Class II, Excessive Overjet and Deep Bite with a Congenitally Missing Lower Incisor

Abstract

A 9-year-11-month female was placed on recall until her buccal segments erupted. At 13-years of age she returned with a severe dentofacial malocclusion: (1) convex facial profile, (2) protrusive and everted upper lip, (3) Class II buccal segments, 5 mm on the right and 2 mm on the left (4) overjet 11 mm, (5) overbite 9 mm, and (6) a congenital missing lower left lateral incisor. The Discrepancy Index (DI) for this complex malocclusion was 22. Treatment involved extraction of both upper first premolars as well as the lower left central incisor. The overjet was corrected by retraction with miniscrews placed in the infrazygomatic crest (IZC). The lower canines were moved into the lateral incisor positions (canine substitution). The treatment outcomes were excellent, as evidenced by the Cast Radiograph Evaluation (CRE) of 24 and a Pink and White dental esthetics score of 3. (Int J Orthod Implantol 2016;41:42-55)

Key words:

Maxillary lip protrusion, severe overjet, deep bite, congenital missing lower incisor, mandibular canine substitution

History And Etiology

A 9-year-11-month female presented for orthodontics consultation with a chief concern of an everted upper lip associated with excessive incisal display at rest (*Fig. 1*). Clinical examination revealed a Class II malocclusion with a lip trap, impinging deep



Fig. 1:

A lip trap, associated with a protrusive, everted maxillary lip, results in an unesthetic incisal display at rest.

bite, and a congenitally missing lower left lateral incisor. The patient had no known contributing habits, so the etiology of the malocclusion appeared to be an interaction of environmental (abnormal lipincisor posture) and hereditary (missing incisor) factors. To minimize active treatment time, the patient was placed on recall until the permanent buccal segments erupted. Three years later, she returned for consultation and began orthodontic treatment at the aged 13 years and 1 month (Figs. 2-4). The treatment was completed when she was 15 years 6 months of age (Figs. 5-7), and the total treatment time was 2 years and 5 months. Radiographic documentation of the pre-treatment condition and post-treatment results are provided in Figs. 8 and 9, respectively. The cephalometric values are summarized in Table 1, and Fig. 10 shows the superimposed cephalometric tracings.

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Fig. 2: Pre-treatment facial photographs



Fig. 5: Post-treatment facial photographs



Fig. 3: Pre-treatment intraoral photographs



Fig. 6: Post-treatment intraoral photographs



Fig. 4: Pre-treatment study models (casts)



Fig. 7: Post-treatment study models (casts)



- **Fig. 8**: Pre-treatment cephalometric and panoramic radiographs
- Fig. 9: Post-treatment cephalometric and panoramic radiographs



Fig. 10:

Superimposed start (black) and finish (red) cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right) and mandible (lower right). The superimpositions show the treatment retracted and intruded the maxillary incisors, but only intruded the lower incisors. All the molars drifted mesially during orthodontic treatment. The mandible grew anteriorly and rotated in a counter-clockwise direction to improve the facial profile and lip protrusion (left).

CEPHALOMETRIC						
SKELETAL ANALYSIS						
	PRE-Tx	POST-Tx	DIFF.			
SNA°	79°	79°	0°			
SNB°	76°	78°	2°			
ANB°	3°	1°	2°			
SN-MP°	33°	30°	3°			
FMA°	28°	26°	2°			
DENTAL ANALYSIS						
U1 TO NA mm	12 mm	5 mm	7 mm			
U1 TO SN°	117°	113°	4°			
L1 TO NB mm	4.5 mm	3.5 mm	1 mm			
L1 TO MP°	96°	96°	0°			
FACIAL ANALYSIS						
E-LINE UL	2 mm	-3 mm	5 mm			
E-LINE LL	2 mm	-2 mm	4 mm			

Table 1: Cephalometric summary

Diagnosis

Skeletal Relationship

- 1. Bimaxillary Retrusive: SNA 79°, SNB 76°, ANB 3°
- 2. Mandibular plane angle (SN-MP 33°) was within normal limits (WNL)

Dental Relationship

- 1. Angle Molar Classification:
 - Right side: End-on Class II
 - Left side: Class I molar but with a Class II buccal segment
- 2. Overjet: 11 mm (Fig. 11)
- 3. Overbite: 9 mm 100% overbite with gingival impingement (Fig. 12)
- 4. Tooth Size to Arch Length Discrepancy:
 - Maxillary: 5 mm



Fig. 11: Pretreatment overjet is 11 mm



Fig. 12:

Pretreatment overbite is 9 mm, but it is impinging on gingiva (100% overbite).

- Mandibular: 6 mm
- 5. Crossbite
 - Buccal crossbite of [#]5, upper right 1st premolar (UR4) (Fig. 13)
 - Buccal crossbite of [#]13, upper left 2nd premolar (UL5) (Fig. 14)
- 6. Radiographic Evaluation
 - Congenitally missing lower left lateral incisor (*Fig.* 15)



Fig. 13:

Pretreatment buccal crossbite of upper right 1st premolar ([#]5)



Fig. 14:

Pretreatment buccal crossbite of the upper left 2nd premolar (*13)

• All four third molars were present

Facial Relationship

- 1. Protrusive and everted maxillary lip
- 2. Lip trap

American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 22 as shown in the subsequent worksheet.^{1,2}



Fig. 15:

An enlarged portion of the pretreatment panoramic radiograph (Fig. 8) indicates that the congenitally missing incisor is the lower left lateral incisor (*23). Note that the adjacent canine (*22) erupted into the adjacent missing incisor space, which subsequently resulted in mesially tipping of the first premolar (*21) to fill the canine space.

Specific Objectives Of Treatment

Maxilla (all three planes):

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

Mandible (all three planes):

- A P: Protract consistent with normal growth
- Vertical: Maintain
- Transverse: Maintain

Maxillary Dentition

- A P: Protract molars, retract incisors
- Vertical: Intrude incisors
- Inter-molar Width: Maintain
- Inter-canine Width: Maintain
- Buccolingual Inclination: Correct crossbites

Mandibular Dentition

- A P: Protract molars on the right side to maintain the midline
- Vertical: Maintain molars, intrude incisors
- Inter-molar Width: Maintain
- Inter-canine Width: Maintain
- Buccolingual Inclination: Correct buccal crossbites
- Canine substitution for the mandibular lateral incisors
- Improve the symmetry of the lower arch

Facial esthetics: Correct the lip-incisor relationship, reduce dentoalveolar protrusion

Treatment Plan

The Chang Decision Making Tree³ was utilized to plan and sequence the treatment.

Extract both upper first premolars and the lower right central incisor. Reshape the lower cuspids to simulate lateral incisors. Bond fixed appliances on both arches, and place anterior bite turbos on the upper central incisors. Use early light short elastics (*ELSE*) (*Parrot 5/16*", *2oz*) in conjunction with the anterior bite turbos to correct the Class II buccal relationships while intruding the upper and lower incisors. Place bilateral miniscrews in the infrazygomatic crests (*IZC*) to serve as anchorage to retract the maxillary anterior dentition.⁴ Apply Class II elastics as needed and detail the final occlusion. Retain with anterior fixed and clear overlay retainers.

Appliances and Treatment Procedures

Following extraction of the maxillary premolars

and the mandibular central incisor, Damon Q® .022" brackets (Ormco, Glendora, CA) were bonded on the upper arch, utilizing high torque brackets in the anterior segment.⁵ After 1 month of active treatment, the same series of brackets was bonded on the lower arch, using standard torque for the lower anterior teeth. To prevent bracket interference, posterior bite turbos were constructed with glass ionomer cement on the occlusal surfaces of the lower first molars (Fig. 16). Class II elastics (Parrot 5/16", 2oz) were attached from the upper canines to the lower first molars to help resolve the sagittal occlusal discrepancy (Fig. 17). Elastomeric chains were used to close the mandibular anterior space. The wire sequence for the upper arch was .014" CuNiTi, .018" CuNiTi, .014x.025" CuNiTi, .016x.025" pre-torgued CuNiTi, .017x.025" TMA, and .019x.025" SS. The wire sequence for the lower arch was .014" CuNiTi, .016" CuNiTi, .018" CuNiTi, .014x.025" CuNiTi, .016x.025" pre-torgued CuNiTi, and .017x.025" TMA.

In the 4th month of treatment, bite turbos were bonded on the palatal surfaces of the upper central incisors to open the bite and serve as a guide planes



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Fig. 16:
Bite turbos composed of glass ionomer cement were
bonded on the lower first molars.
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Fig. 17:

Early Light Short Elastics (ELSE): Class II elastics (Parrot 5/16'', 202) were attached from the upper canines to the lower first molars to help resolve the sagittal occlusal discrepancy.

for the lower incisors (Fig. 18). In the 9th month of treatment, composite resin was added to the upper central incisor bite turbos, and an anterior segment, torquing auxiliary was used for delivering lingual root torque (Fig. 19). In the 10th month of treatment, Class II elastics (Fox 1/4", 3.5oz) were used from the upper canines to the lower 2nd premolars and 1st molars (L-configuration) to resolve the sagittal occlusal discrepancy (Fig. 20). In the 12th month of treatment, brackets for teeth #6, 7, 10 & 26 were repositioned. In the 13th month of treatment, brackets for teeth [#]6, 11 & 26 were repositioned. In the 14th month of treatment, the upper and lower archwires were changed to .017x.025" TMA. Class II elastics (Fox 1/4", 3.5oz) were used from the upper canines to the lower 1st molars and 2nd molars (*L-configuration*) to help resolve the sagittal occlusal discrepancy. In the 17th month of treatment, a torque spring was used on tooth [#]10 to provide buccal root torque (*Fig.* 21).



Fig. 18:

Bite turbos were bonded on the palatal side of the upper central incisors.



Fig. 19:

An anterior root torquing spring was used to delivery lingual root torque to resist distal tipping due to the Class II elastics.



Fig. 20:

Class II elastics (Fox $\frac{1}{4}$ ", 3.5oz) were used from the upper canines to lower 2^{nd} premolars and 1^{st} molars (L - configuration) to help resolve the sagittal occlusal discrepancy.



Fig. 21: A torque spring was used on tooth #10 to deliver buccal root

torque.

In the 19th month of treatment, two bone screws (2x12mm OrthoBoneScrew[®], Newton's A Ltd, Hsinchu, *Taiwan*) were inserted into the infrazygomatic crests to anchor elastomeric chains that were attached to the upper canines to retract the maxillary dentition. In the 23rd month of treatment, a panoramic film was taken and the brackets for teeth #22, 23 & 26 were repositioned. In the 24th month of treatment, Class II elastics (Bear 1/4", 4.5oz) were used on the right side from the upper canine to lower 1st molar and 2nd molar (L-configuration) to resolve the sagittal occlusal discrepancy. In addition, 1st order detailing bends were used to detail teeth #6, 7, 9, 10, 23 & 26 (Fig. 22). Buccal root torgue was added for teeth #3, 4, 5, 12,13 & 14. In the 26th month of treatment, the IZC bone screws were removed. To improve the posterior occlusal contacts, the maxillary arch wire was cut distal to the 2nd premolars (Fig. 23), and Class II elastics (Kangaroo 3/16", 4.5oz) were applied on the right side from the upper canine to the lower 1st molar. Class Il elastics (triangular shape) were applied on the left side from the upper canine to lower 1st premolar and 2nd premolar to detail the occlusion. A torquing spring was used on [#]11 to correct its axial inclination. Two lingual buttons were bonded on [#]23 & 27 to anchor an elastic chain for reciprocal rotation. In the final stage of treatment, subtle detailing adjustments were made for teeth [#]10, 18 & 19. In the 28th month of treatment, torque springs were used on teeth [#]22 & 27 for final adjustment of their axial inclinations.



Fig. 22:

1st order bends on teeth [#]6, 7, 9 & 10 were used to detail alignment.



Fig. 23:

To improve the posterior occlusal contacts with vertical elastics, the maxillary arch wire was cut distal to the 2nd premolars.

In the 29th month of treatment, all fixed appliances were removed and retainers were provided.

Results Achieved

Maxilla (all three planes):

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

Mandible (all three planes):

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

Maxillary Dentition

- A P: Molars protracted, Incisors retracted
- Vertical: Molars maintained, Incisors intruded
- Inter-molar Width: Increased
- Inter-canine Width: Decreased

Mandibular Dentition

- A P: Molars maintained, Incisors retracted
- Vertical: Molars maintained, Incisors intruded
- Inter-molar Width: Increased
- Inter-canine Width: Decreased

Facial esthetics:

- Upper lip retracted 5 mm
- Lower lip retracted 4 mm (Figs. 24)
- Chin appeared more prominent due to the mandibular growth and lip retraction



The pretreatment lip profile (left) was retracted 5 mm (upper) and 4 mm (lower).

Retention

- 1. Fixed 3-3 retainers were bonded on all anterior teeth in both arches.
- 2. Clear overlay retainers were delivered for both arches. The patient was instructed to wear the overlay retainers full time for the first 6 months and nights only thereafter. Home care and retainer maintenance instructions were provided.

Final Evaluation Of Treatment

The ABO CRE score was 24 points, as documented in the form that appears later in this report.⁶

Significant discrepancies were:

- 1. Occlusal relationships (8 points)
- 2. Buccolingual inclination (7 points)

- 3. Lack of occlusal contacts (4 points)
- 4. Root angulation (3 points)
- 5. Overjet (1 point)
- 6. Interproximal contacts (1 point)

Cephalometric Analysis:

- 1. ANB: decreased from 3° to 1°
- 2. U1SN: decreased from 117° to 113°

Finishing Details:

- Lower canines were substituted for the lateral incisors, both in position and modified morphology.
- 2. Lip protrusion was decreased in both arches:
 - UL-E line decreased from +2 mm to -3 mm
 - LL-E line decreased from +2 mm to -2 mm

As will be documented on a subsequent form, the pink and white dental esthetic score was 3.⁷

Discussion

Treatment timing was an important issue for two reasons: 1. improving facial esthetics, and 2. taking maximal advantage of mandibular growth. At the initial consultation (9 year and 11 month), the decision was to delay the start of mechanics to reduce the overall duration of active treatment. That decision risked a negative psychologic impact for the patient because she had to endure the compromised facial appearance for an additional three years. In retrospect, an initial stage of mixed dentition treatment was indicated to improve the facial appearance by reducing maxillary protrusion, correcting the lip trap, and establishing lip competence.

Patients with severe overjet and overbite discrepancies may require a surgical correction. Fortunately the present patient had adequate growth remaining to assist with overjet correction. However, delaying the start of treatment for three years could have compromised overjet correction because many females complete growth before the age of 13 years. In retrospect, headgear to restrain maxillary growth during mixed dentition treatment would have been a more predictable approach for taking advantage of mandibular growth.

A congenitally missing lower incisor is a significant compromise for most patients. However, it is a major complicating factor for those with excessive overjet and deepbite because a missing lower incisor intensifies the sagittal component of the malocclusion, creates asymmetry and may result in a midline deviation. Congenitally missing teeth is a hereditary trait that may result in a familial pattern of occlusion that is preferred by some patients. Thus, it is important to inquire about the expectations and desires of each patient.

Prosthetic replacement of a lower incisor as well as other restorative solutions are rarely indicated for orthodontic patients because the problem can usually be managed with unilateral or bilateral canine substitution. A unilateral approach may require difficult, asymmetric mechanics, whereas extracting one of the three remaining incisors allows a symmetric approach to resolving the problem. In deciding which teeth to extract, there are three important dental considerations: 1. number of teeth in each quadrant, 2. arch symmetry, and 3. Angle molar relationship.

Two types of extraction patterns were considered for the present patient, but both approaches involved removing the maxillary first premolars. The option considered was to also extract one of the remaining three mandibular incisors to create a symmetric malocclusion, that could be corrected to a bilateral Class I molar relationship. Not extracting an incisor lessens the overjet discrepancy, which is favorable if there is no mandibular growth, but it results in difficult, unilateral mechanics that may produce an asymmetric result with a midline discrepancy. The problem with extraction of a lower incisor is the enhancement of the severe overjet. If the patient fails to grow, a functional appliance (*Herbst etc.*) or orthognathic surgery may be necessary.

Canine substitution is usually the best option for patients with a missing lower incisor, but there are three important considerations: position, morphology and torque. Positioning refers to the crown and root movement necessary to achieve ideal alignment. Morphology involves flattening the cusp tip and slenderizing, i.e. reducing the mesial– distal dimension of the canine and flattening its buccal surface. It is wise to perform adjustments progressively and inform the patient that the process may cause slight discomfort.⁸ Torque is often required to achieve an optimal third order position to effectively simulate a lateral incisor. The most common third order problem is lingual root torque.

Conclusion

Adolescent patients with severe overjet and a deep impinging overbite require careful treatment planning to achieve an optimal result. A congenitally missing incisor significantly complicates the treatment of most malocclusions. The treatment ramifications may include orthognathic surgery, growth modification, extractions, implant-supported prostheses, canine substitution, and/or miniscrew anchorage.

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Discrepancy Index Worksheet

22

TOTAL D.I. SCORE

OVERJET

=	
=	0 pts.
=	2 pts.
=	3 pts.
=	4 pts.
=	5 pts.

Negative OJ (x-bite) 1 pt. per mm. per tooth =



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

ANTERIOR OPEN BITE

0 mm. (edge-to-edge), 1 pt. per tooth then 1 pt. per additional full mm. per tooth

Total



LATERAL OPEN BITE

2 pts. per mm. per tooth

Total

=	0

CROWDING (only one arch)

1 – 3 mm. 3.1 – 5 mm.	=	1 pt. 2 pts.
5.1 – 7 mm.	=	4 pts.
> 7 mm.	=	7 pts.

Total



OCCLUSION

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

=

LINGUAL POSTERIOR X-BITE

1 pt. per tooth	Total	=	0		
BUCCAL POSTER	IOR X-F	<u>BITE</u>			
2 pts. per tooth	Total	=	4		
<u>CEPHALOMETRI</u>	<u>CS</u> (Se	ee Instruct	ions)		
ANB $\geq 6^{\circ}$ or ≤ -2	0		= 4	pts.	
Each degree $< -2^{\circ}$		_x 1 pt.	=		
Each degree $> 6^{\circ}$		_x 1 pt.	=		
SN-MP $\geq 38^{\circ}$ Each degree $\geq 38^{\circ}$ $\leq 26^{\circ}$ Each degree $< 26^{\circ}$ 1 to MP $\geq 99^{\circ}$		_x 2 pts _x 1 pt.	= 2 = 1 = 1 = 1	pts. pt. pt.	
Each degree $> 99^{\circ}$		_x 1 pt.	=		
OTHER (See Instru Supernumerary teeth Ankylosis of perm. teet Anomalous morpholog Impaction (except 3 rd n Midline discrepancy (≥ Missing teeth (except 3 rd Missing teeth, congenit Spacing (4 or more, per a Spacing (Mx cent. diastem Tooth transposition Skeletal asymmetry (nonsu Addl. treatment complet	Tot: uctions) h y nolars) al arch) a $\geq 2mm$) urgical tx) exities	al	=		2
Identify:					_
IMPLANT SITELip line : Low (0 pt), MediuGingival biotype : Low-High-scalloped, thin (2 pts)Shape of tooth crownBone level at adjacencontact point (1 pt), \geq 7mm to cBone anatomy of alvesimultaneous augment (1 pt), DeH&V (3 pts)Soft tissue anatomy :Infection at implant site	Tot: m (1 pt), High escalloped, the s : Rectangu t teeth : ; ontact point (olar cress ficient H, req Intact (0 pt), : None (0 pt)	al n (2 pts) ick (0 pt), Ma ick (0 pt), Tr ≤ 5 mm to co 2 pts) t : H&V suf uire prior gr Defective (2 , Chronic (1 p	= edium-scall iangular (2 pontact poin fficient (0 p afting (2 pt 2 pts) t), Acute(2	2 oped, m pts) t (0 pt), s t), Defic s), Defic	= edium-thick (1 pt) = 5.5 to 6.5 mm to = ient H, allow = = =
	То	tal	=	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 (Before Surgical Crown Lengthening)

Total Score: =

- := 3
- 1. Pink Esthetic Score





2. White Esthetic Score (for Micro-esthetics)





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 Papilla	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

Total =

1

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	\bigcirc	1	2
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