

# Early Treatment of Anterior Crossbite Complicated by Maxillary Posterior Crowding

## History And Etiology

An 8-year-1-month female presented with her parents for orthodontic consultation. The chief concerns were anterior crossbite and severe crowding in the maxillary posterior segments. Her facial profile was orthognathic and frontal symmetry was within normal limits (WNL). The mandibular permanent incisors and first molars were present. Maxillary primary lateral incisors, canines and left first molar were retained, but all four upper premolars were erupted in malposed positions (Figs. 1-3). The etiology of the malocclusion was presumed to be a more palatal ectopic path of eruption for maxillary incisors and canines. There was no other contributing medical or dental history.

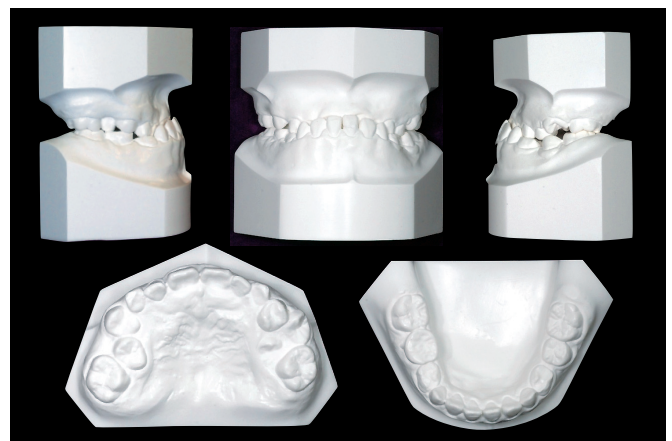
Active treatment started 8 months later when the permanent lateral incisors had erupted. Four years of non-extraction orthodontic treatment, in both the mixed and early permanent dentition, resulted in a near ideal alignment, as documented in Figs. 4. The original profile was maintained. Radiographic documentation of the pretreatment condition and the posttreatment result are provided in Figs. 7-8, respectively. Cephalometric data is presented in Table 1 and Fig. 9 shows the superimposed cephalometric tracings for the anterior cranial base, the maxilla and the mandible.



■ Fig. 1: Pretreatment facial photographs



■ Fig. 2: Pretreatment intraoral photographs



■ Fig. 3: Pretreatment study models

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*International Journal of Orthodontics & Implantology* (left)



■ Fig. 4: Posttreatment facial photographs



■ Fig. 5: Posttreatment intraoral photographs



■ Fig. 6: Posttreatment study models

## Diagnosis

### Skeletal:

- Skeletal Class III ( $SNA\ 73^\circ$ ,  $SNB\ 76^\circ$ ,  $ANB\ -3^\circ$ )
- Mandibular plane angle ( $SN-MP\ 35^\circ$ ,  $FMA\ 28^\circ$ )
- Functional shift 3mm anteriorly and to the left

### Dental:

- Bilateral Class I molar relationship in centric occlusion (Co)
- Bilateral Class II molar relationship in centric relation (Cr)
- Full anterior crossbite with  $>100\%$  overbite OJ -3 mm; OB 8 mm
- Midline left shift 2 mm
- Deep curve of Spee on the lower arch Teeth #4, 12, 13 early and ectopic eruption ABO Discrepancy Index = 37

### Facial:

- Straight (*orthognathic*) profile
- Competent, slightly retrusive lower lip
- Prominent chin

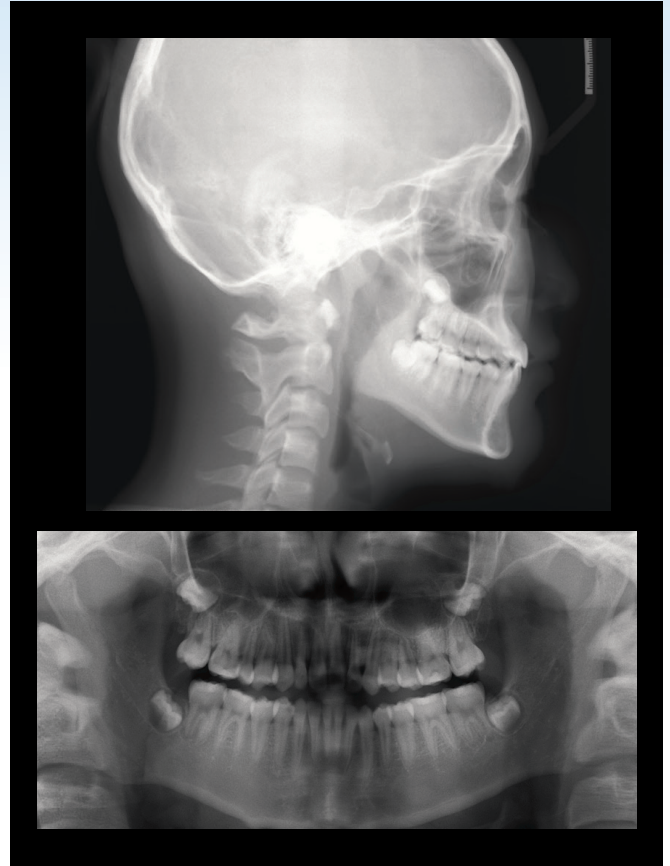
## Specific Objectives Of Treatment

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

- A - P: Anterior crossbite correction allowing for normal expression of growth
- Vertical: Allow for normal expression of growth
- Transverse: Allow for normal expression of growth



■ Fig. 7: Pretreatment pano. and ceph. radiographs



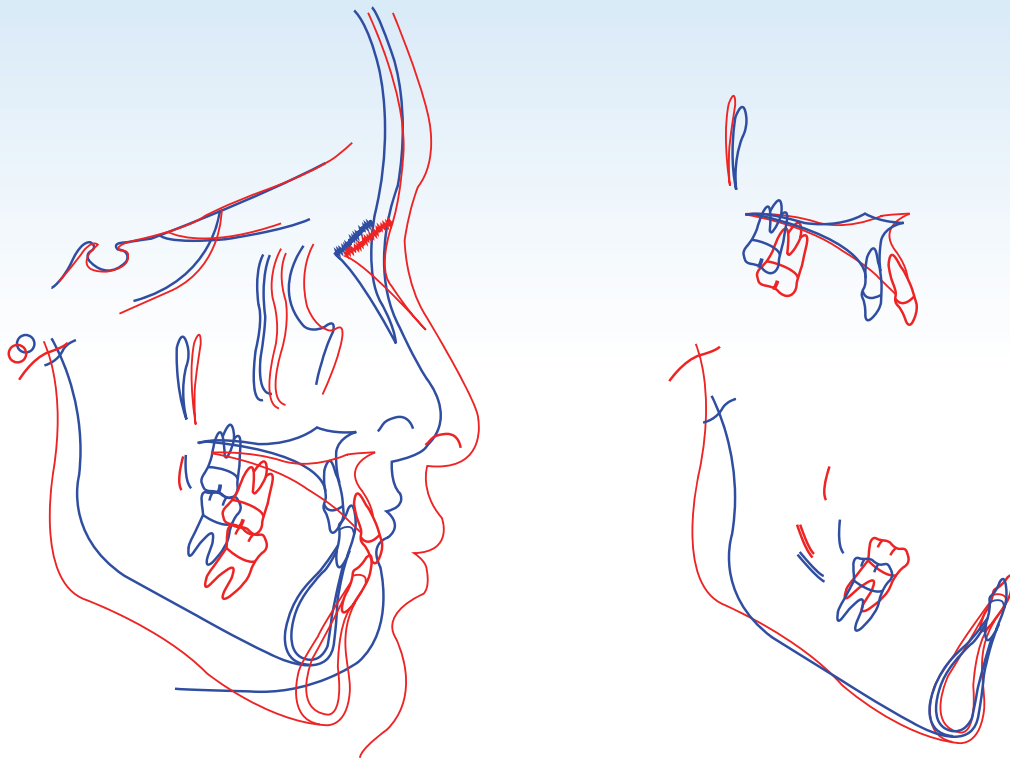
■ Fig. 8: Posttreatment pano. and ceph. radiographs

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	73°	74°	1°
SNB°	76°	76°	0°
ANB°	-3°	-2°	1°
SN-MP°	35°	35°	0°
FMA°	28°	30°	2°
DENTAL ANALYSIS			
U1 TO NA mm	2.4 mm	8 mm	5.6 mm
U1 TO SN°	84°	101°	17°
L1 TO NB mm	1 mm	3.5 mm	2.5 mm
L1 TO MP°	75°	88°	12°
FACIAL ANALYSIS			
E-LINE UL	-4.4 mm	-2 mm	2.4 mm
E-LINE LL	-3.8 mm	-2 mm	1.8 mm

■ Table. 1: Cephalometric summary



■ Fig. 9: Presence of functional shift



■ Fig. 10: Superimposed tracings showed the patient's significant growth in these 4 years. Incisors were flared, and molars were extruded.

**Mandible (all three planes):**

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

**Maxillary Dentition:**

- A - P: Correct anterior crossbite, increase axial inclination of incisors
- Vertical: Allow for growth-related extrusion
- Inter-molar width: Allow for growth-related expansion

**Mandibular Dentition:**

- A - P: Increase axial inclination of incisors
- Vertical: Allow for growth-related extrusion
- Inter-molar / Inter-canine Width: Allow for growth-related expression

**Facial Esthetics:**

- Maintain profile and lip protrusion pattern

**Treatment Plan**

To control the functional inhibition of growth, early intervention was indicated. A good prognosis could be expected because of the orthognathic profile in Cr, Class I molar relationship in Co and presence of a functional shift (Fig. 9). A non-extraction strategy



■ Fig. 11: Incisors flared and molars were pushed back for anterior crossbite correction and posterior space creation with coil springs on a .014 CuNiTi wire.



■ Fig. 12: Low torque brackets combined with coil springs and a bite turbo on a .014 CuNiTi wire.

was chosen to maintain the profile. After eruption of the maxillary lateral incisors, the 2x4 mixed dentition method (brackets on maxillary permanent incisors and first molars) was combined with coil springs and bite turbos to correct the anterior crossbite and open space for alignment of the malposed premolars (Fig. 11).

The deep curve of Spee in the lower arch was corrected with natural eruption following the placement of bite turbos on the mandibular central

incisors (Fig. 12). Once the maxillary arch was aligned (Fig. 13), and the mandibular buccal segments erupt, all permanent teeth were bonded. Intermaxillary elastics (Class III and midline) were used as needed to solve the sagittal discrepancy and detailing bends produced the final occlusion. Following detailing, fixed appliances were removed and both arches were retained with removable retainers.

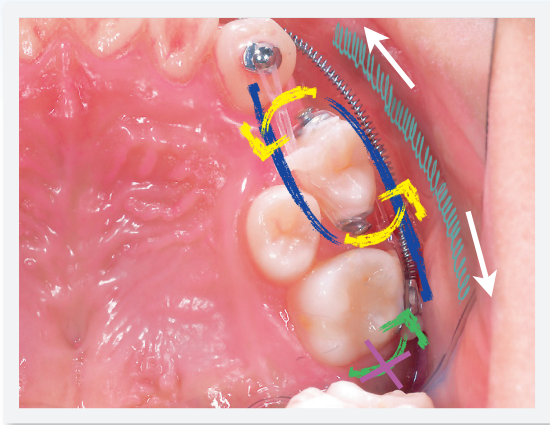
### Appliances And Treatment Progress

Damon Q low torque .022" brackets (Ormco) were bonded on the maxillary arch: both first molars, right first premolar, and all four incisors. Bite turbos were installed on the lower central incisors, and a .014 CuNiTi archwire was fitted, with three lengths of open coil spring, to correct the negative overjet and posterior crowding (Fig. 12). The anterior crossbite was corrected in one month. (Fig. 13)

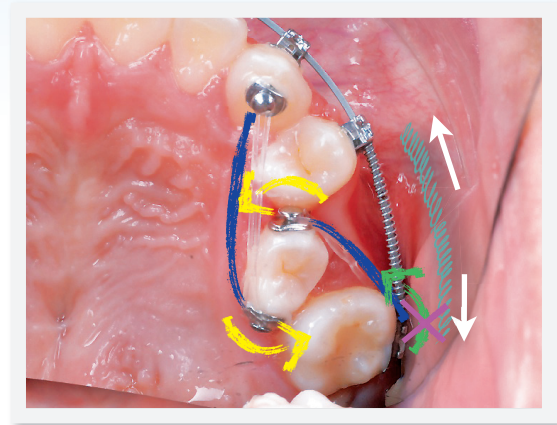
The subsequent archwire sequence was .014x.025 CuNiTi, followed by a .017x.025 TMA wire. Upper left and right canines erupted and were bonded in the 15<sup>th</sup> and 17<sup>th</sup> month of active treatment, respectively.



■ Fig. 13: Anterior crossbite was corrected in one month and the overbite was 2mm due to posterior teeth elongation.



■ Fig. 14: Tooth #12 rotation correction.



■ Fig. 15: Tooth #13 rotation correction.

In the 23<sup>rd</sup> month, all upper teeth were engaged on the archwire except for teeth #12 and Buttons were bonded on the lingual surface of tooth #11, as well as buccal and lingual surfaces of tooth #As shown in Fig. 14, two sections of power chain were used to rotate tooth #Over a period of 6 months, tooth #12 was brought into position, and then tooth #13 was rotated with a similar approach in about 4 months (Fig. 15). All of the maxillary teeth were engaged on the archwire by 34 months (Fig. 16).

In the 33<sup>rd</sup> month of active treatment, the lower arch was bonded for alignment and leveling. Class III elastics was applied to correct the sagittal discrepancy and detailing bends produced the final occlusion. Fixed appliances were removed after 48 months of active treatment and the corrected dentition was retained with removal retainers in both arches.



■ Fig. 16: Intra-oral photos showed the progress of upper arch.

## Results Achieved

### Maxilla (all three planes):

- A - P: Optimal growth expression
- Vertical: Optimal growth expression
- Transverse: Optimal growth expression

### Mandible (all three planes):

- A - P: Optimal growth expression
- Vertical: Optimal growth expression
- Transverse: Optimal growth expression

### Maxillary Dentition

- A - P: Increased axial inclination of the incisors
- Vertical: Posterior teeth extrusion
- Inter-molar width: Increased

### Mandibular Dentition

- A - P: Increased axial inclination of the incisors
- Vertical: Posterior teeth extrusion
- Inter-molar / Inter-canine Width: Increased

### Facial Esthetics:

- The orthognathic profile was maintained, consistent with optimal growth and incisor alignment.

## Retention

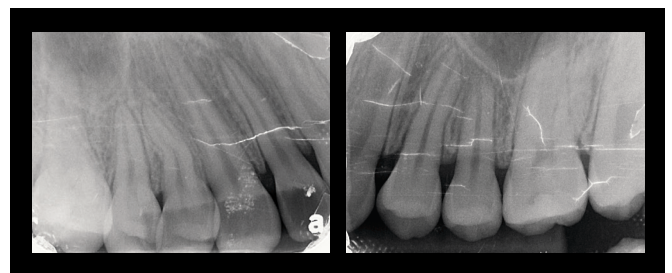
Upper and lower clear overlay retainers were delivered. The patient was instructed to wear them full time for the first 6 months and nights only thereafter. The patient was instructed in proper home hygiene and maintenance of the retainers.

## Final Evaluation Of Treatment

The ABO Cast-Radiograph Evaluation was scored at 25, which was deemed to be a board quality result. The major discrepancies were buccolingual inclination (10 points), uneven marginal ridges (6 points) and problematic alignment and rotation (4 points). From the radiographs, the root alignment was nearly ideal, except for tooth #5. Fortunately, no bone loss was noted after the relatively long treatment time. Mild external apical root resorption (EARR) was noted on teeth #12 and #13, while the root of tooth #5 was dilacerated (Fig. 17).

The final occlusion was stable. The molar and canine relationships were both Class I (Fig. 18).

In terms of the pink esthetics score, the gingiva texture was pleasing, and the root prominence was satisfactory, while the axial inclination in white esthetic score was generally acceptable (Fig. 19).<sup>1,2</sup>

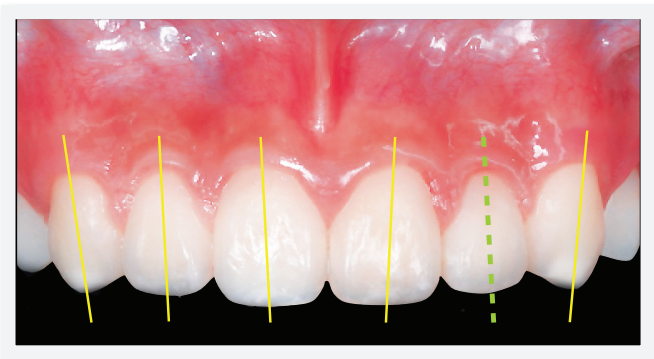


■ Fig. 17:

The posttreatment periapical films showed dilacerated root of tooth #5 and external root resorption of teeth #12,



■ Fig. 18:  
Posttreatment photos showed canine and molar Class I relationships.



■ Fig. 19:  
The intra-oral photo showed the inclination of tooth #10 was less than ideal.

Overall, the treatment results for this challenging early intervention case were pleasing to the patient and the clinician.

## Discussion

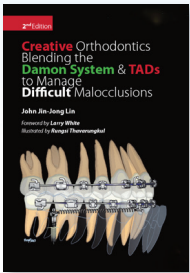
Early treatment continues to be controversial because a prolonged treatment time may increase treatment costs, but it also exhausts the patients' patience. Oral hygiene is often a problem, especially when extraoral devices and elastics are required.

However, early treatment can provide long-term benefits that are difficult to achieve with delayed treatment. For instance, dental and/or periodontal trauma, as well as growth disturbances, can be more effectively controlled. Chang<sup>3</sup> proposed three practical indicators for early treatment: to address problems that can be corrected in less than 6 months, to intercept developmental problem that might get worse, and to eliminate growth disturbances. For the present case, an uncorrected anterior crossbite might restrict maxillary growth and result in incisor attrition. Additionally, mesial drift of the upper molars mesial would further complicate treatment.

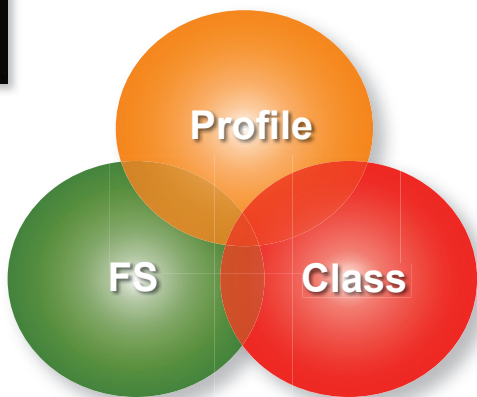
Skeletal Class III treatment is usually postponed until the end of puberty, due to the unpredictable growth of the mandible. Lin<sup>4</sup> has defined a Three-Ring Diagnosis system, which predicts a good prognosis for 90% of anterior crossbite patients who have an orthognathic profile in Cr position, a functional shift and a canine/molar Class I relationship (Fig. 20). The present patient matched all three criteria, so a favorable result could be expected. However, the parents and patient were still informed that there was a chance of undesirable mandibular growth, and additional treatment might be needed in the future.

To minimize treatment time, the start was delayed until the maxillary lateral incisors had erupted. With





**Profile:** Orthognathic profile at CR position  
**Class:** Canine and molar Class I relationship  
**FS:** Functional shift (CO≠CR)



**Fig. 20:**  
 Lin's Three-Ring Diagnosis<sup>4</sup> indicated that good prognosis could be expected for 90% anterior crossbite patients who matched the 3 criteria listed above.

regard to the initial stage of treatment (Fig. 12), there are 3 clinical keys: low torque brackets help prevent incisors from excessive flaring; bonding the bite turbos on **two lower central incisors** together help reduce trauma from occlusion; placing resin balls on the extending ends of the archwire helps avoid mucosa trauma and prevents the wire from coming out of the tube (Fig. 21). Posttreatment periapical films of the incisors showed no pathologic changes, although the crossbite was corrected over a very short period of time (Fig. 22). It is important to monitor root resorption for teeth that have turbos attached.

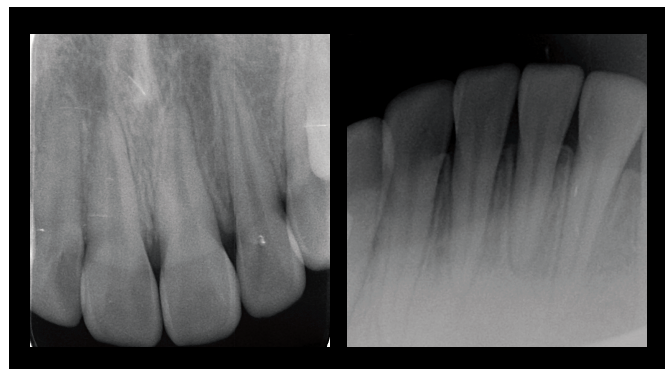
For the upper left region, the challenge was to align the premolars without damaging the roots



**Fig. 21:**  
 A resin ball bonded at the distal end of the wire to prevent wire from coming out of the tube and soft tissue trauma.



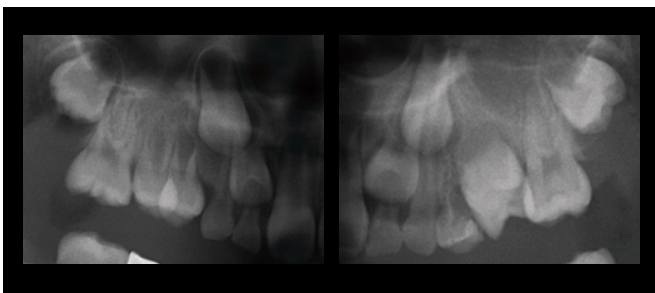
**Fig. 23:**  
 Molar mesial movement due to passive coil spring which couldn't resist the traction force from the power chain.



**Fig. 22:**  
 The posttreatment periapical films of incisors showed no pathologic change of the roots.

or altering the arch form. In the 19<sup>th</sup> month of treatment, the space was sufficient to allow for eruption and alignment of the upper permanent canines. As shown in Figs. 14-15, large rotations are best managed by applying a couple, via elastic chains attached to buttons bonded on the buccal and lingual surfaces. An activated open coil spring, as opposed to a passive one, was necessary to resist the traction force from the power chain to prevent mesial rotation of the molar. Fig. 23 shows the effect of a passive coil spring in a later stage of treatment. It is important to avoid applying force to the second premolar while the first premolar is being aligned.<sup>5,6</sup>

Maxillary premolars usually erupt between the ages of 10 to 12 years, when more than half of the root is formed. For the present patient, they erupted when less than a quarter of their roots formed, and the patient was only 8 years old (Fig. 24). It is important to carefully monitor this unusual development radiographically (Figs. 17 and 24). In treating ectopically erupted and transposed teeth, root pathology is always a concern. Some root

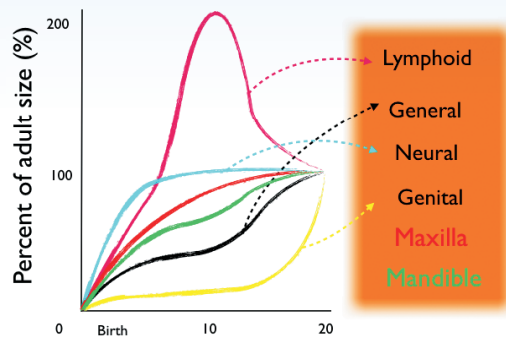


■ Fig. 24:  
Early erupted premolars with less than a quarter of root formation was observed when the patient was over

resorption and/or arrested root development was noted for the transposed premolars (Fig. 17), but fortunately the problem was modest. However, it is important to ensure that there is no occlusal trauma when the occlusion is detailed. Otherwise, external apical root resorption can be progressive following the treatment.<sup>7</sup>

Fig. 23 suggests that early intervention in retracting the molar was unnecessary, and the early bonding of the maxillary premolars may have been a factor in the dilaceration of tooth #In retrospect, a two-stage treatment plan may have been a better therapeutic approach. For instance, the first stage would be directed at achieving a positive overbite and preventing the molars tipping mesially. The second stage could be delayed until the permanent buccal segments had erupted. With this two stage treatment approach, it would have been possible to save active treatment time and better manage the oral hygiene.

The superimposed cephalometric tracings revealed significant lower facial growth, of both the maxilla and mandible. Generally speaking, the size of the maxilla is 80% complete at the age of 8 (Fig. 25).<sup>8</sup> However, for the present patient, a considerable amount of maxillary growth was observed after anterior crossbite correction. This observation supports the hypothesis that anterior crossbite restricts maxillary growth. Thus, correcting crossbites should be a high priority for intercepting malocclusion in the mixed dentition.



■ Fig. 25:

Growth of jaw is intermediate between the neural and general body curves, with the mandible (green) following the general body curve more closely than the maxilla (red).

## Conclusion

Early Intervention to correct anterior crossbite decreases the chance of incisors attrition, helps avoid gingival recession, improves facial appearance, and intercepts growth disturbances. Moreover, this important service can be achieved usually in a short amount of time, less than one month for the present case, and the mechanics are relatively simple, i. e. coil springs or advancement loop combined with bite turbos. Therefore, early intervention is strongly recommended for anterior crossbite if three criteria are met: functional shift, Class I canine and molar relationships, and an orthognathic profile in the Cr position.

## References

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7. Tseng SP, Chang C, Roberts WE. Impacted Maxillary Canines on Both sides: One Palatally and One Labially. *News & Trends in Orthodontics*. 2011;22:22-35.
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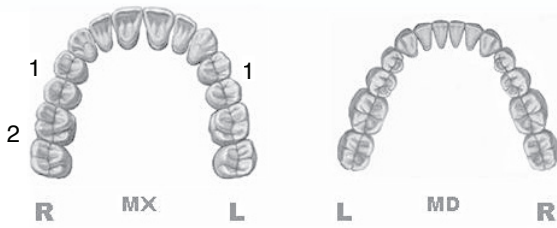


# Cast-Radiograph Evaluation

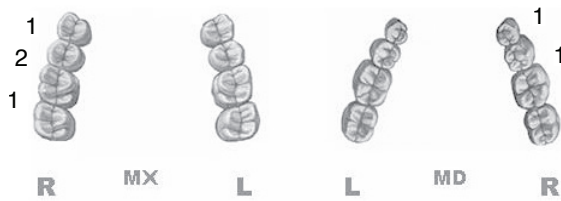
Case #  Patient

Total Score:

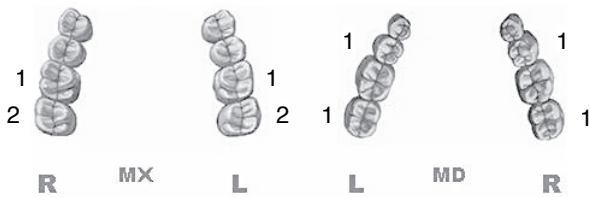
## Alignment/Rotations



## Marginal Ridges



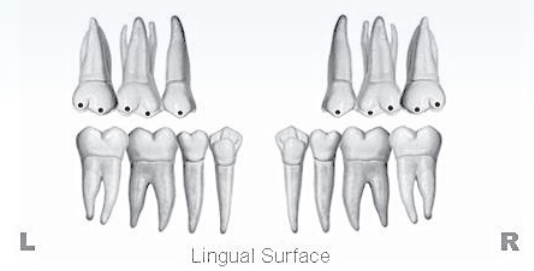
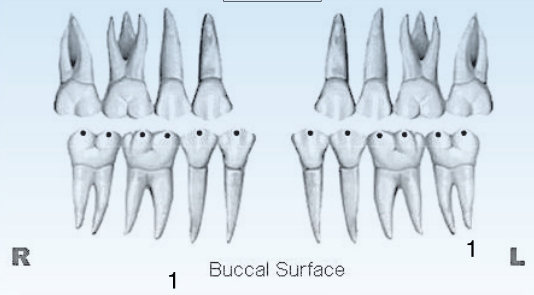
## Buccolingual Inclination



## Overjet



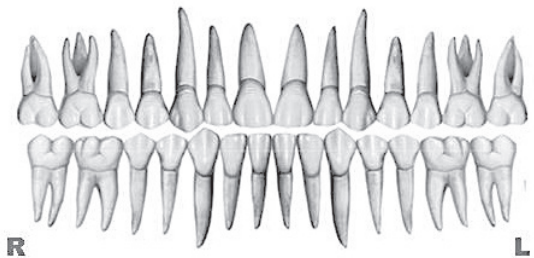
## Occlusal Contacts



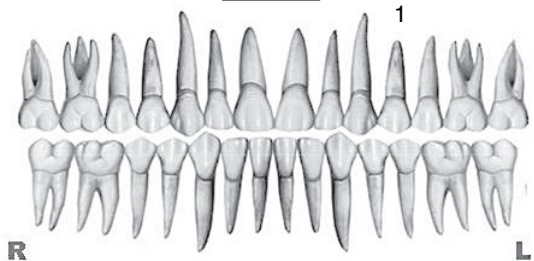
## Occlusal Relationships



## Interproximal Contacts



## Root Angulation

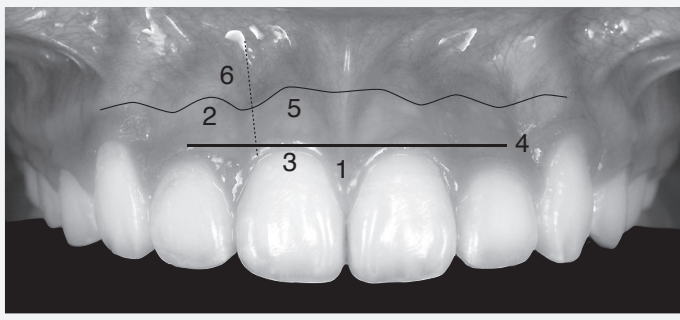


**INSTRUCTIONS:** Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

## IBOI Pink & White Esthetic Score

Total Score = 6

### Pink Esthetic Score

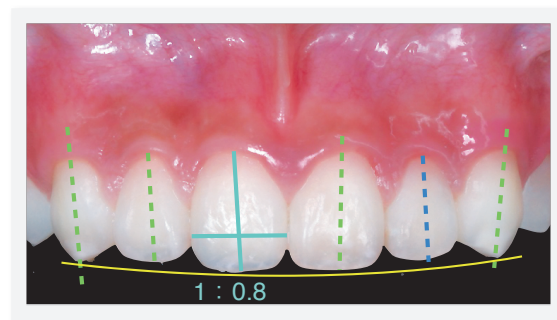
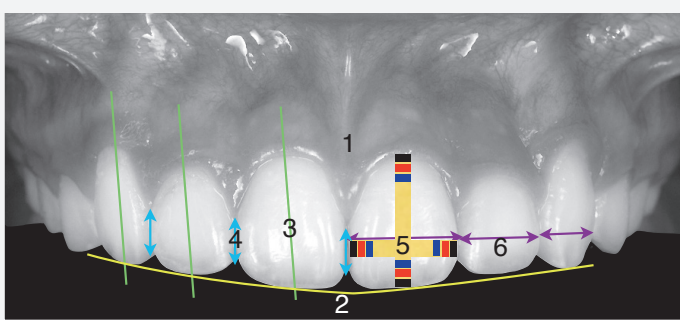


Total = 2

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

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

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



Total = 4

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

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