2019 CDABO Case Report of the Year Award

Severe Unilateral Scissors-bite with a Constricted Mandibular Arch: Bite Turbos and Extra-alveolar Bone Screws in the Infra-zygomatic Crests and Mandibular Buccal Shelf

Abstract

A 33-year-old woman had a chief complaint of difficulty chewing, caused by a constricted mandibular arch and a unilateral full buccal crossbite (scissors-bite or Brodie bite). She requested minimally invasive treat- ment but agreed to anchorage with extra-alveolar temporary anchorage devices as needed. Her facial form was convex with protrusive but competent lips. Skeletally, the maxilla was protrusive (SNA, 86°) with an ANB angle of 5°. Amounts of crowding were 5 mm in the mandibular arch and 3 mm in the maxillary arch. The mandibular midline was deviated to the left about 2 mm, which was consistent with a medially and inferiorly displaced mandibular right condyle. Ectopic eruption of the maxillary right permanent first molar to the buccal side of the mandibular first molar cusps resulted in a 2-mm functional shift of the mandible to the left, which subsequently developed into a full buccal crossbite on the right side. Treatment was a conservative nonextraction approach with passive self-ligating brackets. Glass ionomer bite turbos were bonded on the occlusal surfaces of the maxillary left molars at 1 month into treatment. An extra- alveolar temporary anchorage device, a 2x12-mm OrthoBoneScrew (Newton A, HsinChu City, Taiwan), was inserted in the right mandibular buccal shelf. Elastomeric chains, anchored by the OrthoBoneScrew, extended to lingual buttons bonded on the lingually inclined mandibular right molars. Cross elastics were added as secondary uprighting mechanics. The maxillary right bite turbos were reduced at 4 months and removed 1 month later. At 11 months, bite turbos were bonded on the lingual surfaces of the maxillary central incisors, and an OrthoBoneScrew was inserted in each infrazygomatic crest. The Class II relationship was resolved with bimaxillary retraction of the maxillary arch with infrazygomatic crest anchorage and inter maxillary elastics. Interproximal reduction was performed to correct the black interdental spaces and the anterior flaring of the incisors. The scissors-bite and lingually inclined mandibular right posterior segment were sufficiently corrected after 3 months of treatment to establish adequate intermaxillary occlusion in the right posterior segments to intrude the maxillary right molars. The anterior bite turbos opened space for extrusion of the posterior teeth to level the mandibular arch, and the infrazygomatic crest bone screws anchored the retraction of the maxillary arch. In 27 months, this difficult malocclusion, with a Discrepancy Index score of 25, was treated to a Cast-Radiograph Evaluation score of 22 and a pink and white esthetic score of 3. (Reprinted with permission from Am J Ortho Dentofacial Ortho 2018;154;554-69). (J Digital Orthod 2019;55:44-62)

Key words:

Scissors-bite, Brodie bite, buccal crossbite, lingually inclined lower molars, ectopic eruption, maxillary protrusion, lip protrusion, cross elastics, occlusal bite turbo, extra-alveolar anchorage, mandibular buccal shelf, mandibular rotation, infra-zygomatic crest, inter-proximal reduction, bone screws, TADs

Introduction

A buccal crossbite is a malocclusion when the palatal cusp of the maxillary tooth is buccal to the buccal cusp of the opposing mandibular dentition; a lingual crossbite is when the maxillary buccal cusp is lingual to the buccal cusp tip of the opposing mandibular tooth. Brodie[1] defined a malocclusion as a "*Brodie bite*" or "*Brodie syndrome*" when the mandibular jaw "*telescoped*" within the upper arch, i.e. the mandibular teeth

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were completely contained within the upper arch. Sim[2] preferred the more generic term "*bilateral buccal crossbite,*" but van der Linden and Boersma[3] introduced the term "*scissors bite*" for the total "*endo-occlusion*" of the mandibular posterior teeth. Moyer[4] characterized a bilateral buccal crossbite as a skeletal disharmony between the mandible and maxilla. If the scissors-bite is bilateral, the mandible may be functionally retruded, and if it is unilateral, there is often a cant to the occlusal plane and a lateral deviation of the mandible.[4,5]

Fig. 1: Pretreatment facial and intraoral photographs

Diagnosis and Etiology

The patient's chief concern was the inability to chew on the right side. Her medical and dental histories were noncontributory. Facially, she had a convex profile with protrusive lips (*Fig. 1*), but her dental smile line was acceptable. The intraoral examination showered a scissors-bite on the right, a lingually inclined mandibular right posterior segment, Class I molar relationship on the left, an anterior deep overbite, canting of the occlusal plane down on the right, and mandibular anterior crowding (*Fig. 1*). The mandible deviated to the left on closure resulting in a dental midline shift 2 mm to the left (*Fig. 2*). The dental casts showed that the maxillary right posterior teeth impinged on the mandibular gingiva, and there was no intercuspation of the right posterior segment (*Figs. 3 and 4*).

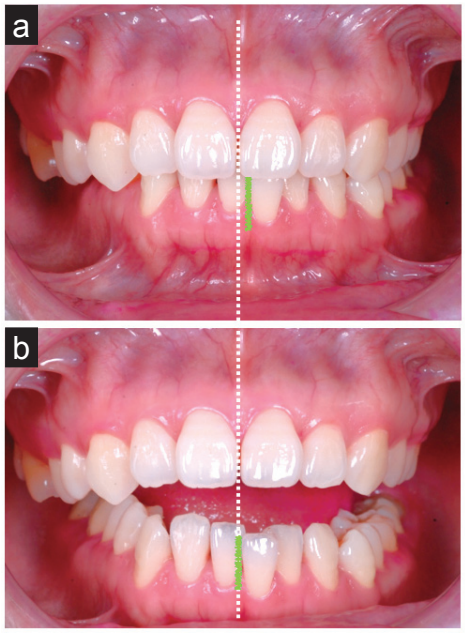

Fig. 2:
(a) Mandibular dental midline was deviated 2-mm to the left when closed.
(b) The midline was coincident when the bite was opened.

The pretreatment cephalometric analysis showed a protrusive pattern of the maxilla, incisors, and lips (*Fig. 5; Table 1*). The panoramic radiograph showed extrusion of the mandibular right posterior segment (*Fig. 6*) consistent with the unilateral scissors-bite. The temporomandibular joint (*TMJ*) radiographs showed no significant difference in the morphology or kinematics (*movement*) of the right and left condyles

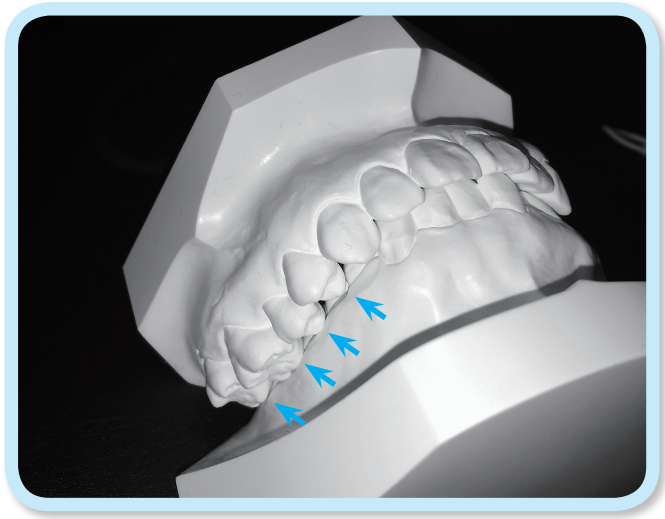

Fig. 3:
Dental casts showed the maxillary right premolars and molars impinging on the mandibular gingiva.

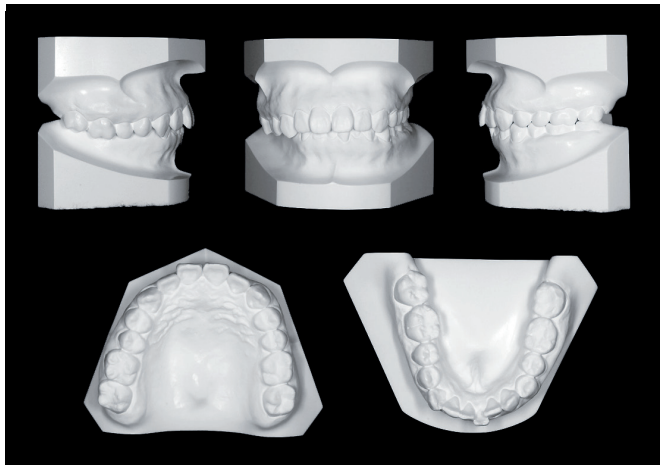

Fig. 4: Pretreatment dental models (casts)

Fig. 5: Pretreatment lateral cephalometric radiograph

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	86°	85°	1°
SNB°	81°	81°	0°
ANB°	5°	4°	1°
SN-MP°	34°	35°	1°
FMA°	27°	28°	1°
DENTAL ANALYSIS			
U1 To NA mm	4 mm	0 mm	4 mm
U1 To SN°	104°	98°	6°
L1 To NB mm	9 mm	6 mm	3 mm
L1 To MP°	100°	90°	10°
FACIAL ANALYSIS			
E-LINE UL	2 mm	1 mm	1 mm
E-LINE LL	3 mm	1 mm	2 mm

Table 1: Cephalometric summary

in the open and rest (*closed*) positions (*Fig. 7*), but the right condylar head in the rest position was more posteriorly and inferiorly positioned, which was consistent with mandibular deviation on closing (*Fig. 2*). No temporomandibular disorder (*TMD*) signs or symptoms were reported or clinically evident.

Asymmetric malocclusions such as scissors-bite may be associated with TMD,[6] and the etiology of the buccal crossbite may be genetic, congenital or developmental.[7] There was no history or morphologic evidence of a skeletal or dental anomaly, so the most likely etiology was developmental: a buccal ectopic eruption of the

Fig. 6: Pretreatment panoramic radiograph

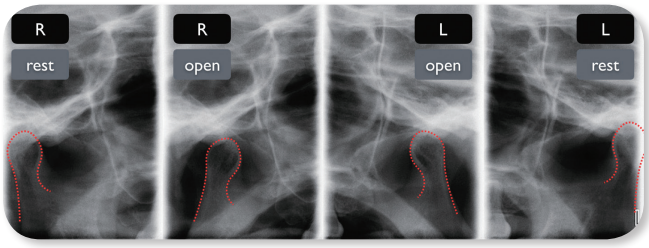

Fig. 7:
Pretreatment TMJ transcranial radiographs are shown of the right (R) and left (L) sides in the rest and open positions. The mandibular condyles are outlined in red. See texts for details.

maxillary right first molar at about age 6 years. This abnormal eruption pattern produces a functional shift of the mandible that results in the rest of the buccal segment erupting in buccal crossbite during the late transitional stage of dental development (*10-12 years*).[7] The American Board of Orthodontic (*ABO*) Discrepancy Index (*DI*) score for this malocclusion was 25 points, as shown in the supplementary worksheet 1.[8]

Treatment Objectives

(1) Correct the unilateral posterior scissors-bite.

(2) Upright the lingually inclined mandibular right buccal segment.

(3) Eliminate the occlusal cant due to the extruded maxillary right buccal segment.

(4) Achieve Class I canine and molar relationships.

(5) Correct the midline discrepancy.

(6) Produce ideal overbite and overjet relationships.

(7) Optimize the intermaxillary occlusion.

(8) Correct facial convexity and asymmetry.

Treatment Alternatives

Unilateral or bilateral scissors-bite of the entire buccal segment can be corrected with orthognathic surgery, biteplates or extensive use of interradicular (*I-R*) temporary anchorage devices (*TADs*) in both arches.[6,9-13] However, all of these approaches are complicated, because the asymmetric tooth movements necessary to finish the occlusion are challenging. No ideal dental alignments after treatment have been reported. A more conservative approach with the potential for a more ideal outcome was to reverse the etiology of scissors-bite by opening the vertical dimension of the occlusion (*VDO*) with glass ionomer bite turbos (*BTs*). With adequate occlusal clearance, the axial inclinations of the right buccal segments can be readily corrected with elastics anchored by a mandibular buccal shelf (*MBS*) bone screw (*miniscrew*) on the right side. Additional extra-alveolar (*E-A*) TADs in the infrazygomatic crest (*IZC*) are needed to correct the maxillary protrusion. Once normal bilateral occlusion is restored, optimal dental function facilitates the orthodontic finishing.

The patient was opposed to orthognathic surgery, extractions or compliance-dependent devices, but she still desired an ideal result. The conservative option with BTs and bone screws was her preference, and she was prepared for the occlusal inconvenience when the VDO was opened at the start of treatment. After an explanation of the anchorage requirements, she agreed to E-A TADs for mandibular right posterior alignment and retraction of the maxillary arch. To optimize dental esthetics, interproximal reduction was required to correct her black triangles.

Treatment Progress

An 0.022-in slot Damon Q® fixed appliance (*Ormco, Glendora, California*) with passive self-ligating (*PSL*) brackets was selected along with all specified archwires and orthodontic auxiliaries. Standard torque brackets were bonded on all teeth in the

maxillary arch. One month later, the mandibular arch was also bonded with standard torque brackets. The initial archwires were 0.014-in copper-nickel-titanium (*CuNiTi*). Two occlusal BTs were constructed with Fuji II type II glass ionomer cement (*GC America, Alsip IL*) on the maxillary left molars to increase the intermaxillary space to allow the collapsed mandibular right molars to upright with no resistance (*Fig. 8*). The mechanics to correct the scissors-bite were (*1*) an E-A MBS OrthoBoneScrew® (*OBS, 2x12-mm, Newton's A Ltd, Hsinchu City, Taiwan*) inserted in the mandibular right buccal shelf,[14-17] with two power chains connected from the miniscrew to the two buttons on the lingual side of each mandibular right molar, and (*2*) two cross elastics (*Chipmunk, 1/8-in, 3.5-oz*) applied on the maxillary right and mandibular right molars. In the 4th month, the scissors-bite was corrected, so the thickness of the occlusal BTs was progressively reduced to begin establishing a normal bilateral posterior occlusion.

As the molars uprighted, the 6-mm distance between the mandibular right miniscrew and the molar tube decreased to 0 mm (*Fig. 9*). The MBS bone screw and occlusal BTs were removed in the 5th month of treatment. The maxillary archwire was changed to 0.014x0.025-in CuNiTi to resolve the remaining rotations, begin torque control, and continue the correction of arch symmetry. In the 6th month, the archwires were changed to 0.017x0.025-in titanium-molybdenum alloy (*TMA®*) in the maxillary arch and 0.014x0.025-in CuNiTi in the mandibular arch. A lingual crossbite tendency was noted for the left molars; thus, two buttons were bonded on the palatal surfaces of the maxillary left molars to anchor the cross elastics (*Chipmunk, 1/8-in,*

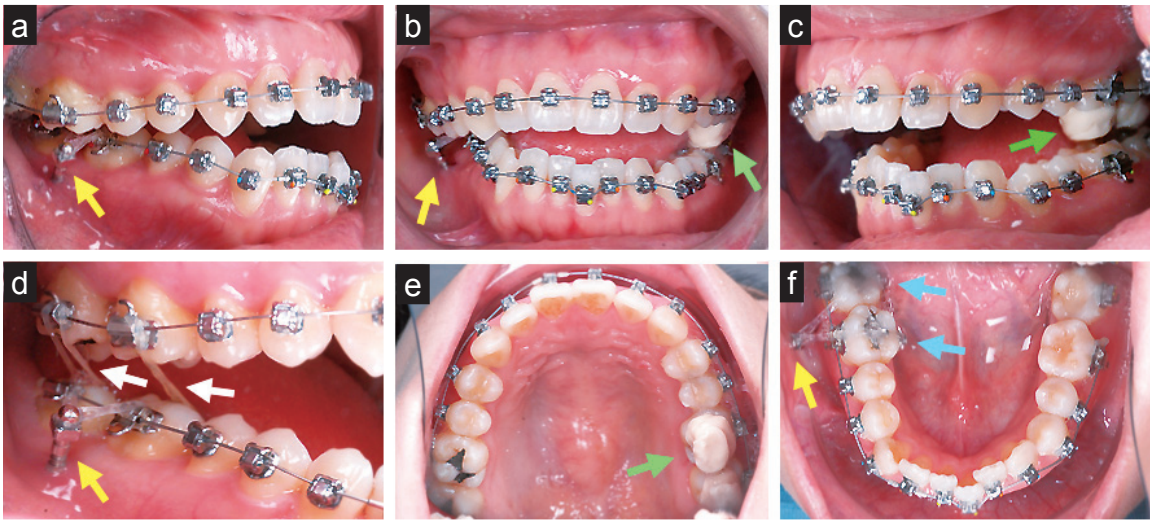

Fig. 8:

a. *In the 1st month of treatment, 0.014-in CuNiTi archwires were placed in both arches. Elastomeric chains from the lingual buttons on the mandibular right molars were activated with the MBS bone screw (yellow arrow).*

b. *BTs were added to the occlusal surfaces of the maxillary left molars (green arrow).*

c. *A buccal view shows that the bite is opened about 5-mm (green arrow).*

d. *Cross elastics supplement the lateral force (white arrows) of the elastomeric chains that are attached to the MBS bone screw (yellow arrow).*

e. *An occlusal view shows the positions of the BTs (green arrow).*

f. *Buccal force (blue arrows) from the lingual buttons on the mandibular right molars is activated by attaching the elastomeric chains to the MBS bone screw (yellow arrow).*

Fig. 9:
The scissors-bite is documented at the start of treatment (0M). The elastomeric chains activated by the MBS bone screw are shown at one month into treatment (1M). The blue bar shows the distance from the bone screw to the first molar is about 7 mm (middle right). At four months (4M), the molar have moved about 6mm to the buccal aspect and the distance from the molar to the bone screw is only about 1 mm (lower right).

3.5-oz). In the 7th month, the maxillary archwire was changed to 0.016x0.025-in stainless-steel (*SS*), which was adjusted to deliver progressive lingual root torque on the right premolar and molar segments to improve the overjet and intermaxillary alignment. The SS archwire was also constricted to develop a more symmetric arch form. A 0.017x0.025-in TMA archwire was placed in the mandibular arch. In the 9th month, the archwire was changed to 0.019x0.025-in SS in the maxillary arch to finalize torque control, with 0.016x0.025-in SS in the mandibular arch to establish symmetry.

In the 10th month, an openbite was noted in the left posterior segment as the bilateral posterior occlusion was established. As the lateral open bite closed, a deeper anterior overbite occurred that subsequently required BTs on the maxillary central incisors. In retrospect, it would have been wiser to further intrude the molars on the right side to close the lateral open bite on the left side. This approach would have decreased or prevented the tendency for clockwise rotation of the mandible.

As the occlusion settled after crossbite correction, the intermaxillary relationship was Class II. In the 11th month, posterior bone screws were inserted bilaterally into the maxillary extra-alveolar IZCs. Power chains were applied from the canines to the extra-alveolar IZC bone screws to improve the protrusive profile by retracting the entire maxillary dentition. Class II elastics (*Fox, 1/4-in, 3.5-oz*) and the BTs bonded on the palatal surface of the maxillary central incisors simultaneously corrected the deep overbite, anterior overjet, and Class II molar relationships.

During the detailing phase, the brackets were repositioned to correct marginal ridge discrepancies. Interproximal reduction (*IPR*) reshaped the maxillary and mandibular incisors to eliminate the black interdental spaces and increase the interproximal space between the incisors to resolve anterior flaring (*Fig. 10*). Two weeks before the completion of

Fig. 10:
The IPR procedure is shown before and after the incisors were reshaped to eliminate black interdental spaces, increase the contact area, and provide space for retraction of the anterior segment. Note that BTs were necessary on the palatal surfaces of the central incisors to control the overbite as the incisors were retracted to reduce lip protrusion.

active treatment, the maxillary archwire was sectioned distally to the canines, and continuous intermaxillary elastics (*Ostrich, 3/4-in, 2-oz*) were used to settle the posterior occlusion.[18] After 27 months of active treatment, all appliances were removed, and retention was accomplished with maxillary and mandibular clear overlay retainers. The entire treatment sequence is documented in Figs. 11a-d.

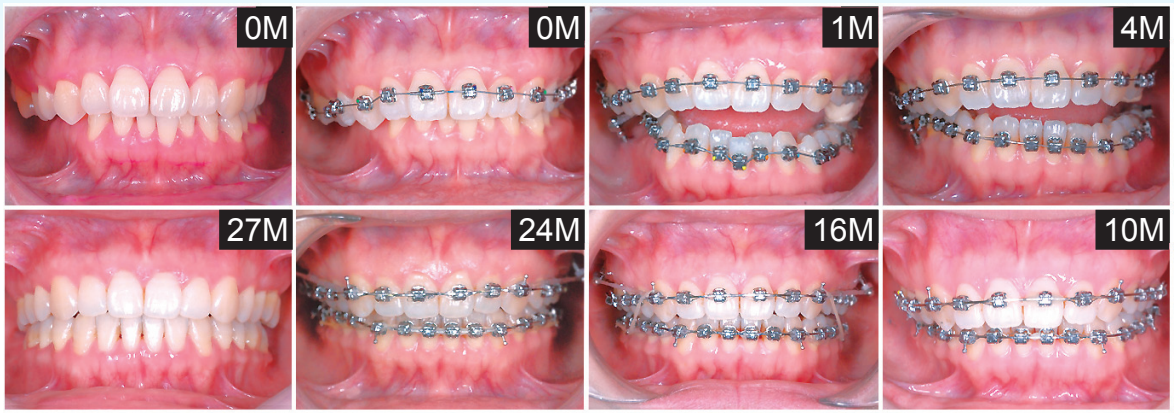

Fig. 11a:
Frontal views of the treatment sequence before treatment and after brackets were bonded on the maxillary arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

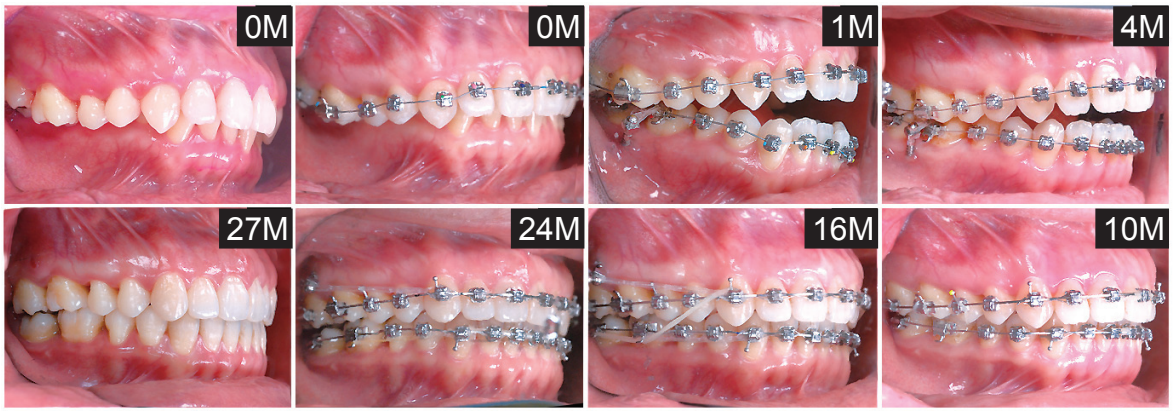

Fig. 11b:
Right lateral views of the treatment sequence before treatment and after brackets were bonded on the maxillary arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

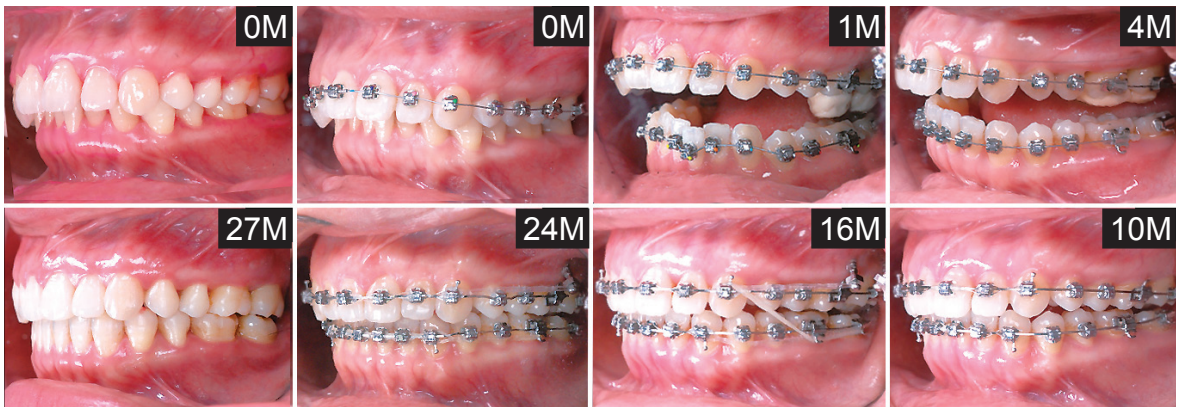

Fig. 11c:
Left lateral views of the treatment sequence before treatment and after brackets were bonded on the maxillary arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

Fig. 11d:
Maxillary occlusal views of the treatment sequence before treatment and after brackets were bonded on the maxillary arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

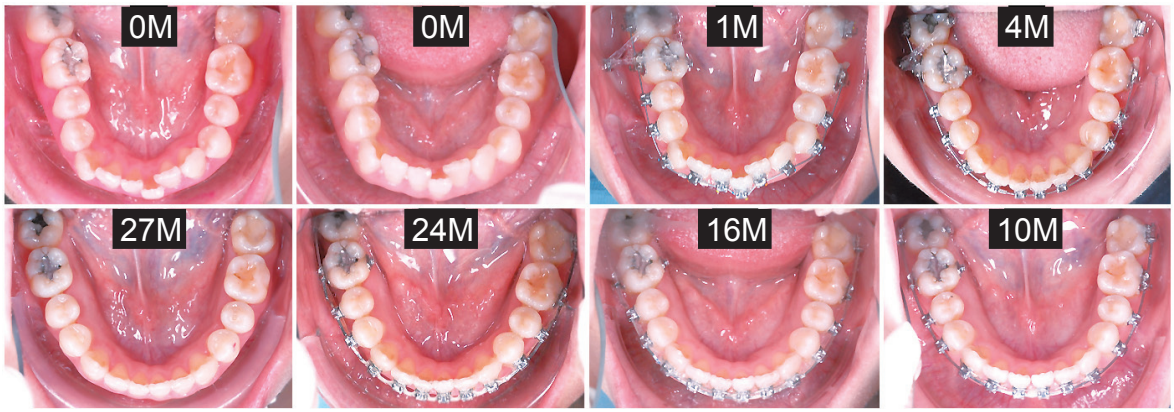

Fig. 11e:
Mandibular occlusal views of the treatment sequence before treatment and after brackets were bonded on the maxillary arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

Treatment Results

The patient's convex profile was improved by retraction of the maxillary arch and protrusive lips (*Fig. 12*). The scissors-bite was successfully resolved by opening the bite, uprighting the lingually inclined buccal segment and intruding the maxillary right posterior dentition (*Fig. 13*). The subsequent anterior deep overbite and mandibular dental midline deviation were also corrected (*Fig. 14*). Near ideal dental alignment was achieved as evidenced by the ABO Cast-Radiograph Evaluation (*CRE*) score of 22 points, as shown in the supplementary worksheet 2.[19] The major residual problems were the marginal ridges discrepancies and inadequate occlusal contacts.

Fig. 12: Posttreatment facial and intraoral photographs

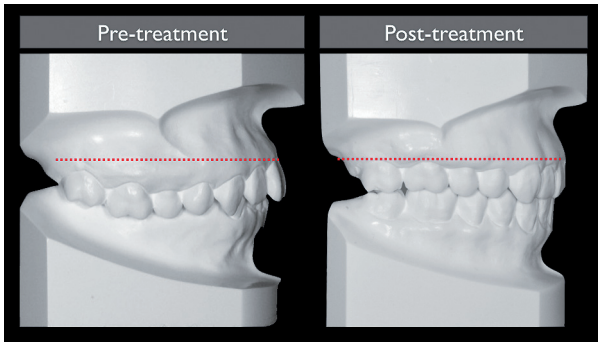

Fig. 13:
Right lateral views of the pretreatment and posttreatment dental casts show the intrusion of the maxillary right posterior teeth, relative to a dotted red line marking the plane of the desired gingival margins. Note that the mandibular right posterior teeth are not visible on the pretreatment cast.

Fig. 14: Posttreatment dental models (casts)

The posttreatment panoramic film (*Fig. 15*) showed good axial inclinations of all teeth except the mandibular molars, which had a root-mesial axial inclination that resulted in marginal ridge discrepancies (*Worksheet 2*). The cephalometric film (*Fig. 16*) and superimposed tracings (*Fig. 17*) showed that the lip protrusion was corrected. The SNA was

Fig. 15: Posttreatment panoramic radiograph

Fig. 16: Posttreatment lateral cephalometric radiograph

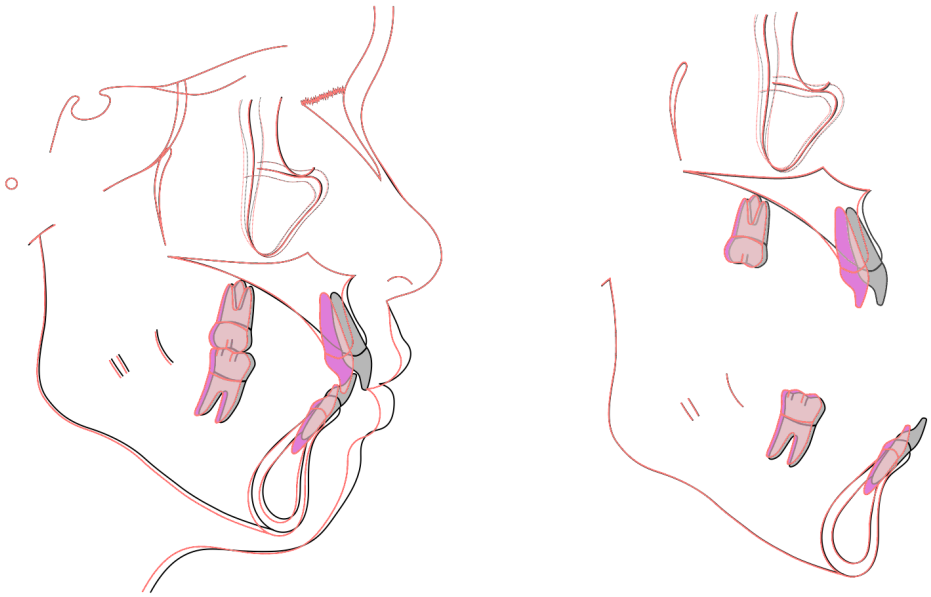

Fig. 17:
Pretreatment (black) and posttreatment (red) cephalometric tracings are superimposed on the anterior cranial base (left), the maxilla (upper right), and the mandible (lower right). The incisors were retracted and lip protrusion was reduced. Because of the poor alignment on the right side, the molars in the tracings are from the left side. Intrusion of the maxillary right buccal segment is shown in Fig. 13. See text for details.

decreased from 86° to 85° due to bone modeling during retraction of the maxillary incisors. Both SN-MP and FMA increased by 1° due to the clockwise mandibular rotation (*Table 1; Fig. 17*), which appears to reflect inadequate intrusion of the mandibular right first molar (*Fig. 15*). The maxillary incisors were retracted and extruded, and the mandibular incisors were retracted and intruded. The maxillary molars were retracted and intruded, but the mandibular molars were retracted and extruded. The posttreatment TMJ transcranial radiographs (*Fig. 18*) showed that the condylar heads returned to symmetric morphology and kinematics. The patient reported no TMD signs or symptoms before, during, or after treatment.

The Pink and White dental esthetic score[20] was 3 points, as shown in the supplementary worksheet 3. The patient was well satisfied with her esthetics and functional occlusion.

Discussion

The first consideration for scissor-bite correction is to determine whether orthognathic surgery is necessary.[13] A wide variety of orthodontic mechanics have been proposed: intermaxillary cross elastics,[6] TAD anchorage,[9,10,12,13] removable plate with a Ti-Ni wire,[11] transpalatal arch (*TPA*) with intramaxillary elastics,[21,22] quad-helix,[23] and lingual arch appliances with intramaxillary elastics.[24] The vertical overlap of a buccal crossbite requires dental intrusion or opening of the bite to correct the cusp in a fossa discrepancy. For instance, unilateral cross elastics produce an extrusive force that may result in clockwise rotation

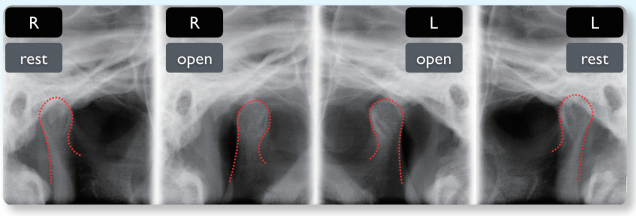

Fig. 18:
The posttreatment transcranial radiographs of both TMJs show that the patient's condylar heads (outlined in red) are symmetric in length and shape. Morphology and kinematics are similar for both sides in the rest and open positions.

of the mandible, cant of the occlusal plane, occlusal prematurities, or an anterior open bite. In addition, cooperation is a critical factor with a removable plate[11] or cross elastics.[25]

I-R miniscrews are commonly used as skeletal anchorage because they are relatively easy to place, provide direct anchorage to intrude teeth, and do not require compliance.[10,12,25,26] However, a scissor-bite of multiple teeth with a large vertical overlap is difficult to correct with routine orthodontic mechanics, even with bone screw anchorage, especially in an adult. Therefore, most severe scissors-bite problems have been corrected with surgical orthodontics.[6,27,28]

Our patient had a scissors-bite of the maxillary right buccal segment that articulated with a lingually tipped mandibular right buccal segment. The extruded maxillary right molars and premolars impinged on the mandibular gingiva (*Fig. 3*). Orthognathic surgery is usually indicated for such a severe malocclusion. However, E-A TADs with contralateral bite turbos allowed reverse of the etiology of the malocclusion by intruding the

maxillary right buccal segment and uprighting the mandibular right buccal segment. There were three steps in the correction process:

1. **Adequate Bite Opening**: A 5-mm posterior open-bite was created with BTs to allow the buccal cusps of the mandibular right molar and premolars to pass the lingual cusps of the opposing maxillary buccal segment (*Fig. 8*). The BTs were reduced and eventually removed when the posterior overjet was corrected.

2. **Simultaneous Intrusion and Buccal Tipping**: Elastic chains attached to the lingual buttons on the mandibular right molars pass over the occlusal surfaces and connect to the MBS bone screw. Because of the archwire connecting the teeth, these mechanics intruded and uprighted the entire buccal segment (*Figs. 8 and 9*). Supplemental cross elastics provided the additional lateral force for the crossbite correction. The extrusive force on the mandibular segment because of the cross elastics was offset by the intrusive force delivered by the elastomeric chains connected to the MBS bone screw. There are three benefits favoring a MBS bone screw compared with I-R bone screw:

   a. **Prominent Head**: The OBS has a large head with deep undercuts to readily retain elastomeric chains, which produce efficient uprighting of the mandibular right segment (*Fig. 19*).

   b. **More Buccal Position**: The E-A TAD can be positioned up to 10-mm to the buccal aspect of the lingually tipped molars (*Fig. 19*). This is adequate space to upright the entire buccal segment with one bone screw. Elastic chains can be connected to both molars (*Fig. 20*) because they are connected with a archwire on the buccal surface. I-R TADs interfere with movement of the teeth, and frequent replacement would be necessary (*Fig. 19*).

   c. **Variable Head Position**: The OBS head can be positioned as close to the soft tissue as needed. The clinician can screw it in deeper if a more intrusive force component is needed (*Fig. 21*).

3. **Compatible with Cross Elastics**: An elastomeric chain anchored by an MBS bone screw provides effective intrusion of the mandibular right molars and is compatible with the simultaneous use of cross elastics. These combined mechanics uprighted the mandibular right molars 6 mm in three months (*Figs. 8 and 9*).

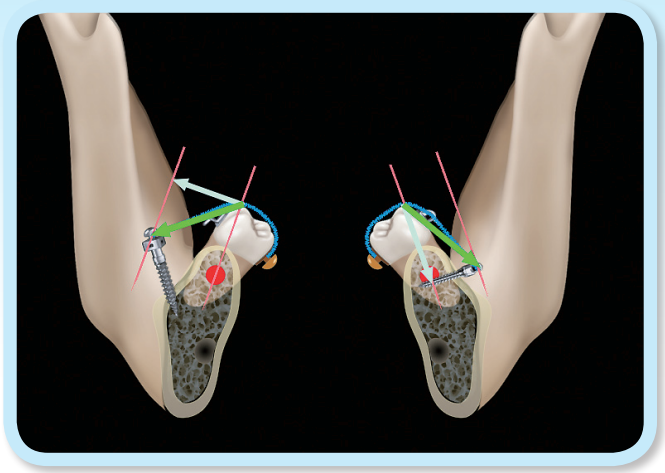

Fig. 19:
Comparing the I-R bone screw (right) with the contralateral E-A bone screw (left), it is evident that the elevated head position and more buccal position of the E-A TAD, relative to the center of rotation of the molar root (pink lines), provides a mechanical advantage for uprighting the molar (left).

A severe Class II unilateral scissors-bite was corrected with a minimally invasive approach that reversed

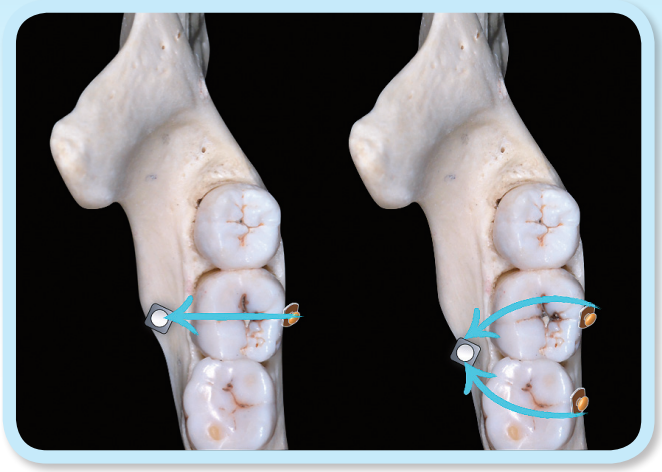

Fig. 20:
The E-A bone screw can be positioned buccal to the second molar or between the first and second molars. Either configuration is a viable alternative depending on the patient's anatomy because of the archwire, which transfers uprighting force to all teeth in the buccal segment.

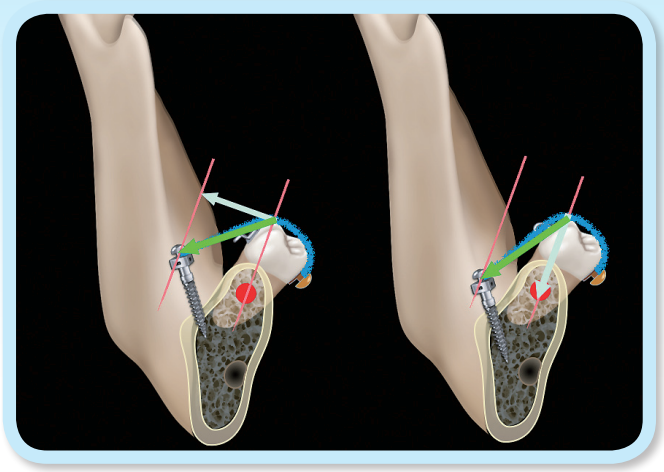

Fig. 21:
The head position height of the E-A bone screw can be controlled by the clinician. The force anchored by the higher (more superficial) bone screw head (left) delivers more buccal and less intrusive force compared with a screw head positioned more closely to the soft tissue (right).

the etiology of the malocclusion. This conservative treatment avoided extractions and orthognathic surgery. Once the transverse discrepancy was corrected, extra-alveolar IZC bone screws were used as E-A posterior maxillary anchorage to retract the entire maxillary arch. After 16 months of retraction, the patient's profile was corrected (*Fig. 22*). Her occlusion and facial esthetics were stable at 38 months after treatment (*Fig. 23*), and the second-order alignment of the dentition has continued to improve (*Fig. 24*).

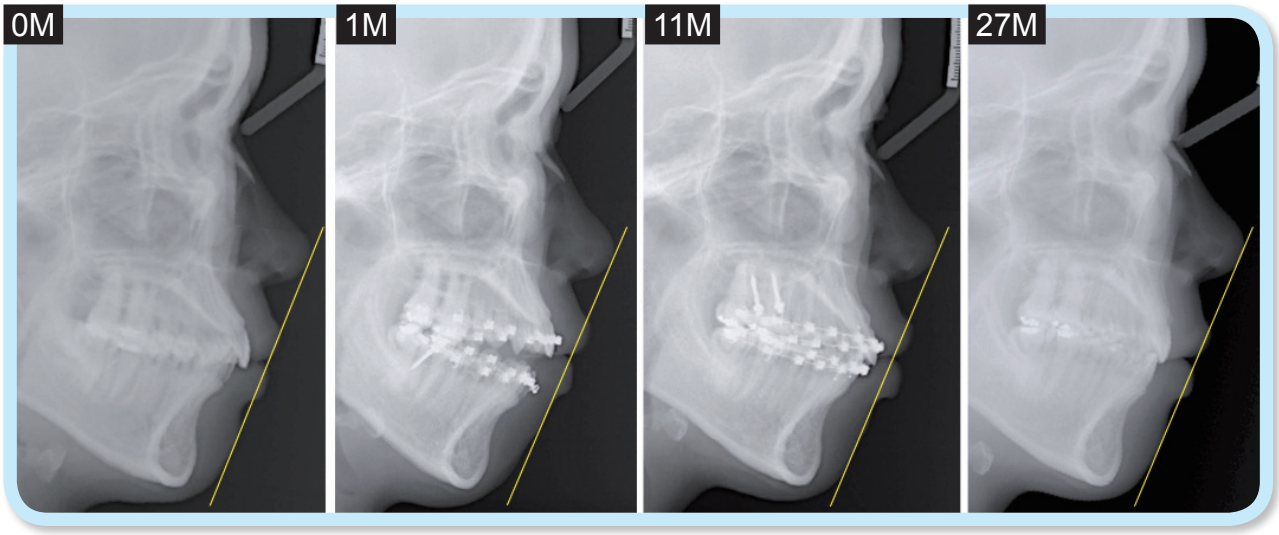

Fig. 22:
Lateral cephalometric radiographs compare lip protrusion before, during, and after treatment with the esthetic plane, a yellow line connecting the tip of the nose with the most anterior contour of the chin (Pg'). Before treatment (0M), the patient's lips were slightly protrusive. In the 1st month of treatment (1M), a 5-mm open-bite was created by the occlusal BT on the upper left side. In the 1th month (11M), more pronounced maxillary and lip protrusion was noted. Bilateral extra-alveolar IZC bone screws were placed to retract the maxillary arch. In the 27th month of treatment (27M), lip protrusion was corrected to the Na-Pg' line (esthetic plane).

Fig. 23:
Facial and intraoral photographs at the 38-month follow-up.

Fig. 24: Panoramic radiograph at the38-monthfollow-up.

Conclusions

1. E-A bone screws are a minimally invasive approach for resolving severe scissors-bite malocclusion complicated with maxillary protrusion.

2. Uprighting the mandibular right buccal segment with a MBS bone screw provided a normal occlusion to intrude the extruded maxillary molars. However, it is important to ensure that there is adequate intrusion of the maxillary and mandibular molars on the affected side to prevent opening the VDO (*clockwise rotation of the mandible*).

3. Bilateral extra-alveolar IZC bone screws were effective for reducing maxillary protrusion by retracting the entire maxillary arch.

4. Correcting axial inclinations in the buccal segments is important for preventing marginal ridge discrepancies.

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Discrepancy Index Worksheet

TOTAL D.I. SCORE 25

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 = 2

OVERBITE

0 – 3 mm.	=	0 pts.
3.1 – 5 mm.	=	2 pts.
5.1 – 7 mm.	=	3 pts.
Impinging (100%)	=	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 = 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 = 8

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. = 1

Total = 2

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	_____	x 2 pts. =	_____
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	3	x 2 pts. =	6

Identify: over-erupted right premolars and molars

Total = 6

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 =

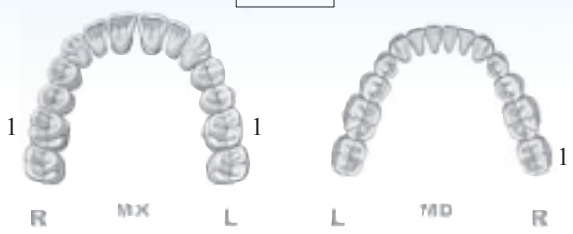
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 22

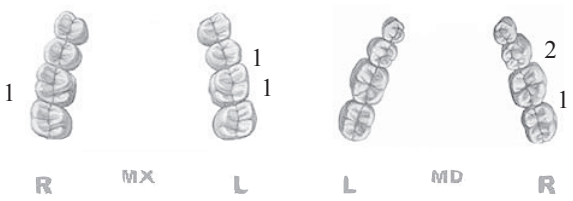
Alignment/Rotations

3



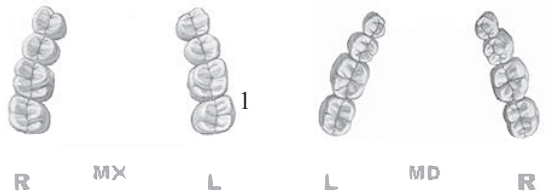
Marginal Ridges

6



Buccolingual Inclination

1

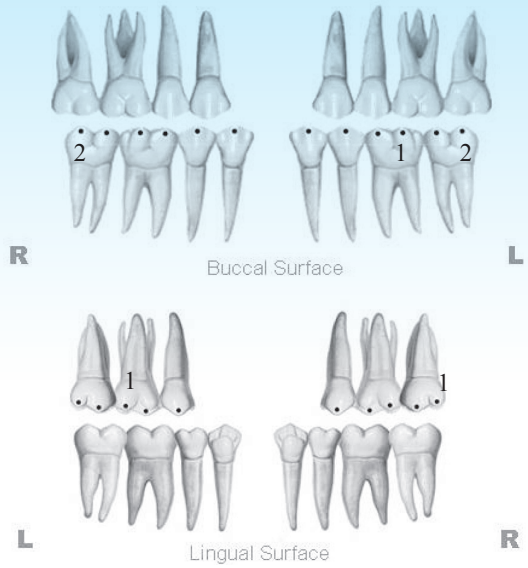


Overjet

1

Occlusal Contacts

7

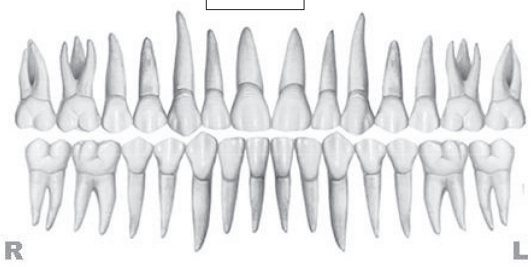


Occlusal Relationships

2

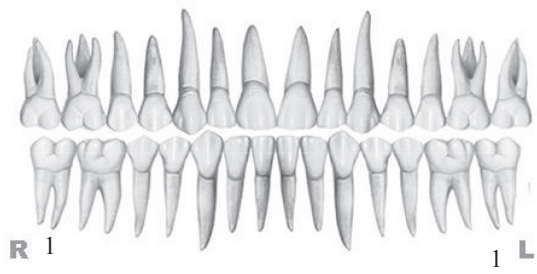
Interproximal Contacts

0



Root Angulation

2



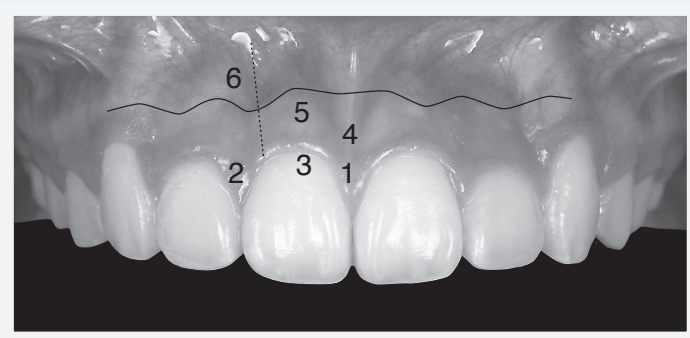
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

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

Total Score: = 3

1. Pink Esthetic Score

Total = 0

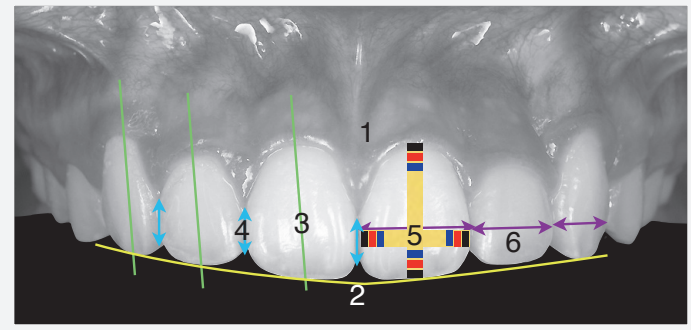


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

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

2. White Esthetic Score (for Micro-esthetics)

Total = 3



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

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