Conservative Management of a Severe Class III Open Bite Malocclusion

History and Etiology

A 17-year-11-month-old girl was referred by her dentist for orthodontic consultation (*Fig. 1*). Her chief concerns were anterior cross bite, open bite and prognathic mandible (*Figs. 2 and 3*). She was told that surgery is the best solution for her severe malocclusion. However, the patient deemed that approach to be too aggressive, thus a nonsurgical camouflage plan was devised to meet her needs. There was no contributory medical or dental history. The patient was treated to an acceptable outcome as documented in Figs. 4-9. The details for diagnosis and treatment of this challenging malocclusion will be discussed in the following sections.

■ *Fig. 1: Pretreatment facial photographs*

■ *Fig. 2: Pretreatment intraoral photographs*

Dianosis

Skeletal:
  • Skeletal Class III (*SNA 80°, SNB 83°, ANB -3°*)
  • Mandibular plane angle (*SN-MP 40°, FMA 33°*)

Dental:
  • Bilateral Class III malocclusion
  • Negative overjet was 5mm
  • Anterior open bite was about 5mm
  • Crowding was about 9mm in the upper arch, the lower arch was well aligned
  • Bilateral posterior crossbite tendency

■ *Fig. 3: Pretreatment study models*

Dr. Bill Su, Director, Newtons Implant Center (right)
Dr. Chris Chang, Director, Beethoven Orthodontic Center (middle)
Dr. W. Eugene Roberts, Consultant,
International Journal of Orthodontics & Implantology (left)

■ *Fig. 4: Posttreatment facial photographs*

■ *Fig. 5: Posttreatment intraoral photographs*

■ *Fig. 6: Posttreatment study models*

• Mandibular midline was on the facial midline and the maxillary midline was shifted 2mm right

Facial:

• Competent lips

• Moderately convex profile with a protruded lower lip

The ABO Discrepancy Index (*DI*) was 77 as shown in the subsequent worksheet (*Fig. 10*).[1]

Specific Objectives of Treatment

Maxilla (*all three planes*):

• A - P: Maintain

• Vertical: Maintain

• Transverse: Maintain

Mandible (*all three planes*):

• A - P: Maintain

• Vertical: Posterior rotation of ~3-4mm

• Transverse: Maintain

Maxillary Dentition:

• A - P: Maintain

• Vertical: Extrude molars and incisors to correct the openbite and accommodate the posterior mandibular rotation

■ *Fig. 7:*

Pretreatment pano and ceph radiographs show high mandibular angle and open bite.
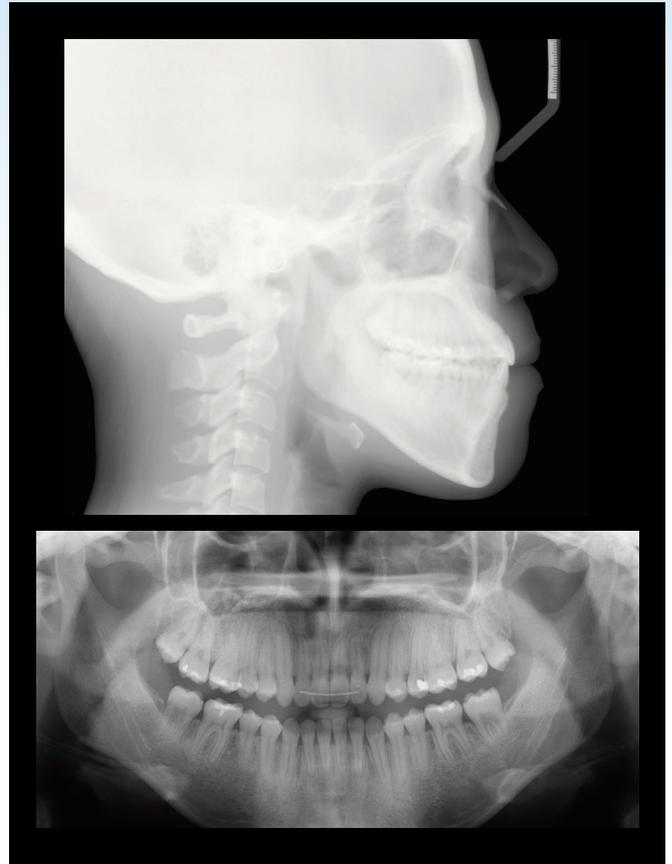
■ *Fig. 8:*

Posttreatment pano and ceph radiographs show a balancing lip profile.
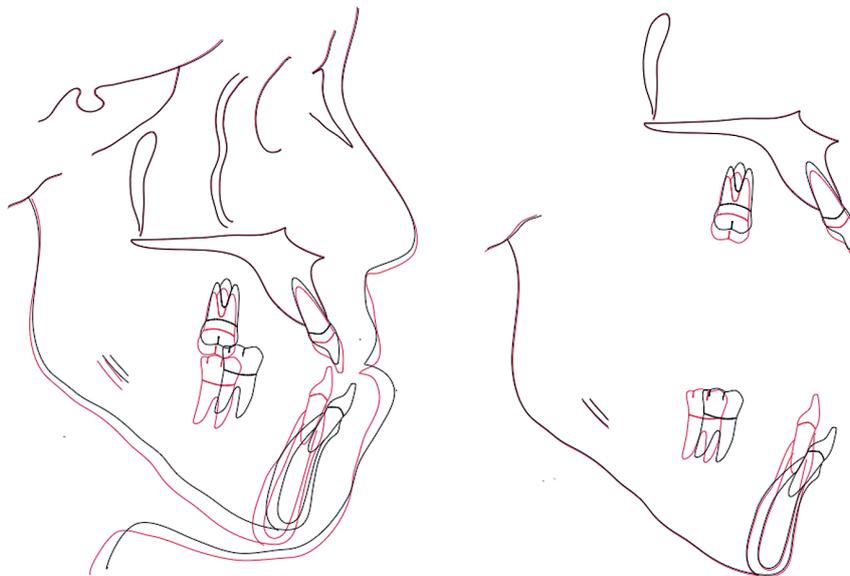
■ *Fig. 9:*

Superimposed tracings. The rotation of the occlusal plane helps correct this severe Class III malocclusion. But the extrusion of upper molars also produces the undesirable rotation of the mandible.

DISCREPANCY INDEX WORKSH[EET]

CASE #   PATIENT

TOTAL D.I. SCORE

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 = **23**

OVERBITE

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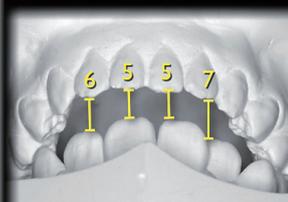
Total = **0**

6   5   5   7

6+5+5+7=23

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2 pts. per mm. per tooth

Total =

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 =

OCCLUSION

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

Total = **8**
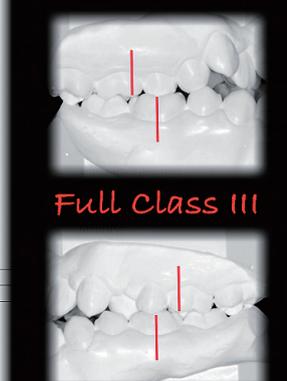
Full Class III

ANTERIOR OPEN BITE

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

Total = **15**

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 =

3   1   1   2   2   0

6+3+1+1+2+2+0=15

EXAM YEAR   2009
ABO ID#

LINGUAL POSTERIOR X-BITE

1 pt. per tooth   Total = **2**

BUCCAL POSTERIOR X-BITE

2 pts. per tooth   Total = **4**

CEPHALOMETRICS   (See Instructions)

ANB ≥ 6° or ≤ -2°	=	4 pts.
SN-MP		
≥ 38°	=	2 pts.
Each degree > 38° _____ x 2 pts. =		
≤ 26°	=	1 pt.
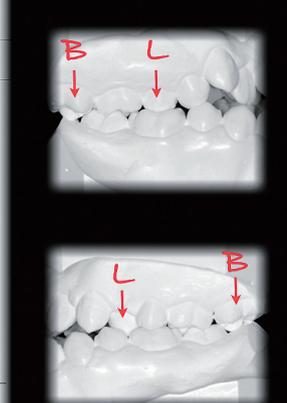
B   L

L   B

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 =

CROWDING (only one arch)

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

Total = **4**

CEPHALOMETRICS   (See Instructions)

ANB ≥ 6° or ≤ -2°	=	**4** pts.
Each degree < -2° _____ x 1 pt. =		**1**
Each degree > 6° _____ x 1 pt. =		
SN-MP		
≥ 38°	=	**2** pts.
Each degree > 38° _____ x 2 pts. =		**4**
≤ 26°	=	1 pt.
Each degree < 26° _____ x 1 pt. =		
1 to MP ≥ 99°	=	1 pt.
Each degree > 99° _____ x 1 pt. =		

Total = **11**

OTHER   (See Instructions)

Supernumerary teeth _____ x 1 pt. =
Ankylosis of perm. teeth _____ x 2 pts. =

80°
83°
-3°

40°

89°
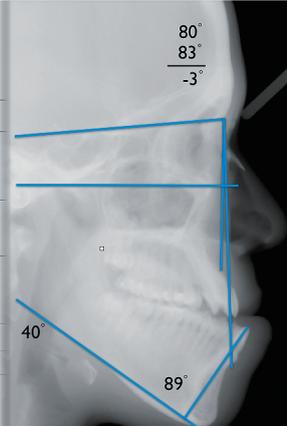
■ *Fig. 10: ABO-Discrepancy Index measurement*

• Transverse: Inter-molar expansion to relieve crowding and correct the posterior crossbite

Mandibular Dentition:
• A - P: Retract the entire mandibular dentition
• Vertical: Maintain
• Inter-molar / Inter-canine Width: Maintain

Facial Esthetics:
Retract lower lip to improve facial balance.

Treatment Plan

The Discrepancy Index (*DI*) worksheet revealed a very severe skeletal malocclusion, scoring 77 points. Consistent with the patient's wishes, three treatment options were presented (*Fig. 11*):

1. Extract the unerupted mandibular 3rd molars, and retract the entire mandibular dentition, utilizing the anchorage provided by two bone screws placed in the buccal shelves.

2. Extract the maxillary second bicuspids and the mandibular first bicuspids. Protract the upper posterior segments and retract the lower segment.

3. Extract both mandibular second molars, protract the third molars, and retract the entire mandibular arch, with anchorage provided by two bone screws, placed on the buccal shelves of the mandible.

The pros and Cons on each treatment option were discussed. *Option A*, pros: remove the third molars and preserve the bicuspids. Cons: longer treatment

time, bone screws would be needed for full dentition retraction, and the axial inclination of the mandibular second molars would probably be tipped distally. *Option B*, pros: the Class III molar relation, open bite and protruded lower anteriors could be improved with the extraction of upper second and lower first bicuspids. Cons: the mesialdistal width of lower
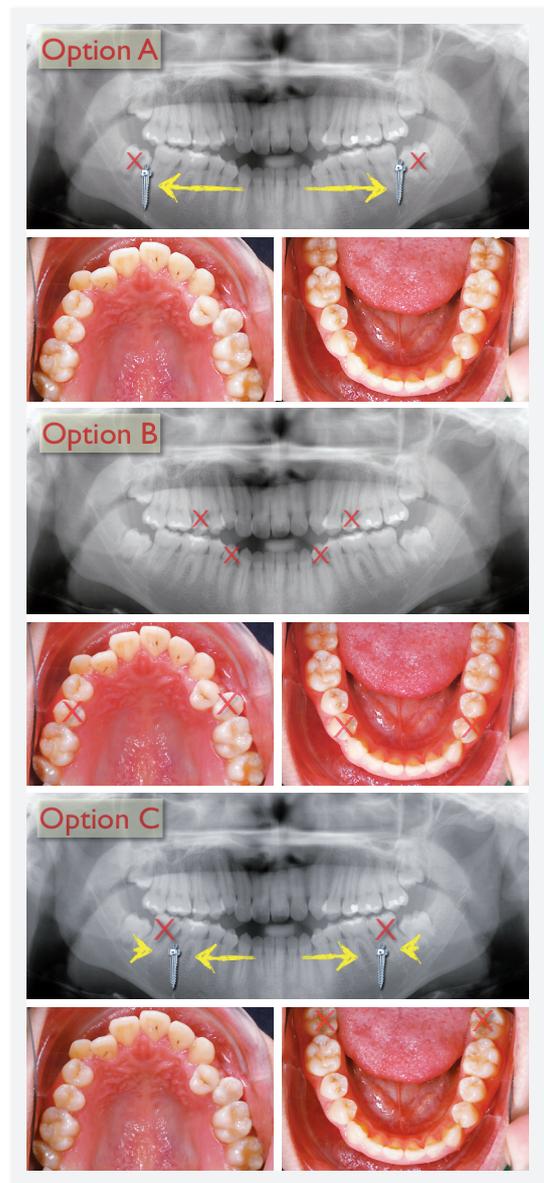

■ *Fig. 11: Treatment options.*

Bonding

■ Fig. 12: Bonding positons

Class III openbite, Damon Q, 0.014 CuNiti, Posterior bite-turbo
Quail 3/16, 2oz, Class III shorty U5-L3
Parrot 5/16, 2oz, Reverse rainbow UR2-L1'S-UL2
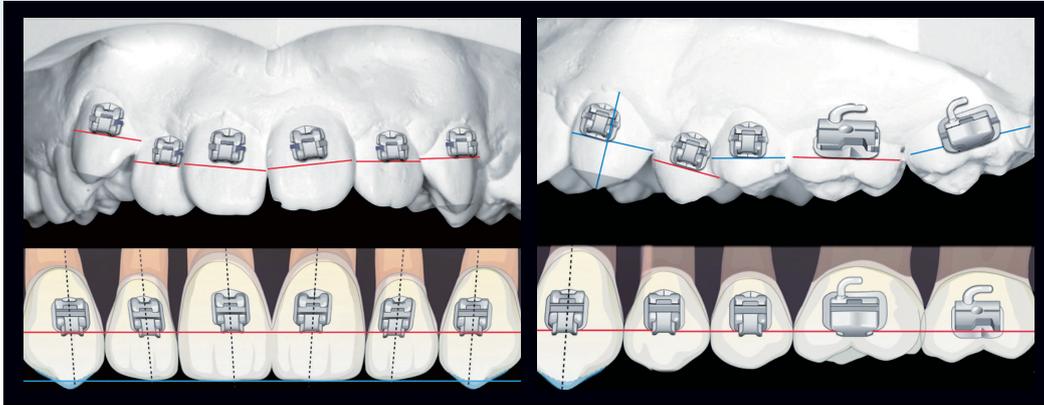
Posterior Cross-bite, Damon Q, 0.014 CuNiti, Posterior bite-turbo,
Parrot 5/16, 2oz, Posterior cross elastics U6,U5-L6's or L5's
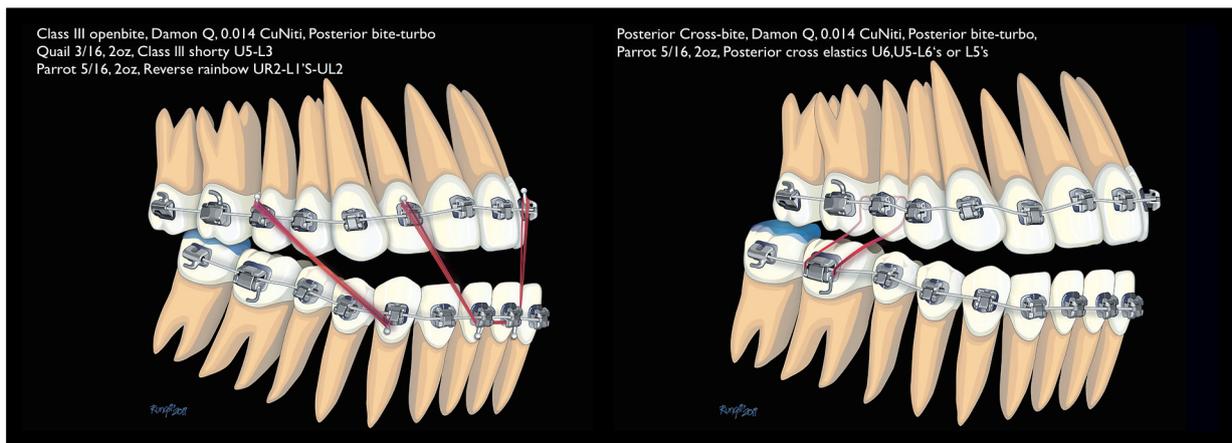
■ Fig. 13: Application of elastics

Wire Sequence

Initial Light Wire Phase
.014 NiTi 4~6M

High-Tech Edgewise Phase
14x25 NiTi 3M

Major Mechanics Phase
17x25 TMA 2M (Non-ext. 1Y)
U19x25 SS,L16x25 SS 1Y (Ext.)

Finishing Phase

■ Fig. 14: Wire sequence.

bicuspids is inadequate space for correction of the large negative overjet. Especially for open bite malocclusions, it is necessary to retract the lower dentition more than 10 mm, so 4 quadrants of bicuspid extraction may be insufficient for optimal correction of the buccal interdigitation. Option C, pros: extracting second molars simplifies mandibular arch retraction, prevents distal tipping the terminal molars, and preserves both the bicuspids and the third molars. The mesial-distal width of the lower second molar extraction sites is ~10-12mm, which is adequate space for retraction of the arch to correct the negative overjet. Cons: retraction of the entire arch requires a longer treatment time and anchorage support is essential, so buccal shelf bone screws must be used bilaterally.

Following an extensive discussion of the relative risks and benefits of the three treatment options, the patient reemphasized her desire to avoid surgery and accepted camouflage orthodontic treatment, based on option C. Early class III elastics (*Fig. 13*), supplemented with posterior bite turbos, generated light force to help correct the Class III canine relationship and anterior open bite. Torque control of the incisors during Class III elastics therapy was maintained with low torque maxillary and high torque mandibular brackets (*Fig. 15*). Bilateral extra-radicular miniscrews (*2x12mm OrthoBoneScrew, Newton's A Inc.*) were inserted in the mandibular buccal shelves for traction anchorage (*Fig. 17*). Class III elastics were used to finish correction of the sagittal occlusal discrepancy, and detailing bends refined the final occlusion. Fixed anterior retainers were planned for both arches: Mx 2-2, Md 3-3.
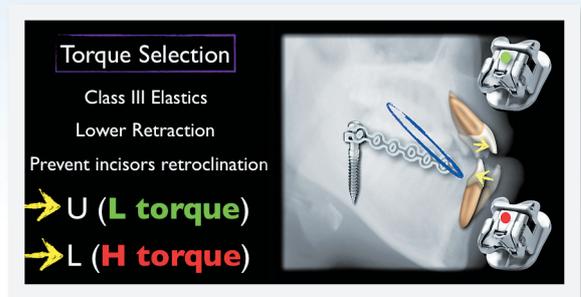

Fig. 15:
Torque selection: Upper arch (lower torque), lower arch (high torque)


Fig. 16: The position of posterior Bite Turbos

Fig. 17:
The bone screws were placed on the bilateral buccal shelves.

Appliances and Treatment Progress

A .022" slot Damon D3MX bracket system (*Ormco*) was used (*Fig. 12*). The maxillary arch was bonded with low torque brackets on incisors (*U1: 7°, U2: 3°*), and low torque brackets were bonded upside down on the lower central and lateral incisors (*L1, L2: -6° → 6°*). High torque brackets were bonded on the lower canines (*L3: 7°*) (*Figs. 18-19*). Posterior bite turbos were placed on the lower first molars for intrusion and to assist in posterior crossbite correction (*Fig. 16*).

D3MX Torque

Torque	U1	U2	U3	U4	U5
High	17	10	7		
Std	12	8	0	-7	-7
Low	7	3			

Torque	L1	L2	L3	L4	L5
High			7		
Std	-1	-1	0	-12	-17
Low	-6	-6			

D3MX Torque (Upside down)

Torque	U1	U2	U3	U4	U5
High	17	10	7		
Std	12	8	0	-7	-7
Low	7	3			
Super Low	-17	-10	-7		

Torque	L1	L2	L3	L4	L5
High	6	6	7		
Std	-1	-1	0	-12	-17
Low	-6	-6	-7		

DQ Torque

Torque	U1	U2	U3	U4	U5
High	22	13	11		
Std	15	6	7	-11	-11
Low	2	-5	-9		

Torque	L1	L2	L3	L4	L5
High	11	11	13	-5	
Std	-3	-3	7	-12	-17
Low	-11	-11	0		

DQ Torque (Upside down)

Torque	U1	U2	U3	U4	U5
High	22	13	11		
Std	15	6	7	-11	-11
Low	2	-5	-9		
Super Low	-22	-13	-11		

Torque	L1	L2	L3	L4	L5
High	11	11	13	-5	
Std	-3	-3	7	-12	-17
Low	-11	-11	0		
Super Low			-13		

■ *Fig. 18:*

The torque of the Damon 3MX and Damon Q. For Damon 3MX, the upper anteriors can be up side down as super low torque brackets, and lower incisors can be up side down as high torque brackets. The same as Damon Q brackets.

From the start of treatment, full time light short Class III elastics (*2oz*) were applied from the lower canines to the upper second bicuspids to help resolve the sagittal discrepancy.

The wire sequence was as follows: .014″ CuNiTi, .014x25″ CuNiTi, .017x25″ TMA, .019x25″ SS (*Fig. 14*). During treatment, the Class III elastics were upgraded gradually from 2oz, 3.5oz, 4.5oz, to 6oz. Substantial slow palatal expansion was noted six months into treatment, at the same time that a panoramic film was taken to evaluate the position of bonds on the teeth (*Fig. 21*). The light wire on the upper arch corrected the posterior transverse discrepancy over the first 12 months of treatment, and resolved the posterior cross-bite without the use of a rapid palatal expander or W-arch. In the 9th month, .016x25″ SS arch-wires were placed on the lower arch, and bilateral bone screws (*2x12mm OrthoBoneScrew, Newton's A inc.*) were installed in the mandibular buccal shelves (*Fig. 20*). The bone screws were used to provide anchorage to retract the entire mandibular dentition while intruding the molars.

17 months after the initiation of active treatment, the negative overjet was corrected and anterior triangular elastics (*U1-L2-U3-L4*) were applied for open bite correction (*Fig. 22*). Once the bilateral Class I molar relationship was achieved, the lower bone screws were removed and closed coil springs were used to protract the third molars and complete closure of the residual spaces. In the 29th month

of the treatment, a cephalometric film showed a bimaxillary lip protrusion. Bilateral bone screws (*2x12mm OrthoBoneScrew, Newton's A inc.*) were inserted into the infrazygomatic crests (*Fig. 23*). Elastometric chains from upper canines to the infrazygomatic screws, and Class III elastics from lower canines to the IZC screws, were used to retract both arches simultaneously.

At the start of finishing phase, alignment was scored with the Cast-Radiograph Evaluation (*CRE*) worksheet to determine which brackets should be rebonded to correct first and second order problems (*Fig. 26*).[2] When using self-ligation brackets, this approach is more efficient than extensive wire bending for detailing the occlusion. Third order axial inclinations were corrected with torquing springs (*Figs. 24-25*). Overjet and overbite were refined with vertical elastics (*Fig. 27*). Evaluation of the prefinish casts revealed a posterior arch width discrepancy that required expanding the lower archwire. The substantial maxillary posterior expansion appeared to reflect a more natural tongue posture in the roof of the mouth once the negative overjet and open bite were resolved. To correct an intermaxillary tooth size discrepancy, interproximal reduction was performed in the maxillary anterior and mandibular posterior segments, to refine the canine and molar relationships.

Two weeks prior to the completion of active treatment, the upper archwire was sectioned distal to cuspids. Light up-and-down elastics (*2oz*) were used posteriorly for final settling of the buccal segments (*Fig. 20*). After 42 months of active treatment, all appliances were removed. Upper clear overlay and fixed anterior (*Mx 2-2, Md 3-3*) retainers were delivered for both arches.

Results Achieved

Maxilla (*all three planes*):
- A - P: Maintained
- Vertical: Maintained
- Transverse: Maintained

Mandible (*all three planes*):
- A - P: Maintained
- Vertical: 4mm clockwise rotation of the mandible
- Transverse: Maintained

Maxillary Dentition:
- A - P: Slightly more incisor protrusion
- Vertical: Extrusion of the entire dentition
- Inter-molar / Inter-canine Width: Crowding and cross bite was corrected with arch expansion

Mandibular Dentition:
- A - P: Retract entire dentition and tip the incisors lingually
- Vertical: Maintained
- Inter-molar / Inter-canine Width: Expansion in the molar area to correspond to the maxillary arch

Facial Esthetics:
Lower lip protrusion was improved and lip competence was maintained, but a long chin was evident in the profile view.

■ Fig. 19:

In the first month of treatment, high torque brackets were bonded to lower canines and lower torque brackets were up side down as high torque on the lower anteriors. The poster bite turbos were placed on the lower first molars.
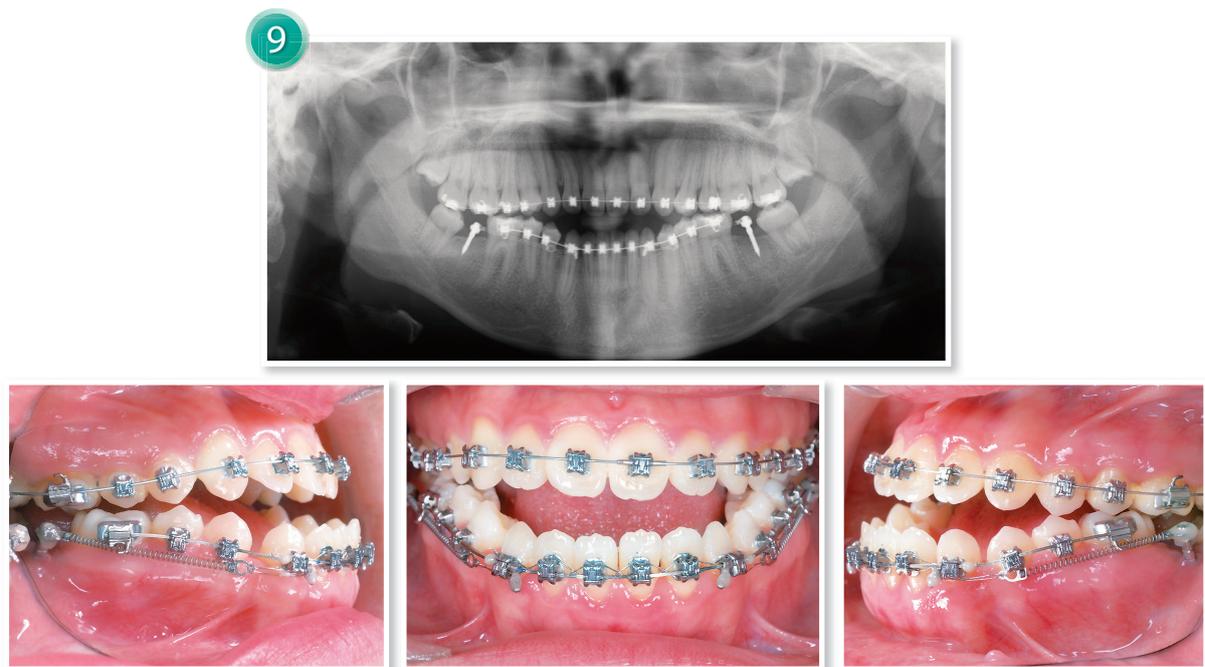

■ Fig. 20:

In the 9th month of treatment, two bone screws were inserted on the bilateral buccal shelves for full dentition distalization.

Retention

Fixed retainers were bonded on all maxillary incisors and from canine to canine in the mandibular arch. An upper clear overlay was delivered. Full time wear was prescribed for the first 6 months, and nights only thereafter. The patient was instructed in the home care and maintenance of the retainers.

Final Evaluation of Treatment

The final CRE score was 23 points, indicated an excellent finished alignment for this challenging malocclusion.[7] The major discrepancies were in occlusal relationships, occlusal contacts, alignment/rotation, and marginal ridges.[1,5] The increased width between the upper second molars, as well as finishing them slightly out of occlusion, increased the CRE score; however, these discrepancies were actually favorable overcorrections and the second molars are expected to settle into a stable, near ideal occlusion. The large negative overjet and severe anterior open bite were corrected without surgery.[3,4] All teeth were well aligned over the apical base of bone, except for the mandibular incisors, which had a slightly decreased axial inclination. A favorable factor during treatment was the expansion of the maxillary arch, which indicated that the patient had spontaneously changed the posture of her tongue to a more ideal relationship. Class III openbite patients usually have a lower tongue posture that is manifest as a rounded out lower arch (*Fig. 3*). When the tongue assumes a more normal posture, in the roof of the mouth, the maxillary arch tends to expand and round out (*Fig. 6*). Extra-

■ *Fig. 21*

After having used the light wire and .022" slot self-ligating system, arch expansion effect was noticed.
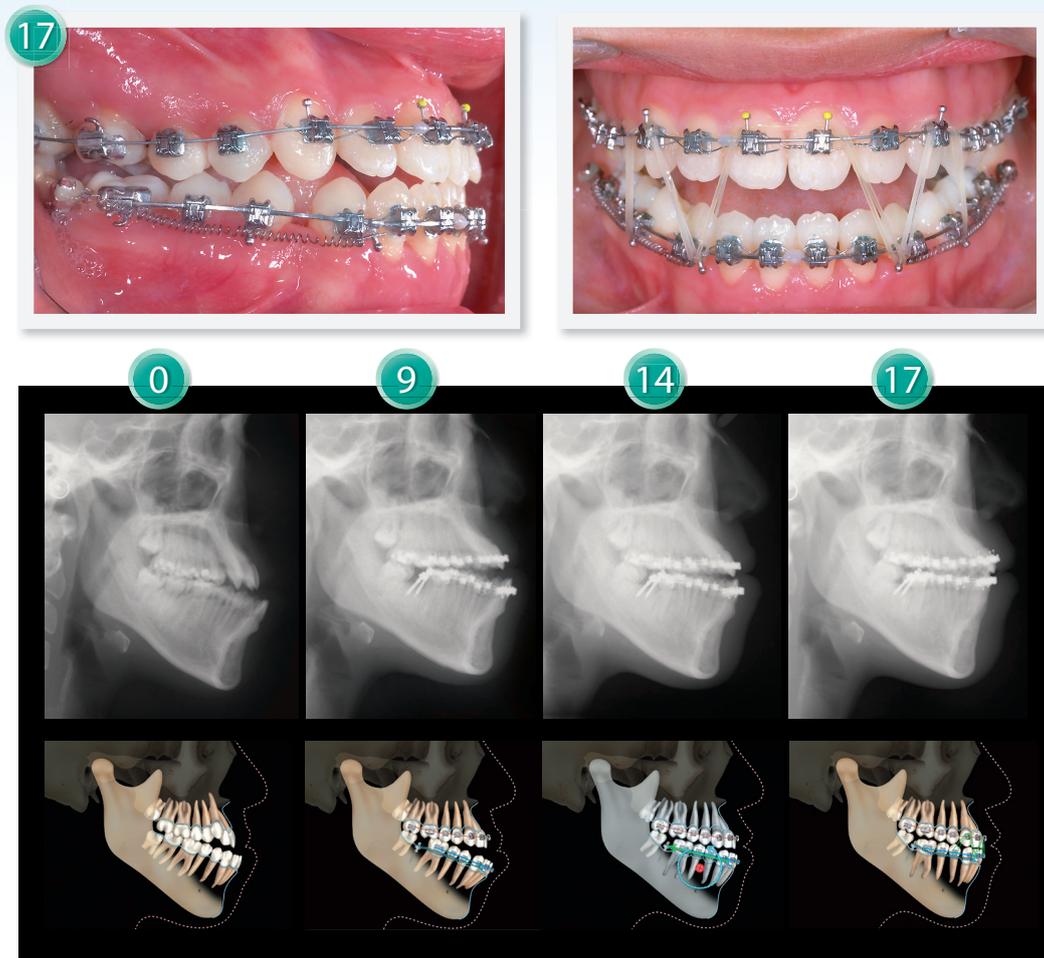
■ Fig. 22:
   In the 17th month, the negative overjet was corrected and anterior triangular elastics were applied for open bite correction.
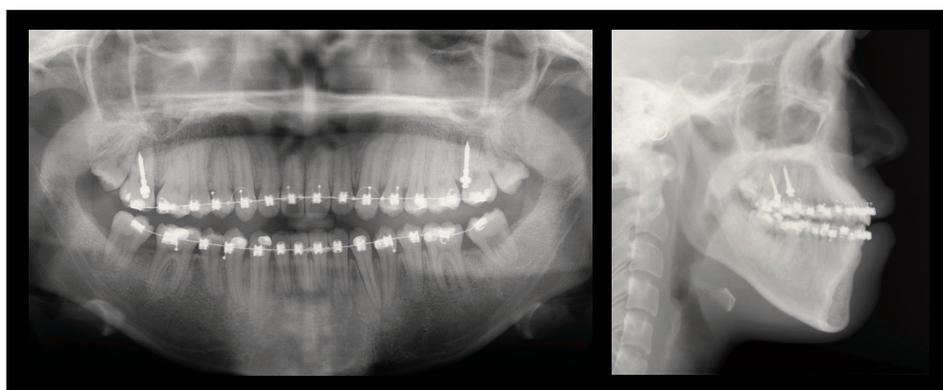
■ Fig. 23: 2 bone screw inserted into infra-zygomatic crests were applied for upper dentition distalization.

alveolar bone screws provide effective orthopedic anchorage for retracting both arches in skeletal Class III malocclusions.[6] The necessity for mandibular arch retrusion is intuitive, but it is important to realize that retraction of the entire mandibular arch usually results in a bimaxillary protrusion, when the negative overjet is corrected (*Fig. 22*). Thus, infrazygomatic screws are also necessary in the maxilla to augment the mandibular buccal shelf screws in order to achieve simultaneous retraction of both arches. Nonsurgical correction of the current severe skeletal Class III malocclusion required extensive retraction and extrusion of the mandibular incisors. This treatment should be reserved only for patients with a healthy periodontium, that is capable of generating new alveolar bone and attached gingiva. Since the lower incisors have a decreased axial inclination (*more retroclined*) than ideal, the patient's substantial orthodontic correction should be followed long-term. Night wear of the retainers is recommended indefinitely.

Discussion

Conservative treatment, presently defined as without orthognathic surgery, of a Class III skeletal malocclusion is challenging, particularly in the presence of a large negative overjet and open bite. The most common, traditional camouflage treatment option is extraction of upper second premolars and lower first premolars, to provide space and anchorage for retraction of the lower anteriors to correct the buccal segments.[3,4] However, the present case was too severe to effectively manage with premolar extractions. Using bone
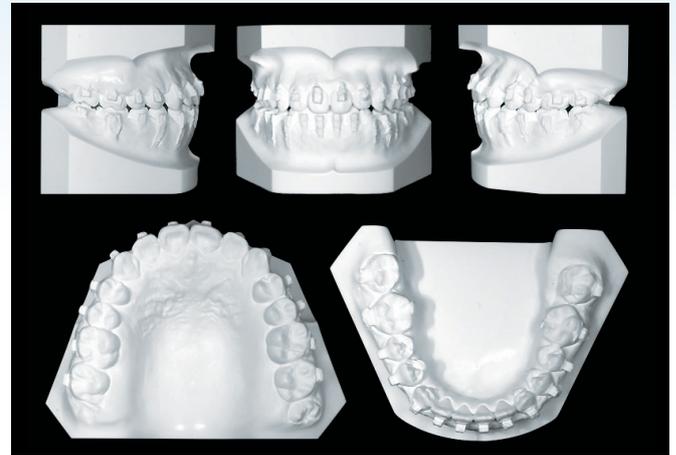
■ Fig. 24:
In the finished stage, take impression for checking each bonding position.
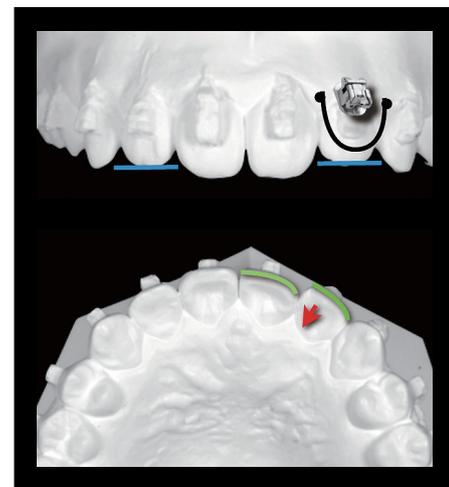
■ Fig. 25:
#10 was higher than #7 and flaring. Rebond the bracket higher and apply reverse torque spring.

screws in the mandibular buccal shelves provides maximum anchorage for retraction of the entire arch to correct the interdigitation of the buccal segments.[6] The DI of 77 documents the extreme severity of this malocclusion. It is unlikely that any other form of camouflage therapy could produce such an excellent outcome, as documented by CRE

■ *Fig. 26:*
  Check tooth axis from buccal, occlusal and palatal side to determine better bonding position.

■ *Fig. 27:*
  Open contact on #10 and 11 was noticed, bond the lingual buttons and correct by cross-elastics.

score of 23.

The chief concern (*complaint*) of the patient is always the first priority in treatment planning (*Fig. 28*). Especially for adult patients, a thorough periodontal evaluation is essential, as part of the diagnostic work-up. Extensive retraction and extrusion of the mandibular incisors in a periodontally compromised patient is contraindicated, because the treatment will probably result in severe bone loss. When teeth are moved long distances, they must generate new bone and attached gingiva. That can only be accomplished by a healthy periodontium. Another important consideration is the smile-line, which is drawn from a facial photograph documenting a natural smile. Once the ideal position of the maxillary

incisors is determined, the position and inclination of the lower incisors can be planned to achieve optimal incisal guidance. The SN-MP angle and lip competence are used to evaluate the facial height of the patient. It is usually necessary to increase the face height during Class III camouflage treatment, so it is important to make sure that the patient has adequate lip length to achieve lip competence at the end of treatment. For the present patient, lip length was adequate to tolerate the posterior mandibular rotation, but her lower face (*chin and lower lip*) area was lengthened. However, at the end of treatment the patient is an attractive young lady with a nice smile-line. The long chin is only noticed in the profile view.
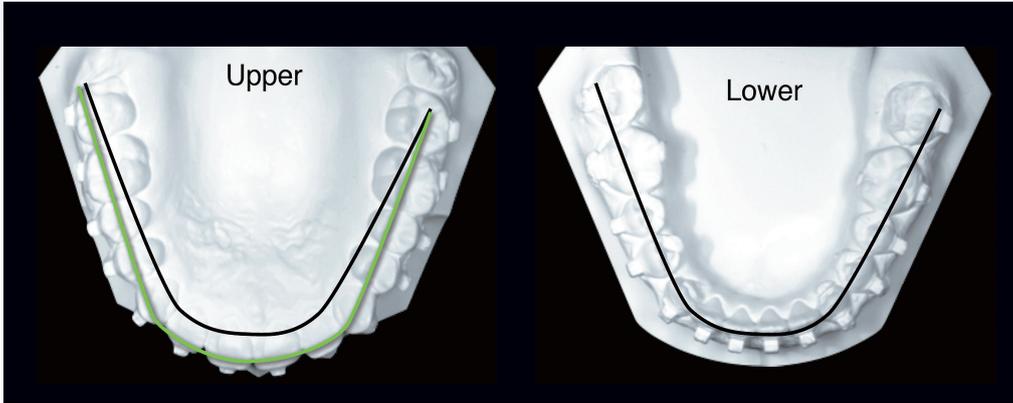
■ *Fig. 28: Upper and lower arch discrepancy were noticed.*
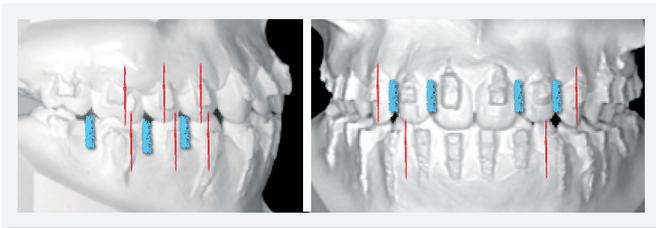
■ *Fig. 29:*

Correct posterior molar relation and anterior canine relation by interproximal reduction.
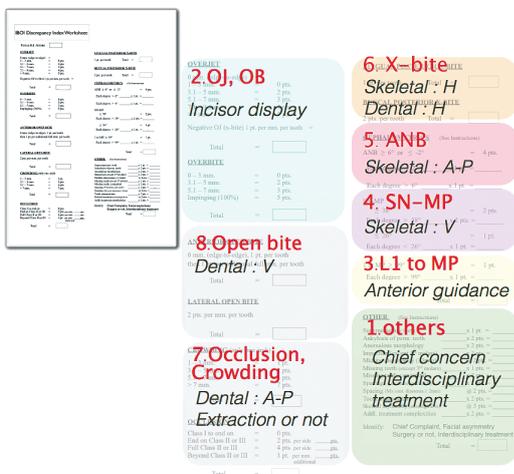
■ *Fig. 30:*

Determining treatment sequence by checking ABO-DI worksheet

The ANB angle was reduced from -3 to 0 degrees, which is within normal limits. The patient's facial esthetics would probably benefit from a surgical chin shortening and advancement procedure. Compared to orthognathic surgery, a skeletal chin revision is a relatively simple procedure, that often accomplished on an out-patient basis. Because of her aversion to surgery, and the attractive result in the frontal view, the patient is unlikely to pursue a chin revision in the near future, but it remains a viable alternative if she becomes concerned about her long chin in the future.

Analysis of the dental casts shows that the maxillary arch can be expanded with light forces. There was no need for rapid palatal expansion. However, as previously mentioned, this favorable result was probably substantially assisted by the patient assuming a more natural tongue posture, i. e. positioning her tongue in the roof of her mouth. Functional forces, and particularly tongue posture, are very important considerations when treating openbite patients. If patients do not assume normal

Dental-facial analysis

Incisor display

Skeletal : V → A-P → H

L1 position

Facial height
(skeletal:V)
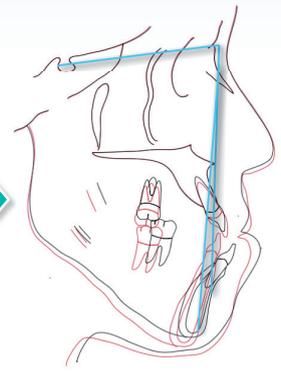
**U & L bone
relative position**
(skeletal:A-P)

■ *Fig. 31:*

Orthodontic thing sequence as following:

dental-facial analysis → skeletal (vertical - AP -horizontal) → dental (horizontal - AP - vertical) and star over.

Dental : H → A-P → V
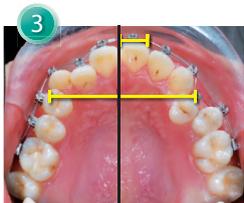
Arch expasion
(*skeletal:H,dental:H*)
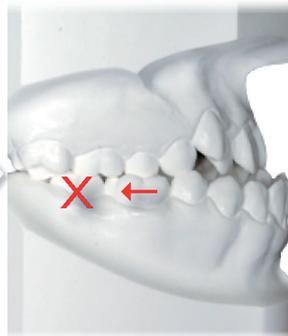
Molar relation
(dental:A-P)
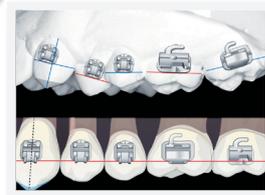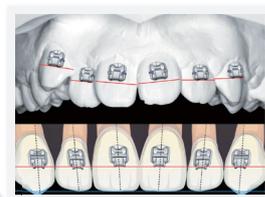
Tooth vertical position
(dental:V)

Start over
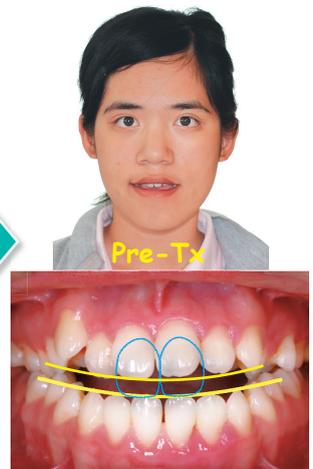
Incisor display

■ *Fig. 32: The comparison of facial profile before and after treatment.*

lip and tongue posture at the end of treatment, relapse of the open bite is likely.

Another important aspect in the favorable results achieved is the ideal alignment of the terminal molars despite substantial retraction of the mandibular arch from first molar to first molar. If the third molars had been extracted and entire arch retracted, it would have been difficult to prevent the terminal teeth (*second molars*) from being tipped distally. Because of the inherent flexibility at the end of an archwire, it is challenging to deliver an adequate root-distal moment, to ideally align the terminal molars in the second order, when the entire arch is retracted. If all three molars are present, there is a substantial biomechanics advantage to extracting the first or second molars, rather than the third molars if the rest of the arch will be retracted with extra-radicular anchorage. Avoiding substantial retraction of the terminal molars is an important treatment planning option.

Before beginning the finishing stage of the

orthodontic treatment, it is advisable to obtain progress casts and a panoramic radiograph. The the CRE worksheet is very helpful for identifying problems that detract from an ideal result. These minor discrepancies are difficult to detect clinically. Preparing a check list to reposition brackets and attend to other details in finishing has been shown to result in a highly significant improvement in treatment outcomes.[11]

The present case report demonstrates that a skeletal Class III malocclusion, with a large negative overjet and severe anterior open bite, can be optimally corrected without orthognathic surgery (*Fig. 32*). The entire mandibular arch can be retracted with extra-alveolar anchorage. Interradicular miniscrews were be inappropriate, because they would interfere with the retraction of all the teeth in the arch. Extensive retraction of particularly the mandibular incisions should only be attempted in patients with a healthy periodontium.

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	80°	80°	0°
SNB°	83°	80°	3°
ANB°	-3°	0°	3°
SN-MP°	40°	42°	2°
FMA°	33°	35°	2°
DENTAL ANALYSIS			
U1 TO NA mm	2mm	3mm	1mm
U1 TO SN°	109°	111°	2°
L1 TO NB mm	6mm	3mm	3mm
L1 TO MP°	89°	75°	14°
FACIAL ANALYSIS			
E-LINE UL	-2mm	0mm	2mm
E-LINE LL	4mm	1mm	3mm

■ Table. 1: Cephalometric summary

Acknowledgment

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3. Chang CH, Roberts WE, Orthodontics, 3D i-Ortho encyclopedia. 2012, Newton's A Ltd, Taiwan.

4. Tseng SP, Chang CH, Roberts WE. Treatment of Full-Cusp Skeletal Class III Malocclusion with Facial Asymmetry without Surgery, Extraoral Anchorage or TADs. Orthodontics 2012:198-208.

5. Huang CH, Chang CH, Robert WE. Non-extraction Management of Skeletal Class III Malocclusion with Facial Asymmetry. News & Trends in Orthod 2010; 20:22-31.

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7. Lin JJ. Creative Orthodontics: Blending the Damon System and TADs to manage difficult malocclusions, 2nd ed. Taipei: Yong Chieh; p. 263-271.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE   77

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   =   **23**

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   =   **15**

LATERAL OPEN BITE

2 pts. per mm. per tooth

Total   =   **0**

CROWDING (only one arch)

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

Total   =   **4**

OCCLUSION

Class I to end on	=	0 pts.
End on Class II or III	=	2 pts. per side ____ pts.
Full Class II or III	=	4 pts. per side __8__ pts.
Beyond Class II or III	=	1 pt. per mm. ____ pts. additional

Total   =   **8**

LINGUAL POSTERIOR X-BITE

1 pt. per tooth   Total   =   **2**

BUCCAL POSTERIOR X-BITE

2 pts. per tooth   Total   =   **4**

CEPHALOMETRICS   (See Instructions)

ANB $\geq$ 6° or $\leq$ -2°   =   4 pts.

  Each degree < -2° _____ x 1 pt. = __1__

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

SN-MP

  $\geq$ 38°   =   2 pts.
  Each degree > 38° _____ x 2 pts. = __4__

  $\leq$ 26°   =   1 pt.
  Each degree < 26° _____ x 1 pt. = _____

1 to MP $\geq$ 99°   =   1 pt.
  Each degree > 99° _____ x 1 pt. = _____

Total   =   **11**

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 ($\geq$3mm)	@ 2 pts. =	_____
Missing teeth (except 3rd molars)	_____ x 1 pts. =	_____
Missing teeth, congenital	_____ x 2 pts. =	_____
Spacing (4 or more, per arch)	_____ x 2 pts. =	_____
Spacing (Mx cent. diastema $\geq$ 2mm)	@ 2 pts. =	_____
Tooth transposition	_____ x 2 pts. =	_____
Skeletal asymmetry (nonsurgical tx)	@ 3 pts. =	_____
Addl. treatment complexities	_____ x 2 pts. =	**10**

Identify: **She insists non-surgical treatment.**

Total   =   **10**

Cast-Radiograph Evaluation

Occlusal Contacts

| 5 |

Buccal Surface

Lingual Surface

Case #   1   **Patient**

Total Score: **23**

Alignment/Rotations

| 7 |

Marginal Ridges

| 5 |
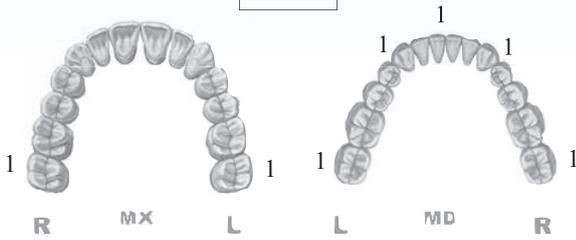
Occlusal Relationships

| 5 |
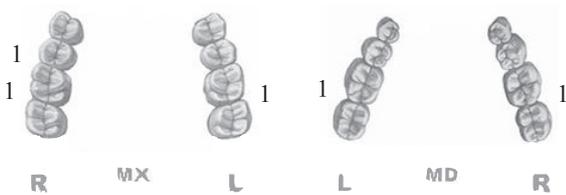
Buccolingual Inclination

| 0 |
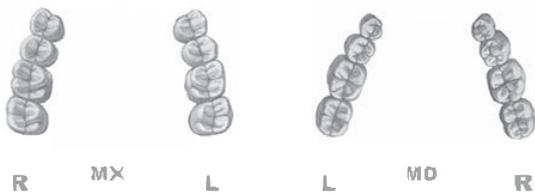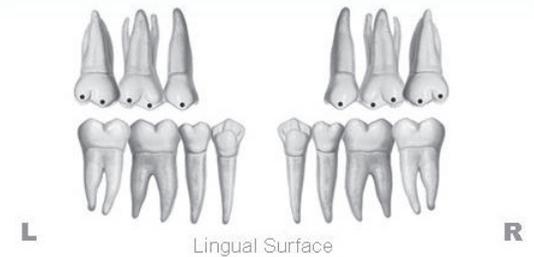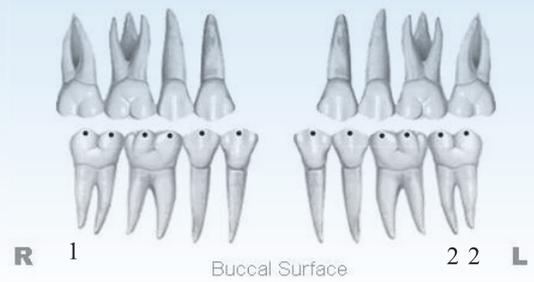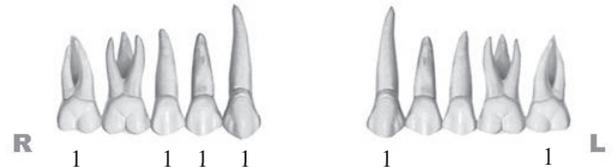
Interproximal Contacts

| 0 |

Overjet

| 1 |
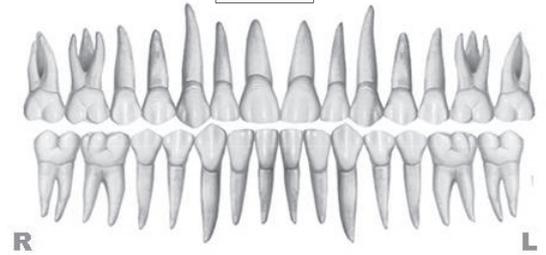
### Root Angulation

| 0 |
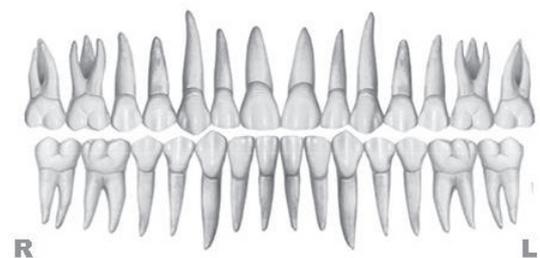
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 7

Pink Esthetic Score

Total = 5

	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

	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 = 2

	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
Tooth to Tooth Proportion	0	1	2

	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
Tooth to Tooth Proportion	(0)	1	2