Congenital Missing of Mandibular Incisors with Class I Malocclsuion

HISTORY AND ETIOLOGY

A 21 year old female was evaluated for maxillary dental crowding (*Figs. 1-3*). She had received orthodontic treatment for 1 year at the age of 12, but was dissatisfied with the long-term result. The initial clinical exam revealed a Class I molar relationship bilaterally, associated wth maxillary anterior crowding and two missing mandibular incisors. The overjet was 6mm, and overbite was 4mm. The maxillary dental midline was shifted 1mm to the right of the facial and mandibular midlines. Oral soft tissues, frena and gingival health were all within normal limits. There was no history of dental trauma or aberrant oral habits. There was no other contributory medical or dental history. The patient desired comprehensive orthodontic treatment to achieve an ideal alignment of the entire dentition, which was achieved as documented in Figs. 4-6.

Fig. 1: Pretreatment facial photographs

Fig. 2: Pretreatment intraoral photographs

The pretreatment radiographs (*Fig. 7*) revealed that the distal curvature of the mandibular right second molar was flattened, possibly during the process of extracting the adjacent third molar. The post-treatment cephalometric radiograph shows normal overjet and overbite (*Fig. 8*). Since there was no history of extraction(s), the mandibular incisors were deemed to be congenitally missing lateral incisors (*Fig. 9*). The before and after treatment cephalometric data are summarized in Table 1. Superimposition of cephalometric tracings documents the skeletal

Fig. 3: Pretreatment study models

Dr. Joy Hung, Lecturer, Beethoven Orthodontic Course (Left)
Dr. Chris Chang, Director, Beethoven Orthodontic Center (Middle)
Dr. W. Eugene Roberts, Consultant, *International Journal of Orthodontics & Implantology* (Right)

Fig. 4: Posttreatment facial photographs

Fig. 5: Posttreatment intraoral photographs

Fig. 6: Posttreatment study models

and dental changes associated with the treatment rendered (*Fig. 10*).

DIAGNOSIS

Skeletal:

- Skeletal Class I (*SNA 83°, SNB 80°, ANB 3°*)
- Normal angle (*SN-MP 30°, FMA 23°*)

Dental:

- Bilateral Class I molar relationship
- OJ 6mm; OB 4mm
- The maxillary dental midline was shifted 1mm to the right of the facial and maxillary midlines.
- Bilateral mandibular central incisors missing
- Left maxillary second molar partially erupted
- Impacted left third molars

Facial:

- Moderate convex profile with protrusive lip position

The ABO Discrepancy Index (*DI*) was 14 as shown in the subsequent worksheet.

SPECIFIC OBJECTIVES OF TREATMENT

Maxilla (*all three planes*):

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

Mandible (*all three planes*):

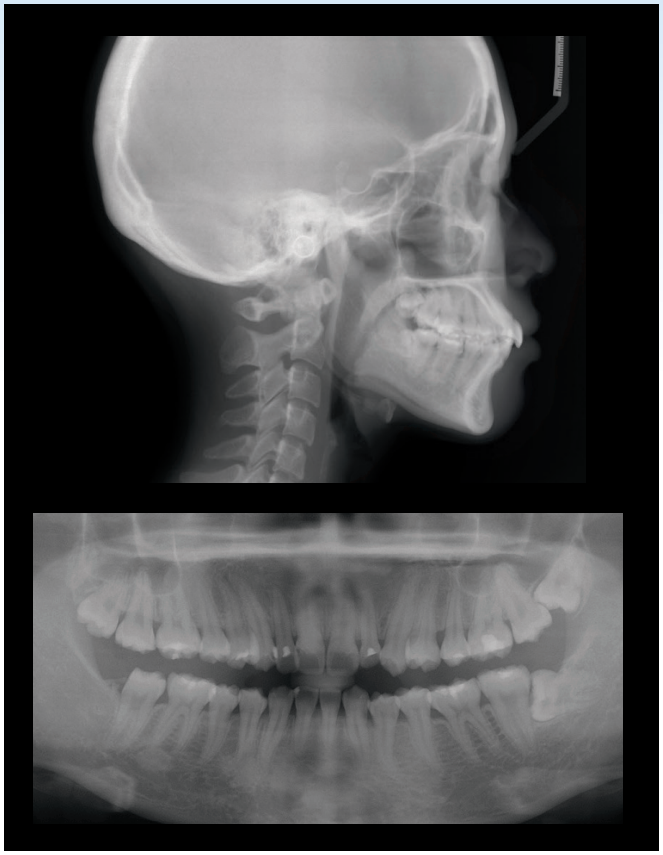


Fig. 7:

Pretreatment pano and ceph radiographs show bilateral anterior teeth proclination and lip protusion.

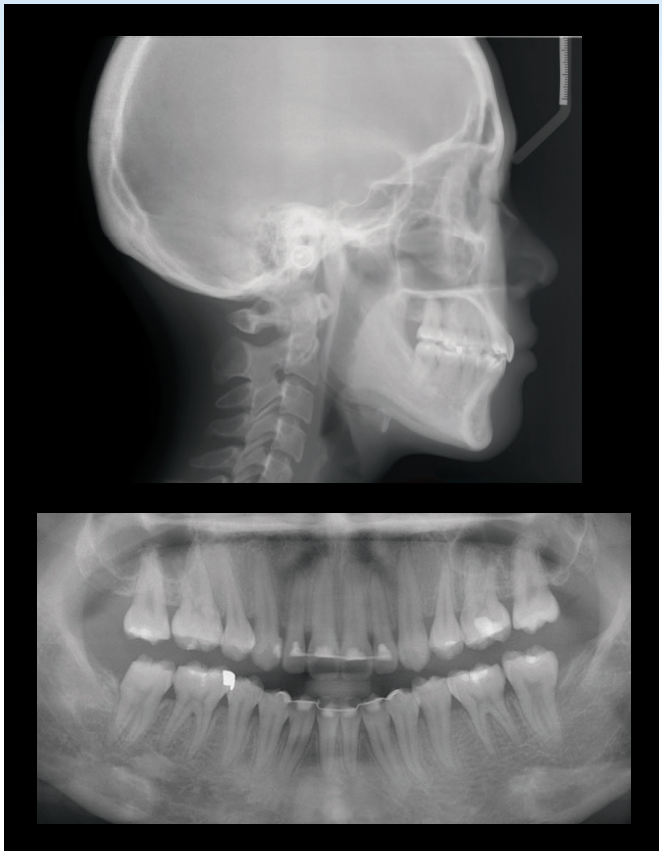


Fig. 8:

Posttreatment pano and ceph radiographs show a balancing lip profile.

Fig. 9: *Congenital missing of both mandibular central incisors*

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	83°	83°	0°
SNB°	80°	80°	0°
ANB°	3°	3°	0°
SN-MP°	30°	30°	0°
FMA°	23°	23°	0°
DENTAL ANALYSIS			
U1 TO NA mm	8 mm	3.5 mm	4.5 mm
U1 TO SN°	113°	105°	8°
L1 TO NB mm	8 mm	5 mm	3 mm
L1 TO MP°	100°	93°	7°
FACIAL ANALYSIS			
E-LINE UL	-1 mm	-2 mm	1 mm
E-LINE LL	2 mm	0 mm	2 mm

Table 1. Cephalometric summary

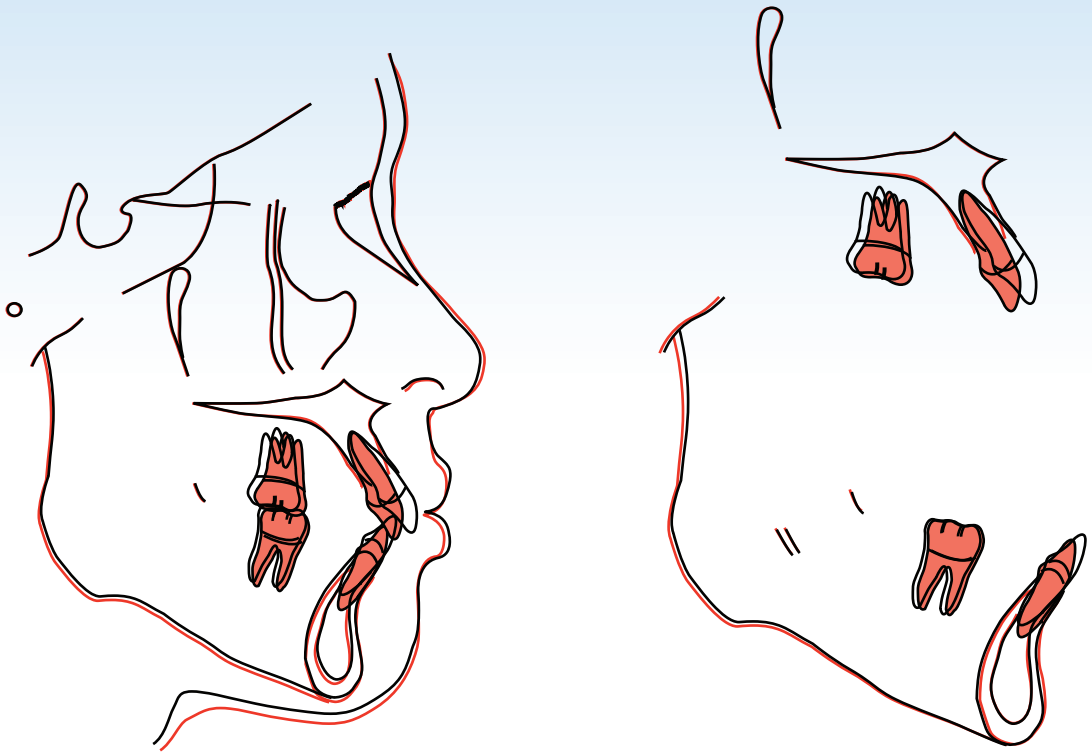


Fig. 10:
Superimposed tracings revealed intrusion of lower anterior teeth and retraction of upper anterior teeth. These contributed to the improvement of profile.

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

Maxillary Dentition

- A - P: Retract to correct excessive overjet, maintain axial inclination of about 110°
- Vertical: Maintain
- Inter-molar Width: Maintain

Mandibular Dentition

- A - P: Maintain
- Vertical: Maintain
- Inter-molar / Inter-canine Width: Maintain

Facial Esthetics:

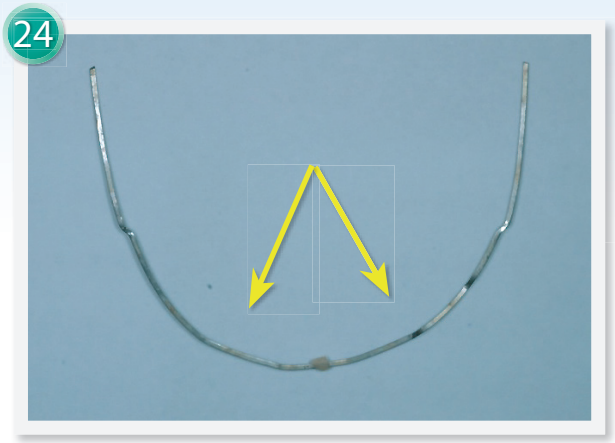
Improved profile with better lip position

TREATMENT PLAN

The Class I occlusion relationship was associated with the absence of lower lateral incisors. Therefore, in order to correct the crowding and coordinate the arches, extraction of bilateral upper first premolars and a full fixed orthodontic appliance were indicated. The final occlusion goals would be Canine Class III and Molar Class I.

APPLIANCES AND TREATMENT PROGRESS

Extraction of three remaining third molars and upper first premolars was accomplished before the orthodontic treatment started. Standard Damon D3MX .22" Brackets (*Ormco Corporation*) were used. The wire sequence was as follows: .014 copper NiTi,



a. inset bends for mandibular canines

b. original arch form showing the eminence of canine labial side.

c. inset bends for mandibular canines

Fig. 11a-c: Inset bends for mandibular canines

.014 x .025 copper NiTi, .017 x .025 TMA, .019 x .025 SS, followed by .014 x .025 copper NiTi and then .017 x .025 TMA for detailed finishing. Class II elastics were used after the .019 x .025 SS (*Max.*) and .017 x .025 TMA (*Mand.*) archwires were engaged. In the 5th month of treatment, interproximal enamel reduction was performed on the lower incisors and canines to reshape the canine and eliminate black triangles between the lower incisors. After 22 months of active treatment, diagnostic casts and a panoramic radiograph were taken to assess the 1st and 2nd order correction. Inset bends were made for both lower canines in order to mimic the labial contour of lower lateral incisors (*Fig. 11*). Consistent with Bolton's Ratio (*Fig. 12*), as well as the Class I molar and Class III canine occlusal goals (*Fig. 13*), interproximal enamel reduction was performed again on the incisors of both arches, and the prominent lingual line angles were recontoured (*Fig. 14*). Once the overjet was corrected, the occlusion was finished, and the fixed appliances were removed after 26 months of active treatment. Immediately after removing the fixed appliances, an upper 2-2 and a lower 4-4 fixed retainer were bonded on each tooth, respectively.

$$\text{Anterior ratio} = \frac{\text{Sum of mesiodistal widths of mandibular six anterior teeth (mm)}}{\text{Sum of mesiodistal widths of maxillary six anterior teeth (mm)}} \text{ X100\%}$$

$$\text{Overall ratio} = \frac{\text{Sum of mesiodistal widths of mandibular twelve teeth (first molar-first molar) (mm)}}{\text{Sum of mesiodistal widths of maxillary twelve teeth (first molar-first molar) (mm)}} \text{ X100\%}$$

Fig. 12: Bolton's Ratio

Fig. 13:
Final occlusal relationships: Canines Cl III and Molar Cl I.

RESULTS ACHIEVED

Maxilla (*all three planes*):

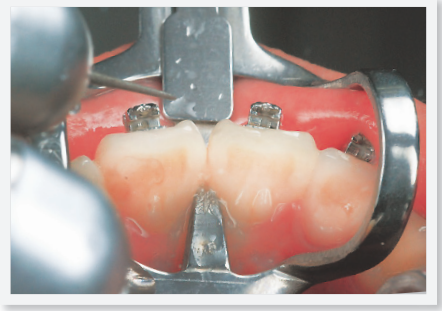
- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Mandible (*all three planes*):

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

Maxillary Dentition

- A - P: Upper incisors axial inclination reduced to 105°



a. Place the teeth separator over the papilla between the target teeth.

b. Tighten the screw to stabilize the separator and open the interproximal area.

c. Shape the marginal ridge at palatal line angle with high speed diamond fissure.

d. Smoothen the surface with coarse abrasive strip.

e. Use fine abrasive strip for finishing touch.

f. Interproximal area was reducted for 1-2mm.

Fig. 14: Interproximal enamel reduction technique

Fig. 15: Rotation of left upper first molar

- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition

- A - P: Lower incisors intruded and axial inclination reduced
- Vertical: Maintained
- Inter-molar / Inter-canine Width: Maintained

Facial Esthetics

- Optimal profile achieved

RETENTION

The upper fixed 2-2 retainer and the lower fixed 4-4 retainer were bonded on every tooth. An upper clear overlay retainer was delivered. The patient was instructed to wear it full time for the first 6 months and nights only thereafter. Home care and maintenance instructions for the retainers were also provided.

FINAL EVALUATION OF TREATMENT

The IBOI Cast-Radiograph Evaluation (*CRE*) was originally scored at 30 points, but a careful reassessment of the records revealed that the appropriate CRE score was 25. The major discrepancies were occlusal relationship (*9 points, Fig. 13*), alignment/rotation problems (*5 points, Fig. 15*) and unevenly marginal ridges (*5 points*). Due to the congenitally missing of mandibular incisors, the canine Class III occlusion was intentionally achieved for esthetics.

Extraction of maxillary first premolars, as well as retraction and alignment of upper incisors helped resolve the patient's chief complaint. The excessive overjet and overbite were reduced. Wearing elastics as instructed helped to achieve canine Class III occlusion.

The posterior intercuspation was adequate and the panoramic radiograph (*Fig. 8*) showed good root positions. Posttreatment facial photographs are shown in Fig. 4. Overall, there was a significant improvement in both dental esthetics and occlusion. The prognosis for stability is good, and the corrections should be maintained with adherence to the prescribed retention plans.

DISCUSSION

The prevalence of congenitally missing teeth (*third molars excluded*) was 6.9% for both sexes combined (*6.1% in males and 7.7% in females*). The

most common congenitally missing teeth are the maxillary lateral incisors in Caucasians[1] and mandibular incisors in Chinese.[2] Davis[2] reported that the missing lower incisors affected 58.7% of the Chinese children with hypodontia.

There are three options for replacing a missing incisors. These include canine substitution, a tooth-supported restoration, and a single-tooth implant.[3] Moreover, in order to achieve an optimal occlusion with ideal overjet and overbite, the maxillary and mandibular teeth must be proportional in size. A number of researchers have evaluated the relationship between the width of the upper and lower teeth.[4] Among them, Bolton's analysis (*Fig. 11*) has the most profound influence on the examination of orthodontic patients and treatment planning.

According to Bolton, the ideal overall ratio, from the right first molar to the left first molar, is 91.3%. In this case, due to the congenitally missing of two mandibular incisors, the overall ratio is 80.8%.[5] In the case of Angle Class I malocclusion and a convex profile, canine substitution with extraction of two upper first premolars helps produce a favorable intercuspid relationship and improves the profile. [6]

After extraction of two maxillary first premolars, the overall ratio improved to 95.7%. The interproximal enamel reduction performed on the incisors in the 5th and 24th months (*Fig. 14*), according to the method of Chang,[7] further improved the relationship to 92.6%, which is much closer to the ideal ratio of 91.3%. However, failure to achieve the ideal Bolton Ratio probably conributed to the less than ideal CRE buccal occlusal score of 9 points. Also, the latter could have been improved by maintaining at least 110° of torque on the maxillary incisors (*Figs. 7, 8 and 10*). The decrease in axial inclination of the maxillary incisors as they were retracted also contributed to the less than ideal CRE buccal occlusal score (*9 points*).

Interproximal enamel reduction has long been used in orthodontic treatment to obtain more space for alignment and maintainance (*retention*) of incisal correction long-term.[8] It can also be useful for improving tooth proportion, establishing better interrpoximal contacts, and reducing black triangles.[9] In addition, enamel stripping can affect Bolton's overall and anterior ratios.[10] Moreover, the present patient had prominent lingual line angles that formed V-shape contact areas. Undesirable interproximal contacts not only affect tooth alignment, but they also are traps for stains on the teeth, raising esthetic concerns. This problem can be eliminated by reshaping the lingual line angle with interproximal reduction procedures. Studies show that interproximal enamel reduction produces furrows in the enamel surface, which cannot be completely eliminated, even with the finest finishing strips.[8] Furrows facilitate plaque accumulation, which cannot be prevented by the use of dental floss.[11] However, in Zachrisson et al.'s 10 year study,[8] interdental enamel reduction did not increase the risk of dental caries, gingival problems or alveolar bone loss. Furthermore, the distance between the roots of the teeth in the mandibular anterior area was not reduced.

At the finishing stage, inset bends were made for both mandibular canines (*Fig. 11*). The purpose of this wire bending is to compensate the variations in the shape and contour of incisors and canines, as well as to correct errors in positioning brackets.[12] For canine substitution, aligning canines more lingually, by making inset bends, creates an illusion of lateral incisors for canines, that is esthetically harmonious.

CONCLUSION

Congenitally missing mandibular incisors have a prevalence of 58.7 % in Chinese children with hypodontia.[2] Treatment options include canine substitution, restorative replacement, and single tooth implants. For Class I malocclusion with a convex profile, extraction of two maxillary premolars with canine substitution usually achieves the best outcome. Moreover, interproximal enamel reduction procedures and inset bends for mandibular canines can help achieve a good occlusion relationship and satisfactory esthetic results. However, it is important to maintain adequate torque as the maxillary incisors are retracted to achieve an optimal posterior interdigitation, as reflected in the CRE occlusal relationships score.

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IBOI Discrepancy Index Worksheet

TOTAL D.I. SCORE 14

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 = 3

OVERBITE

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

Total = 2

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 = 2

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. additional _____ pts.

Total = 0

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 0

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 2

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° _____ x 1 pt. = _____

Each degree > 6° _____ x 1 pt. = _____

SN-MP

≥ 38° = 2 pts.

Each degree > 38° _____ x 2 pts. = _____

≤ 26° = 1 pt.

Each degree < 26° _____ x 1 pt. = _____

1 to MP ≥ 99° = 1 pt.

Each degree > 99° 1 x 1 pt. = _____

Total = 1

OTHER (See Instructions)

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

Identify:

Total = 4

IMPLANT SITE

Lip line : Low (0 pt), Medium (1 pt), High (2 pts) =_____

Gingival biotype : Low-scalloped, thick (0 pt), Medium-scalloped, medium-thick (1 pt), High-scalloped, thin (2 pts) =_____

Shape of tooth crowns : Rectangular (0 pt), Triangular (2 pts) =_____

Bone level at adjacent teeth : ≤ 5 mm to contact point (0 pt), 5.5 to 6.5 mm to contact point (1 pt), ≥ 7mm to contact point (2 pts) =_____

Bone anatomy of alveolar crest : H&V sufficient (0 pt), Deficient H, allow simultaneous augment (1 pt), Deficient H, require prior grafting (2 pts), Deficient V or Both H&V (3 pts) =_____

Soft tissue anatomy : Intact (0 pt), Defective (2 pts) =_____

Infection at implant site : None (0 pt), Chronic (1 pt), Acute(2 pts) =_____

Total = 0

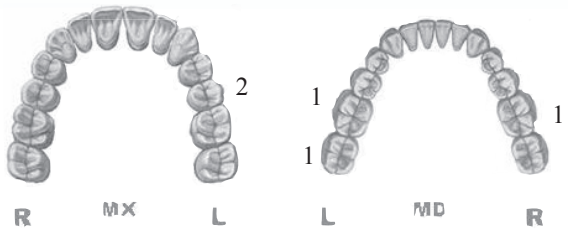
IBOI Cast-Radiograph Evaluation

Case # 1 **Patient**

Total Score: 25

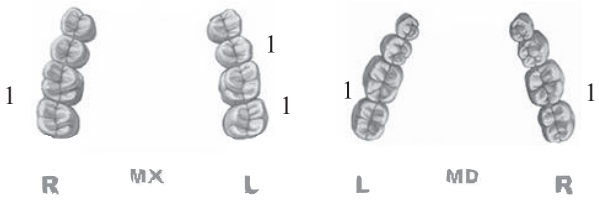
Alignment/Rotations

5



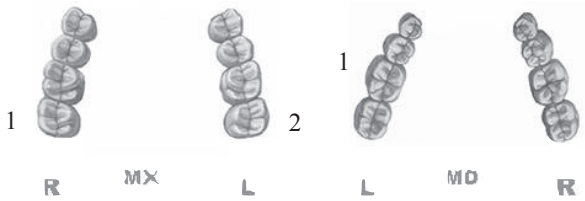
Marginal Ridges

5



Buccolingual Inclination

4

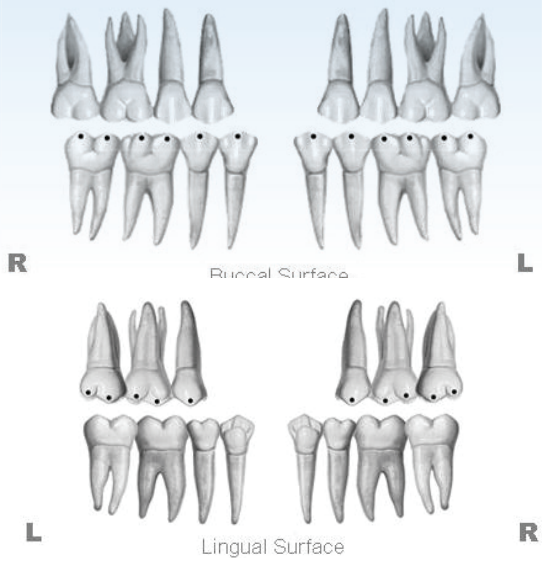


Overjet

2

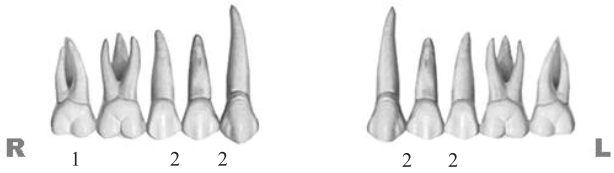
Occlusal Contacts

0



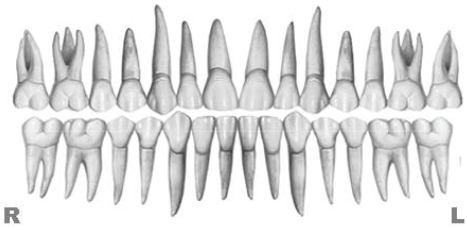
Occlusal Relationships

9



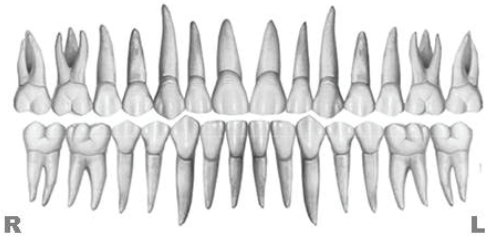
Interproximal Contacts

0



Root Angulation

0



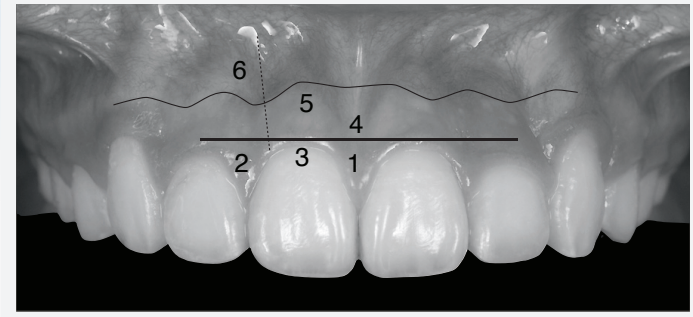
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 0

1. Pink Esthetic Score

Total = 0

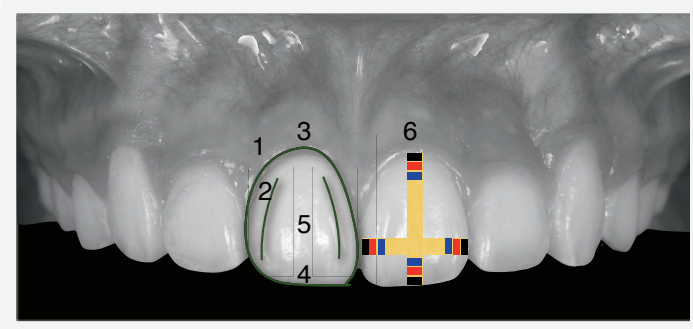


1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

1. 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

2. White Esthetic Score (for Restorative Prosthesis)

Total = 0



1. Tooth Form	0	1	2
2. Mesial & Distal Outline	0	1	2
3. Crown Margin	0	1	2
4. Translucency (Incisal third)	0	1	2
5. Hue & Value (Middle third)	0	1	2
6. Tooth Proportion	0	1	2

1. Tooth Form	(0)	1	2
2. Mesial & Distal Outline	(0)	1	2
3. Crown Margin	(0)	1	2
4. Translucency (Incisal third)	(0)	1	2
5. Hue & Value (Middle third)	(0)	1	2
6. Tooth Proportion	(0)	1	2