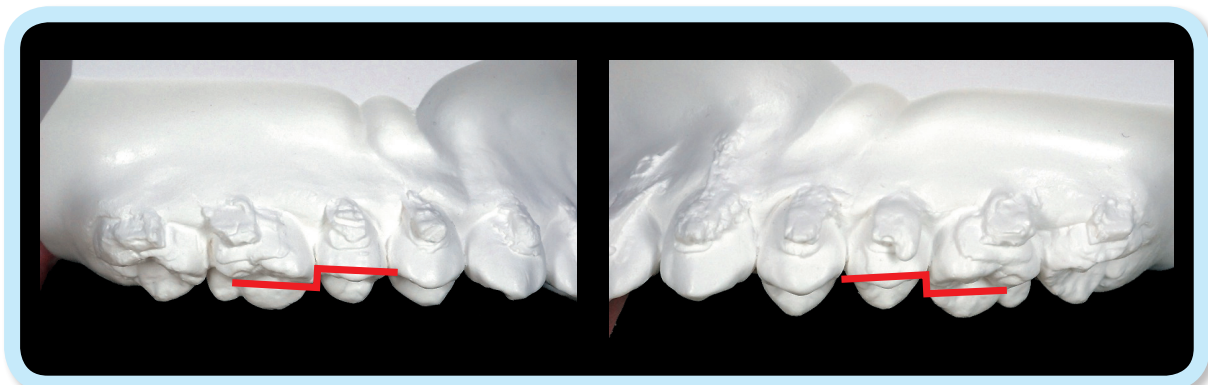
## Treatment Progress

Following 14 months of treatment (age 14y1m) all goals were assessed on a full set of progress records



■ Fig. 25:

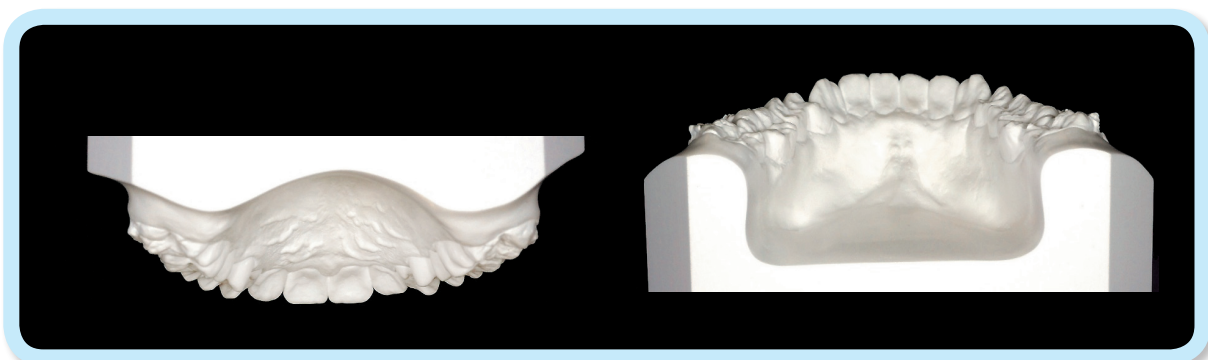
Progress casts were assessed for alignment and rotation; black lines indicate acceptable alignment and red lines reveal discrepancies.



■ Fig. 26:

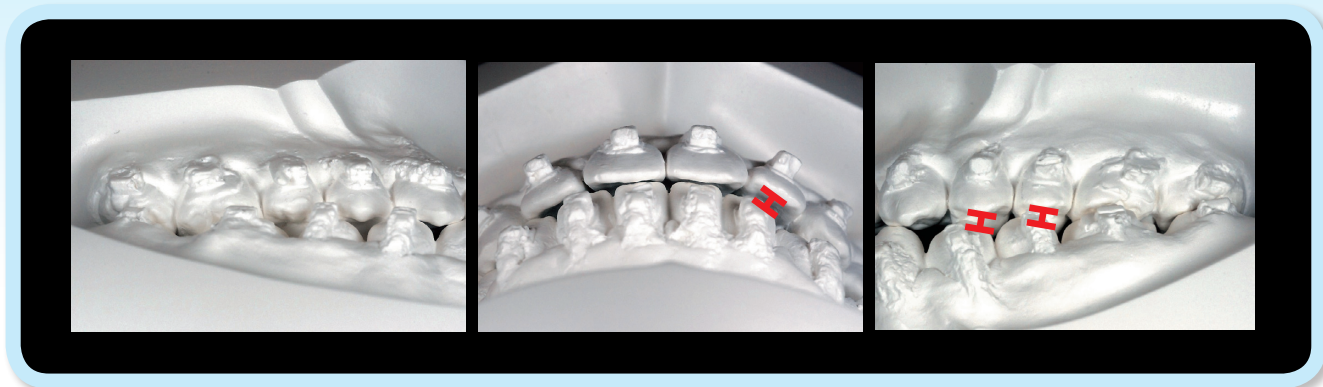
Progress casts were assessed for marginal ridge alignment; red lines reveal discrepancies.

Correction was made by positioning brackets more occlusal on first molars and more gingival on the second premolars.

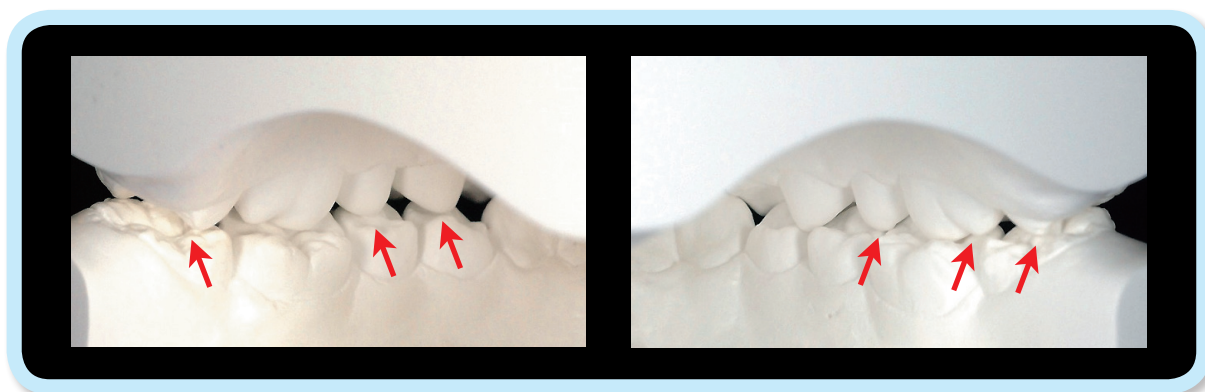


■ Fig. 27:

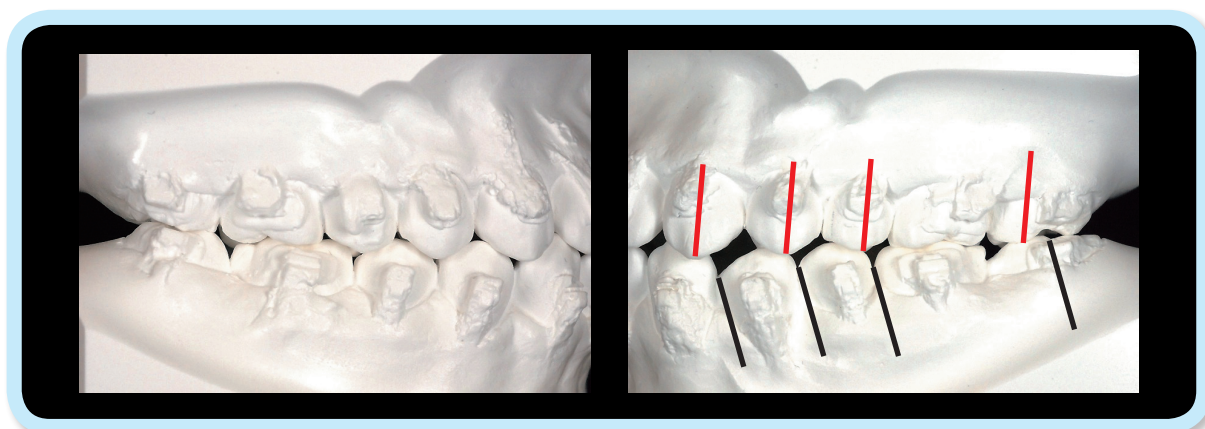
Progress casts were assessed for buccolingual inclinations; discrepancies were corrected by placing progressive torque in the rectangular archwires.



■ Fig. 28: Progress casts were assessed for overjet; the red marks reveal discrepancies that were scored.



■ Fig. 29:  
Progress casts were assessed for maxillary lingual cusp contacts; six cusps (red arrows) were more than 1mm out of contact, so the total score was 12.



■ Fig. 30:  
Progress casts were assessed occlusal relationships (interdigitation); red lines mark cusps that should interdigitate with interproximal contacts, marked with black lines. All discrepancies were 1-2mm, so 4 points were scored.

taken on 12-02-2011. As illustrated in Figs. 21-30, this re-evaluation identified the following problems:

### Mandibular Dentition

- A - P : *Incisors: Flared*
- Vertical :
  - a. Molars: *Extruded*
  - b. Incisors: *Extruded*
- Inter-molar Width: *Constricted*
- Buccolingual Inclination: *Lingual Tipping*

### Treatment Needed for an Optimal Finish

A plan was devised to improve alignment, based on cephalometric superimpositions and the CRE score of 56 :

- Reposition brackets on teeth #3 & #14 to correct marginal ridge discrepancies
- Apply progressive lower posterior buccal crown torque to correct excessive lingual tipping
- Detailing bends to correct rotations
- Arch coordination to improve occlusal relationships and contacts
- IZC Miniscrews to reduce incisor flaring, correct Class II molar relationship and control bite opening

### Treatment Concerns and Summary

After correction of functional shift due to the cross bite of #7, the Class II molar relationship as well as the deviated midline had been resolved. Creating space to relieve crowding has resulted in protrusion and flaring of upper and lower incisors. The bite turbo and Class II elastics, in the absence of favorable growth, had increased the vertical dimension of occlusion (VDO) and produced posterior rotation of the mandible. IZC miniscrews were needed to

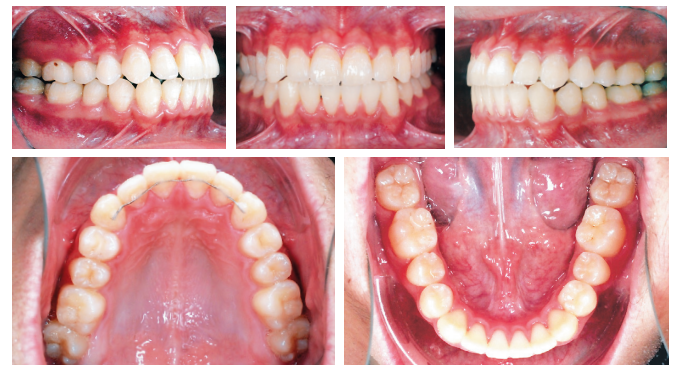
control these side effects. Estimated treatment time is ~6 more months.

### Results Achieved

At age 14y8y after an active treatment time of 21 months, all fixed appliances were removed and post-treatment records (Figs. 31-36) were taken on 07-09-2012.



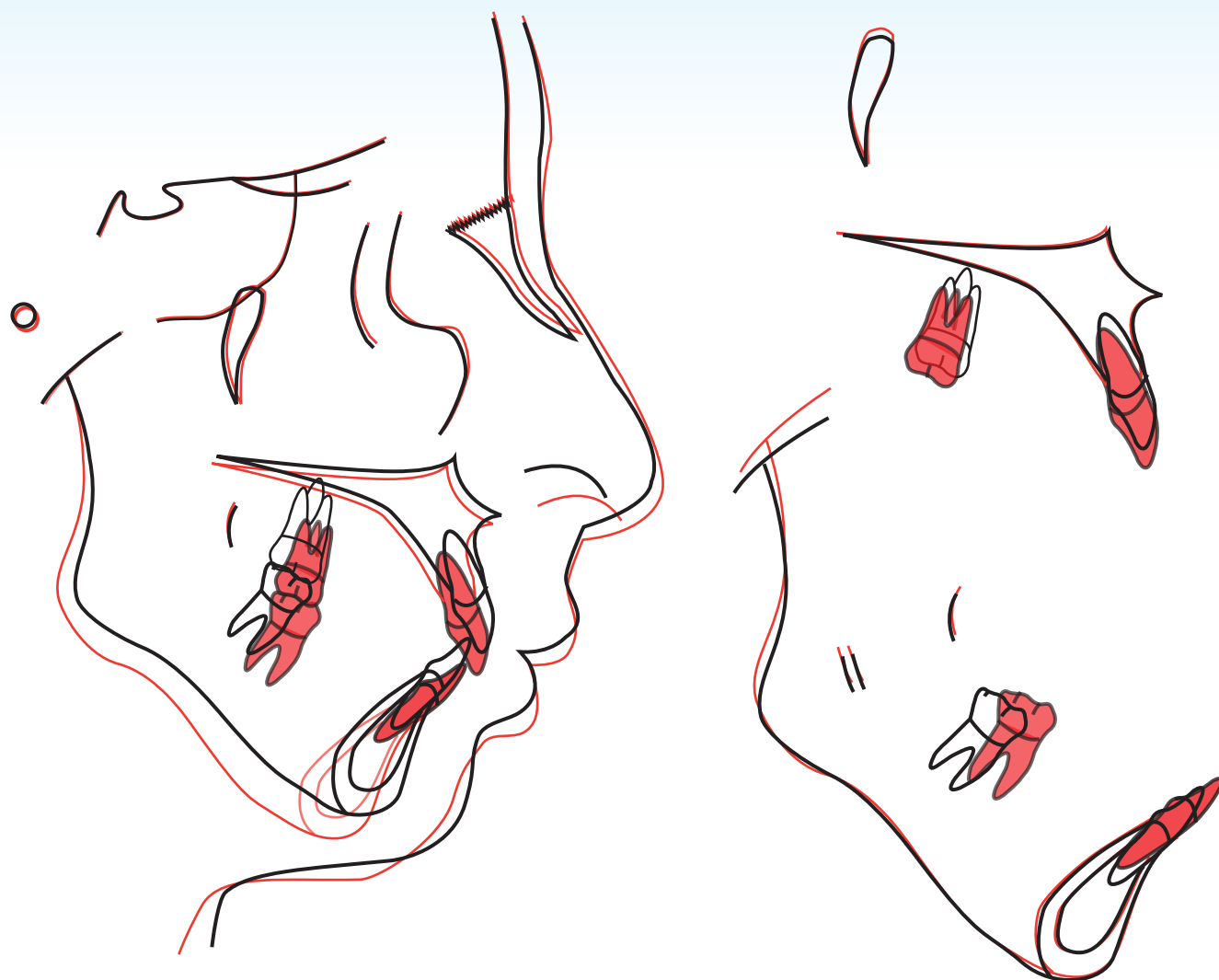
■ Fig.31: Post-treatment facial photographs at 21 months



■ Fig. 32: Post-treatment intraoral photographs at 21 months



■ Fig.33:  
Post-treatment study models show Class I molar relationship on both sides



■ Fig. 34:

Superimposition of pre-treatment and post-treatment ceph tracings demonstrate the dentofacial changes following 21 months of active treatment.

The maxilla was retracted slightly and the mandible had grown vertically. This patient is a vertical grower.

Upper incisors were flared due to regaining the spaces for blocked-out cuspids.

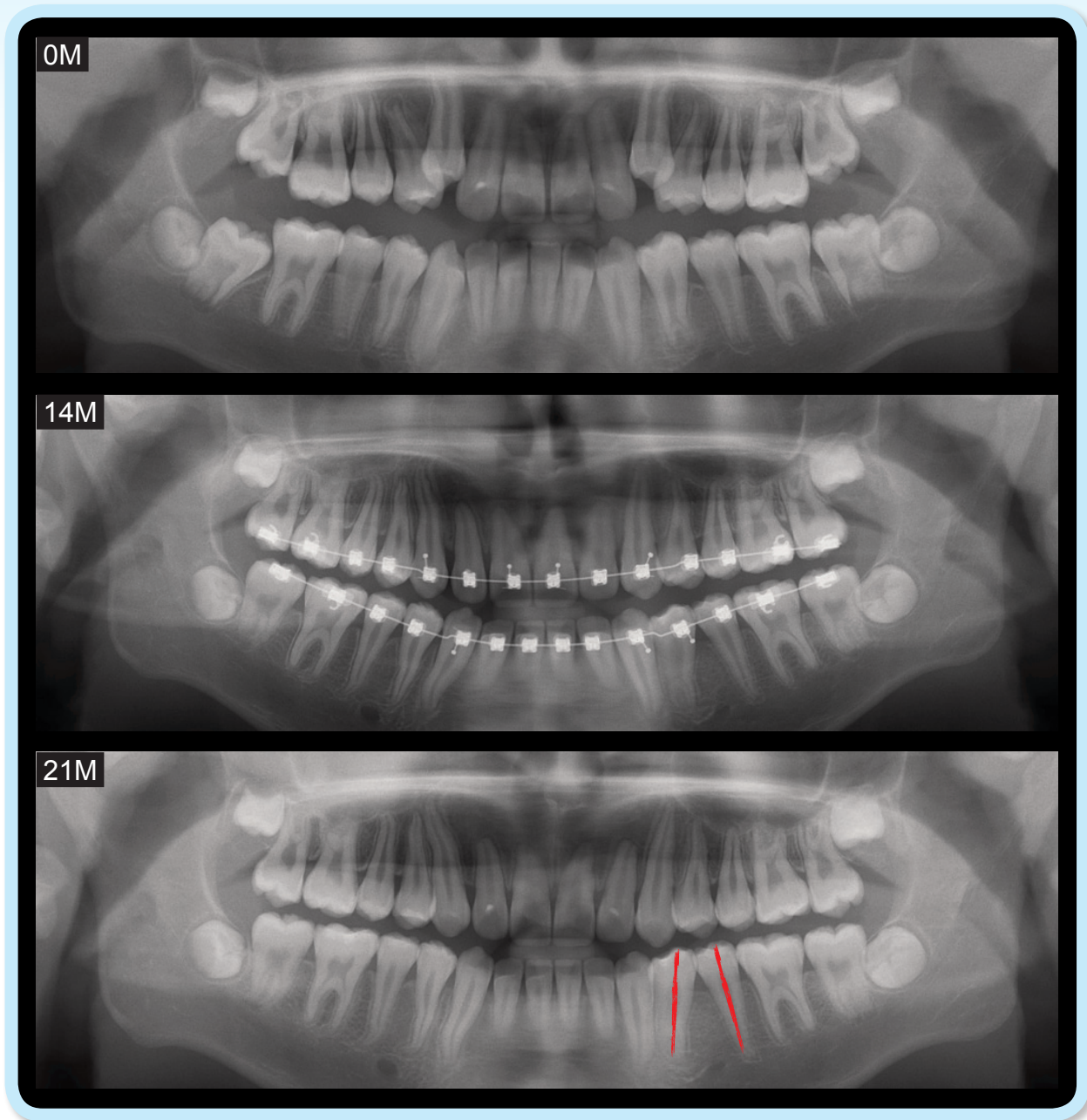
Upper dentition was extruded due to the use of Class II elastics and normal eruption of dentition at this stage.

Upper molars had also been distalized by Class II elastics.

Flaring and extrusion of lower incisors were noticed due to the extensive use of Class II elastics.

The Class II elastics also hinged open the mandible.

The right lower molar was moved forward to achieve Class I molar relationship and to correct the asymmetrical functional shift.

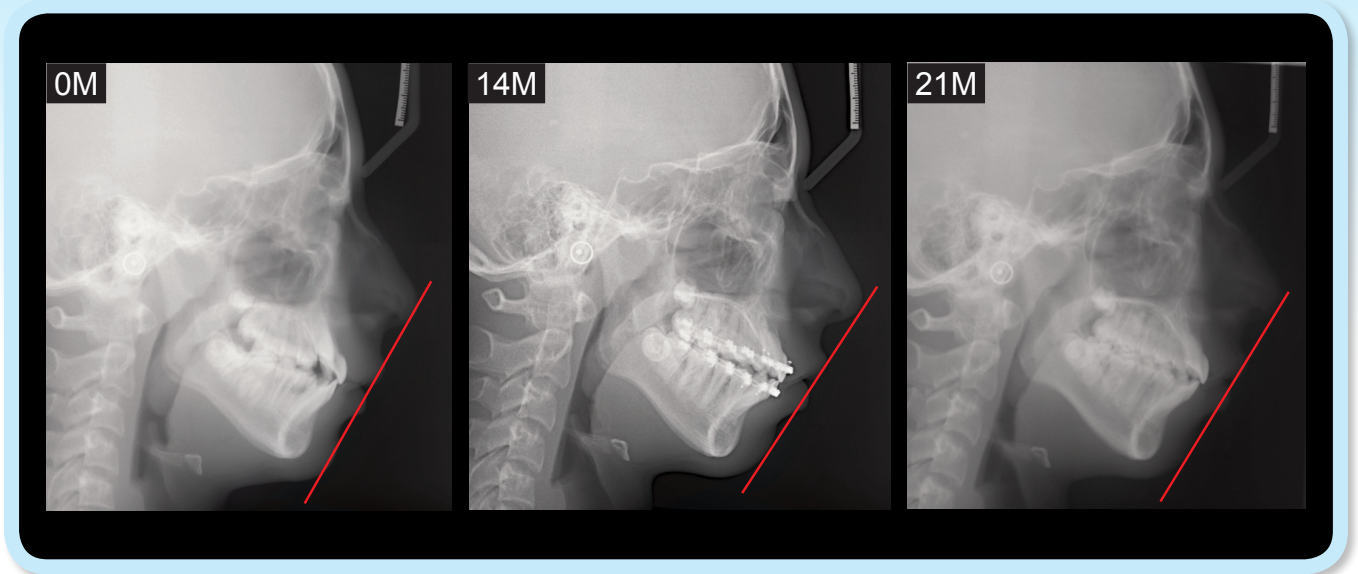


■ Fig. 35:

A series of three panoramic radiographs at 0, 14 and 21 months document the treatment effects.

Root alignment discrepancies, marked by red lines, resulted in a total of two points on the CRE score.

The axial inclination of the second premolar is within 1 mm but the discrepancy for the first premolar is more than 1 mm, so two points are scored.



■ Fig.36:

A series of three cephalometric radiographs (0, 14 and 21 months) document the dentofacial and skeletal affects of treatment. Despite the opening of the VDO, the relationship between upper/lower lips to the E-line remained acceptable. Flaring of the incisors noted at 14 months was improved at 21 months.

#### Maxilla (all three planes):

- A - P: Retracted
- Vertical: Increased
- Transverse: Expanded

#### Mandible (all three planes):

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

#### Maxillary Dentition

- Alignment: #2 rotated mesial side out
- Anchorage: Retraction of upper molars
- Incisor Control: Flared
- Vertical: Increased
- A - P: Retracted
- Inter-molar Width: Increased
- Inter-canine Width: Maintained
- Marginal Ridges: discrepancies from inadequate

alignment of teeth #2 & 14

- Buccolingual Inclination: #2, 3, 14, 15 flared
- Rotations: Acceptable

#### Mandibular Dentition

- Alignment: #19 mesial side in
- Anchorage: Extrusion of molars
- Incisor Control: Flared
- A - P: Maintained
- Vertical: Increased
- Inter-molar Width: Decreased
- Inter-canine Width: Increased
- Marginal Ridges: Discrepancy on #31
- Buccolingual Inclination: Lingual tipping on #18, 19, 30, 31
- Rotations: #27 mesial side in, #29 mesial side out

#### Facial Esthetics:

- Lower lip profile was slightly protrusive

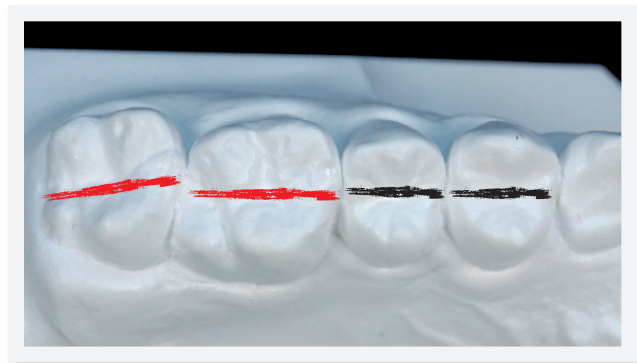
## Retention

An upper fixed 3-3 retainer was bonded on all teeth. Upper and lower clear overlay retainers were delivered, with instructions to wear them full time for the first 6 months, but nights only thereafter. Home care and training for retainer maintenance was provided.

## Final Evaluation of Treatment

The final alignment was assessed at 26 points with the ABO CRE as documented on the form that appears later in this report. This was considered an excellent result for the moderately severe malocclusion ( $DI = 17$ ).<sup>15</sup> The soft and hard tissue in the esthetic zone were also pleasing as will be subsequently documented.<sup>16</sup> The following deviations from ideal were noted: Alignment and rotation: 5 points were scored for buccal position of second molars, and distal out rotation of the lower left canine (Figs. 37-39).

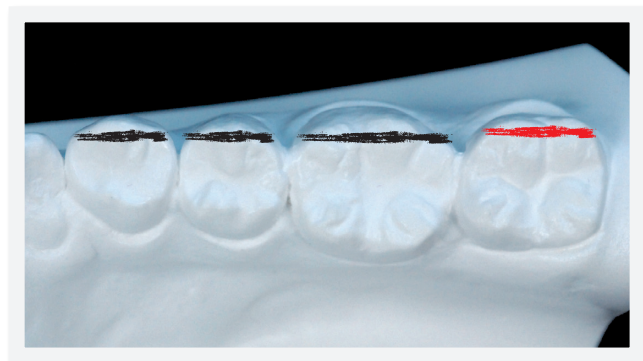
- Marginal ridge discrepancies: 3 points were scored for maxillary premolars and molars (Figs. 40-41).
- Buccolingual inclination: 12 points were scored for molar discrepancies (Fig. 42).



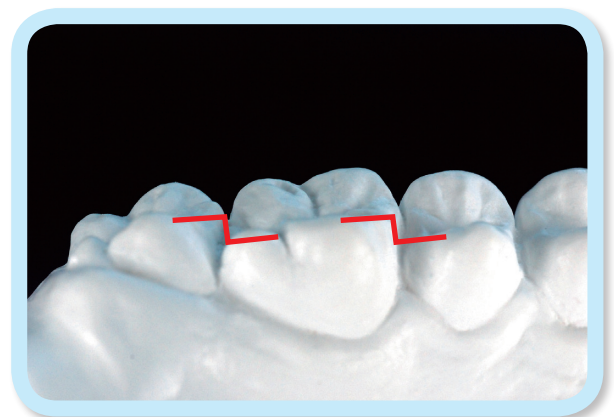
■ **Fig. 37:**  
At 21 months, red lines marked discrepancies in maxillary fossae alignment.



■ **Fig. 38:**  
At 21 months, a red line marks a discrepancy in alignment of the buccal cusps for the lower left 2<sup>nd</sup> molar.

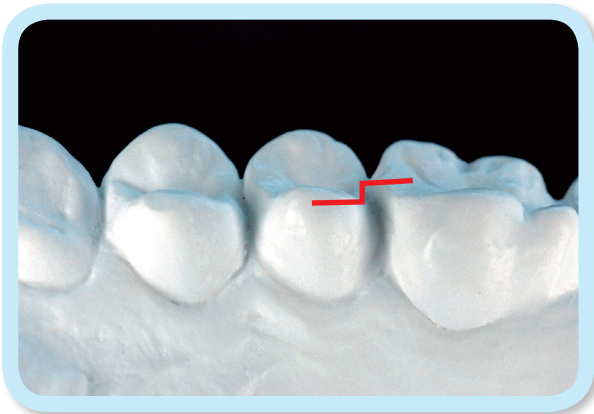


■ **Fig. 39:**  
At 21 months, a red line marks a discrepancy in alignment of the buccal cusps for the lower right 2<sup>nd</sup> molar.

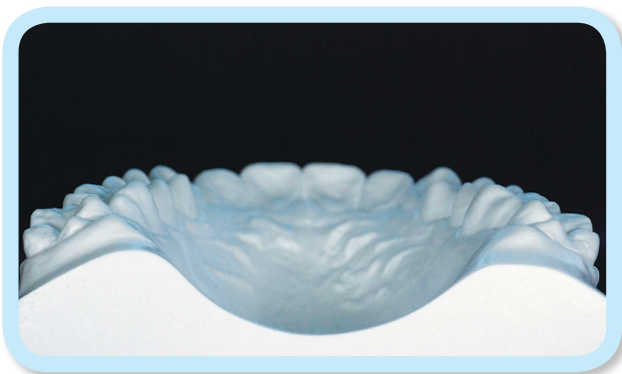


■ **Fig. 40:**  
At 21 months, marginal ridge discrepancies between upper right 1<sup>st</sup> and 2<sup>nd</sup> molars are marked with red lines.

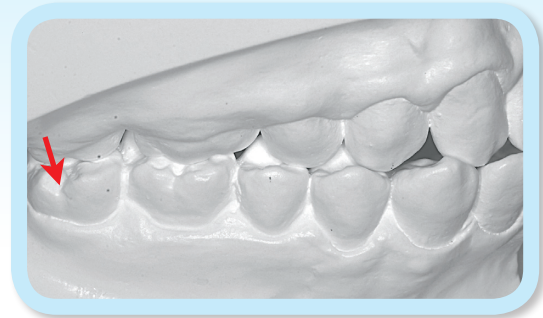
- Occlusal contacts: 3 points were scored for absence of contacts on second molars (Figs. 43-44).
- Root Angulation: 2 points were scored for inadequate alignment of the lower left premolars (Fig. 35).



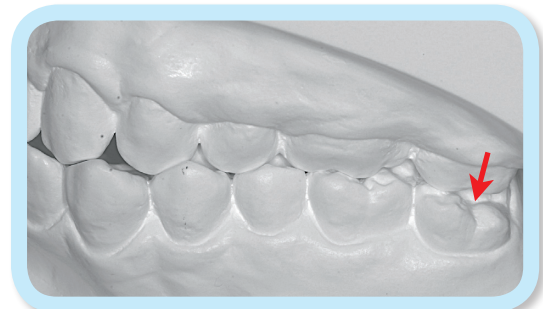
■ **Fig. 41:**  
At 21 months, a marginal ridge discrepancy between the upper left 2<sup>nd</sup> premolar and 1<sup>st</sup> molar



■ **Fig. 42:**  
At 21 months, large buccolingual inclination problems are noted for maxillary molars that are tipped buccally to compensate for the narrow maxilla.



■ **Fig. 43:**  
At 21 months, lack of occlusal contact is noted between the left 2<sup>nd</sup> molars.



■ **Fig. 44:**  
At 21 months, lack of occlusal contact is noted between the right 2<sup>nd</sup> molars.

## Discussion

The dental aspects of the current malocclusion were well treated, but there were problems with the skeletal management. Initially, two conservative approaches were considered for correcting the crowding and incisal flaring in the presence of a high mandibular plane angle and open bite tendency: 1. extractions followed by retraction of the anterior segments, and 2. non-extraction treatment using extra-alveolar (E-A) miniscrews<sup>7</sup> to retract the buccal segments. Unfortunately, the patient and his parents declined both miniscrews and extractions. Since the pre-treatment lip relationship and E-line were

acceptable (Fig. 36), a short-term anterior bite turbo and Class II elastics were used. In the absence of significant forward growth, the risks were flaring of the incisors and opening of the VDO. The progress evaluation showed little significant growth, flaring of the incisors, and opening of the VDO. Again the use IZC miniscrews was proposed but the option was declined. Both the patient and his parents were pleased with the progress and preferred to finish the correction with intermaxillary elastics. Warning was again provided that stability may be a problem.

Anterior crossbite affecting only one or two teeth is usually due to ectopic eruption of one or more maxillary incisors. The most common etiologic factor for non-skeletal anterior crossbite is lack of space for maxillary permanent incisors, which is often manifest as palatal displacement of lateral incisors and blocked out canines.

An asymmetric posterior crossbite may be associated with a functional shift of the mandible to the crossbite side. Clinically, the posterior teeth occlude normally on one side but there is a contralateral crossbite. The etiology may be dental, skeletal, or neuro-muscular, but the problem is frequently associated with a narrow maxillary dental arch.<sup>8</sup> Ectopic eruption of maxillary incisor in palatal version may create a functional shift that results in a narrowing of the maxilla due to cheek pressure on the contralateral side. Alternately, a developmentally small maxilla may be too narrow to accommodate the mandible, so one side assumes a normal occlusion and the opposite side is in crossbite. The inference of posterior cusps when closing may result in a functional shift and changes the habitual

rest position. Subsequent adaptation to a unilateral crossbite may lead to asymmetric mandibular growth and development of TMD.<sup>9-13</sup>

Unilateral crossbite with a functional shift should be treated as early as possible because spontaneous correction is rare. For the present patient, the etiology of crossbite appears to be both skeletal and dental. The ectopic eruption of the right maxillary lateral incisor probably caused premature loss of the adjacent deciduous canine, resulting in a unilateral Class II molar relationship on the right side. The treatment plan attempted to reverse the etiology by retracting the right buccal segment with Class II elastics while opening space for the canine and expanding the maxilla. The molar relationship was corrected to Class I and the midline deviation was resolved. However, the use of a bite turbo and Class II elastics caused a posterior rotation of the mandible creating a more Class II molar relationship bilaterally.

Class II elastics generate clockwise moments on each arch, relative to their centers of resistance. These mechanics result in an opening of the bite, posterior rotation of the mandible, steepening of the plane of occlusion, and flaring of the lower incisors. For patients with a high mandibular plane angle, it is preferable to use an extraction treatment modality or E-A miniscrew anchorage to retract the maxillary dentition as needed without extruding the posterior segments and flaring the lower incisors. Unfortunately the latter two options were repeatedly declined in favor of Class II elastics. At the finish, the dental result was good but there was a significant skeletal compromise, that may result in stability problems.

Anchorage control is a challenging problem in orthodontic treatment. First molars are the primary anchorage units. Including second molars, enhances anchorage but does not completely stabilize the posterior segments. In comparison with conventional anchorage, E-A miniscrews provide osseous anchorage, preventing the undesirable side effects on the posterior segments.<sup>14-18</sup> Osseous anchorage is useful for various types of tooth movement. There are minimal anatomic limitations and the devices are relatively simple to place. The advantages are less traumatic surgery, immediate loading after placement, reduction of treatment time, and enhanced clinical efficiency. In addition, there is less cost, pain, sensitivity or allergic reaction.

The distance from the upper and lower lips to the E-line increased from 1.0 mm to 1.5 mm and from 0.5 mm to 3.0 mm, respectively. The principal deficit with treatment was a more recessive chin. Nevertheless, the facial profile remained balanced without lip strain. Overall, there was a significant improvement in both alignment and function, so the patient was well satisfied with the treatment.

Buccolingual inclination of the second molars indicated a lack of upper buccal root torque and lower lingual root torque. Arch expansion and detailed third order wire bending are needed in the finishing stage to correct these deficiencies. These are typical problems for patients with a narrow maxilla, and even when corrected may not be stable. It was not advisable to expend the treatment plan to correct problems with an uncertain prognosis.

The root angulation of the lower left premolars was not parallel. This discrepancy was recognized early in the progress record, but it presented an interesting dilemma. If the root of #21 were to be tipped distally to make it parallel with #20, then an unesthetic embrasure might be created between #21 and #11. This problem is due to a morphological variation in the buccal cusp of the lower first premolar, which is a common Chinese characteristic.

Non-extraction treatment without E-A miniscrew anchorage certainly increased the degree of difficulty for correcting the current malocclusion. In retrospect, it would have been wise to concentrate on convincing the patient and his family of the necessity for E-A miniscrew anchorage before the start of treatment. It is difficult for patients to appreciate skeletal problems when they note that the dental correction is proceeding as they expected. With appropriate E-A anchorage, it would have been possible to achieve the dental correction with a better facial result, and avoid the flaring of the lower incisors to compensate for the posterior rotation of the mandible.<sup>17-18</sup>

## Conclusion

This case report demonstrates sufficient space is crucial for canine eruption. Open coil springs can create space, but they tend to flare incisors. Although the application of class II elastics can retract buccal segments and resolve the upper anterior flaring, the mechanics produce undesirable side effects that increase facial convexity and

jeopardize lower incisor stability. E-A miniscrews are superior to conventional anchorage for high angle patients with an openbite tendency, so they should be a prospective consideration. All 3<sup>rd</sup> molars should be removed at the age of ~18.

## Acknowledgment

Thanks to Mr. Paul Head for proofreading this article.

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## Edward H. Angle Society

# Cephalometric Summary

Area	Measurement	A <sup>1</sup>	A <sup>2</sup> (progress)	B	Difference A <sup>1</sup> - B
<b>Maxilla to Cranial Base</b>	SNA	83	82	82	1
<b>Mandible to Cranial Base</b>	SNB	78	77	76	1
	SN-Go-Gn	36	37	37	0
	FMA	31	32	32	0
<b>Maxillo-Mandibular</b>	ANB	5	5	6	1
<b>Maxillary Dentition</b>	1 to NA (mm)	3.5 mm	5 mm	4.5 mm	1
	1 to SN	106.5	109	107.5	1
	6-6 (mm) (casts)	48 mm	49 mm	49 mm	1
<b>Mandibular Dentition</b>	1 to NB (mm)	7 mm	13 mm	11.5 mm	4.5
	1 to Go-Gn	98	103	100	2
	6-6 (mm) (casts)	45 mm	44 mm	44 mm	1
	3-3 (mm) (casts)	27 mm	27.5 mm	27.5 mm	0.5
<b>Soft Tissue</b>	Esthetic Plane	U: 1 mm L: 0.5 mm	U: 1 mm L: 2 mm	U: 1.5 mm L: 3 mm	U: 0.5 L: 2.5

A<sup>1</sup> Pretreatment records

A<sup>2</sup> Interim or progress records if indicated

B Posttreatment records

\* NOTE: **Difference between A1 and B.** It is not required for Affiliates to use negative or positive signs to indicate this value. Show only the number difference between the two values. **Note, additional measurements may be used for evaluation. Please place these on additional sheet.**

## Discrepancy Index Worksheet

**TOTAL D.I. SCORE****17****OVERJET**

0 mm. (edge-to-edge)	=	1 pt.
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 = **2****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 <u>    </u> pts.
Full Class II or III	=	4 pts. per side <b>4</b> pts.
Beyond Class II or III	=	1 pt. per mm. <u>    </u> pts. additional

Total = **4****LINGUAL POSTERIOR X-BITE**1 pt. per tooth Total = **2****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  $> 38^\circ$       x 2 pts. =      $\leq 26^\circ$  = 1 pt.Each degree  $< 26^\circ$       x 1 pt. =     I to MP  $\geq 99^\circ$  = 1 pt.Each degree  $> 99^\circ$       x 1 pt. =     Total = **0****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. = <b>2</b>
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 = **2**

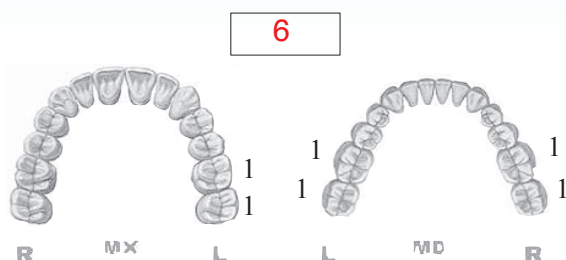
## Cast-Radiograph Evaluation

### Interim-Treatment Progress

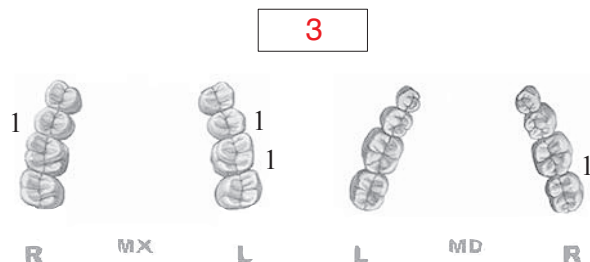
**PROGRESS : 14<sup>th</sup> month in treatment**

**Total Score: 56**

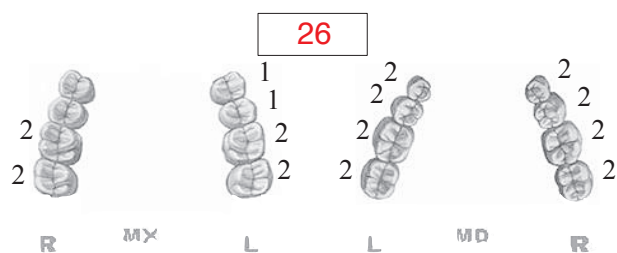
#### Alignment/Rotations



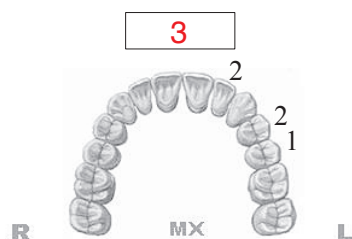
#### Marginal Ridges



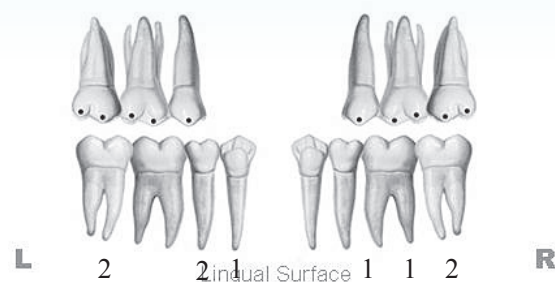
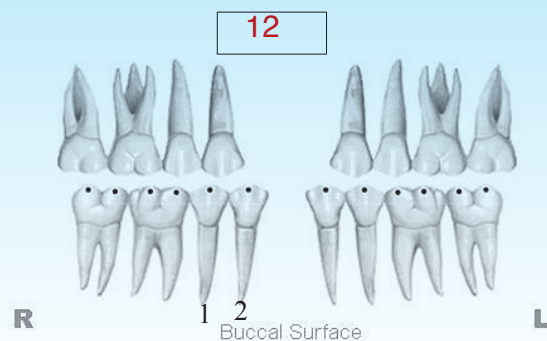
#### Buccolingual Inclination



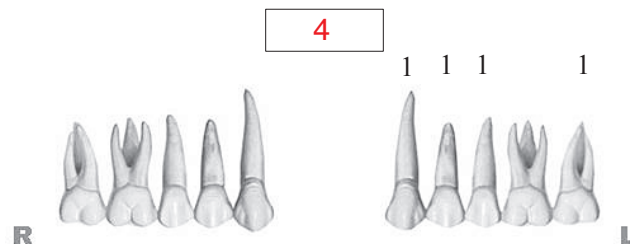
#### Overjet



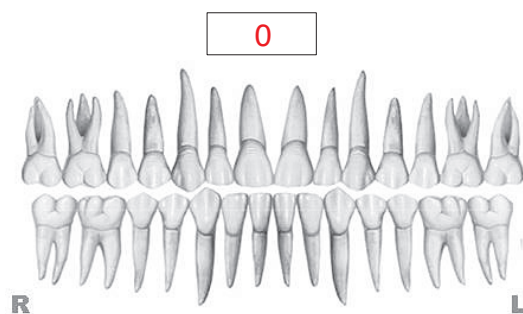
#### Occlusal Contacts



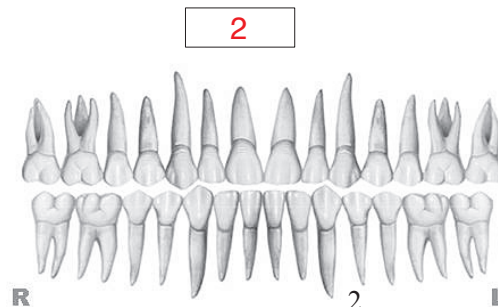
#### Occlusal Relationships



#### Interproximal Contacts



#### Root Angulation



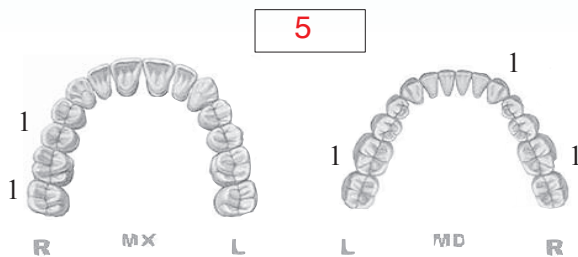
**INSTRUCTIONS:** Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

# Cast-Radiograph Evaluation

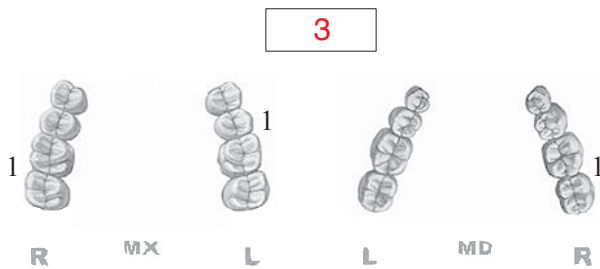
Interim-Treatment Progress

Total Score: **26**

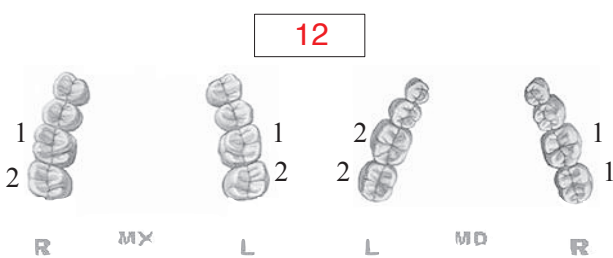
## Alignment/Rotations



## Marginal Ridges



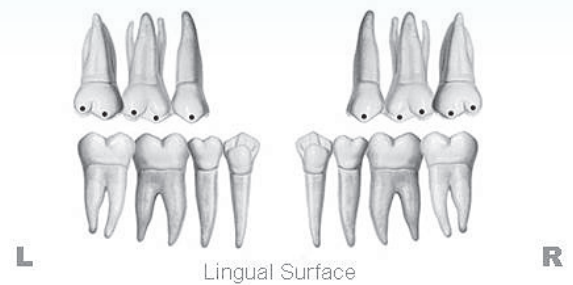
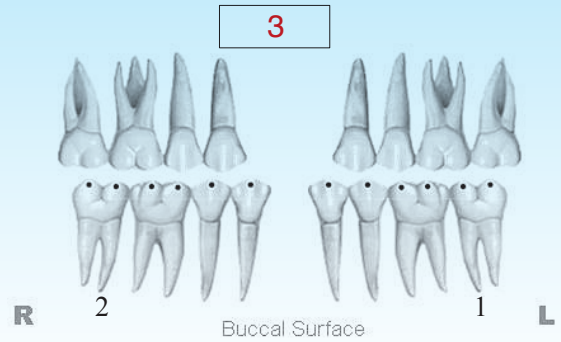
## Buccolingual Inclination



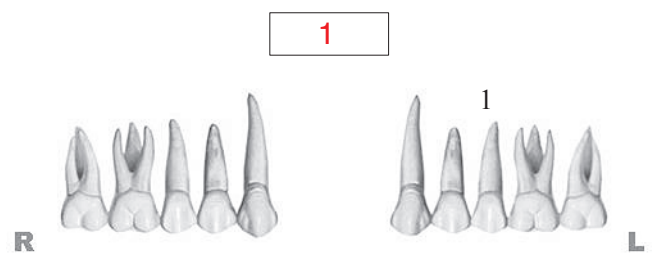
## Overjet



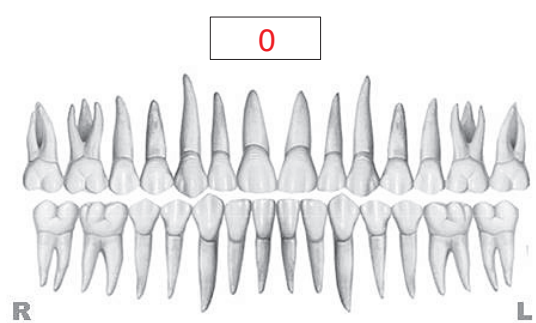
## Occlusal Contacts



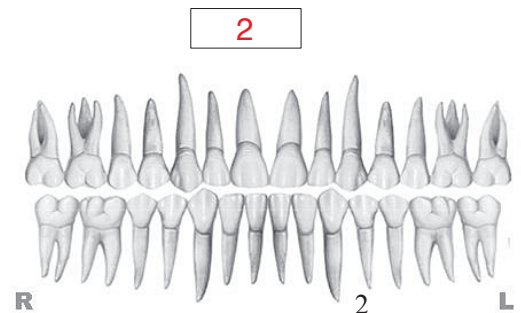
## Occlusal Relationships



## Interproximal Contacts



## Root Angulation

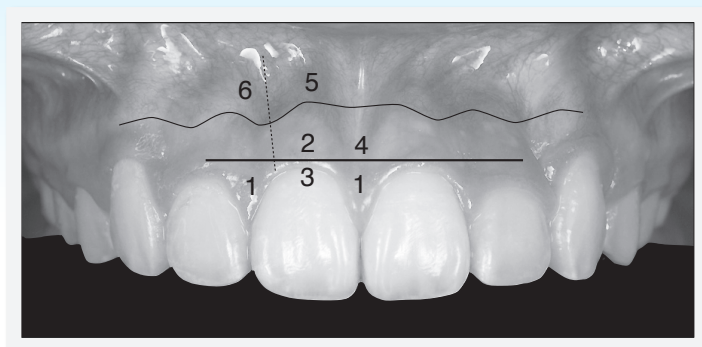


**INSTRUCTIONS:** Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

## IBOI Pink & White Esthetic Score (Before Surgical Crown Lengthening)

Total Score: = **3**

### 1. Pink Esthetic Score



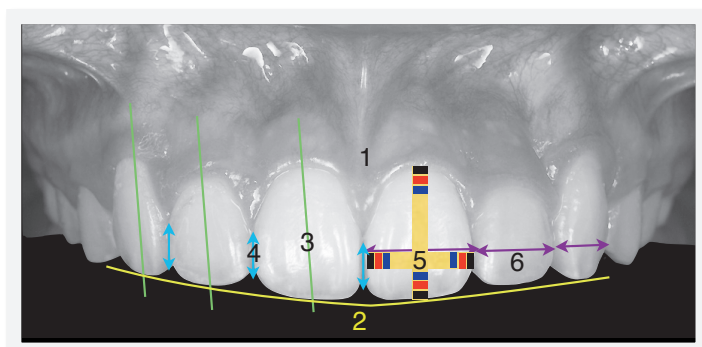
Total = **1**

1. Mesial Papilla	0	1	2
2. Distal Papilla	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

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

### 2. White Esthetic Score ( for Micro-esthetics )

Total = **2**



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

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