Severe Class III Open Bite Malocclusion: Conservative Correction with Lower First Molar Extraction

Abstract

***History**: A 29-year-old male presented with a severe Class III openbite malocclusion. His chief complaint was poor masticatory function.*

***Diagnosis & Etiology**: An increased vertical dimension of occlusion (58%) was associated with flat mandible plane (26˚), openbite (4mm), and negative overjet (-9mm), but there was no functional shift from centric relation (C_R), to maximal intercuspation (centric occlusion, C_O). The dental midline was 2mm to the right of the facial midline. The probable etiology for this severe skeletal malocclusion was a genetic tendency for prognathism (ANB -9˚) that was associated with airway obstruction in the juvenile years. Applying Lin's three-ring diagnosis in C_R, facial profile was concave (G-Sn-Pg' -14˚), molar relationship was Class III (>10 mm), and there was no functional shift. The patient was not an ideal candidate for conservative orthodontic correction, but he declined orthognathic surgery and preferred to avoid temporary anchorage devices (TADs). The lower left first molar (LL6) was compromised so he agreed to extracting both lower first molars (L6s) to maintain symmetry, and close space with primarily Class III elastics. The Discrepancy Index (DI) was 100.*

***Treatment**: Bilateral L6s were removed to produce posterior space for retraction of the lower anterior segment to correct the anterior crossbite. A passive self-ligating (PSL) appliance was bonded on the dentition with high torque brackets on lower incisors and low torque brackets on upper incisors. Axial inclination for the lower anterior was controlled with progressive pre-torqued NiTi and stainless archwires with 15˚ of lingual root torque to compensate for lingual tipping, which is a side effect of Class III elastics.*

***Outcome**: Following 26 months of active treatment, this difficult malocclusion, with a DI=100, was treated to a Cast-Radiograph Evaluation (CRE) score of 29 points and a Pink and White esthetic score of 4 points.*

***Conclusions**: Conservative orthodontic treatment for severe skeletal Class III malocclusion is challenging and may not achieve an ideal outcome. The patient must be informed of potential risk, provide informed consent, and be very cooperative during treatment. Both the clinician and the patient were pleased with the outcome. (J Digital Orthod 2021;61:50-66)*

Key words:
Skeletal Class III pattern, Class III molar relationship, Class III intermaxillary elastics, first molar extraction

Introduction

The dental nomenclature for this case report is a modified Palmer notation. The quadrants are upper right (*UR*), upper left (*UL*), lower right (*LR*), and lower left (*LL*). Relative to the midline, permanent teeth in each quadrant are numbered from 1 to 8, and deciduous teeth are a-e. For example, an upper right first premolar is UR4, and lower right second deciduous molar is LRe.

The prevalence of Angle Class III malocclusion usually varies from 1% to >10% worldwide, but this anomaly is most common among Asians. Chinese and Malaysian populations have a high prevalence of Angle Class III malocclusion, 15.69% and 16.59%, respectively. In the United States, the prevalence of Class III malocclusion is only about 1% of the total population, but about 5% of all orthodontic patients are Class III.[1]

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Generally speaking, Class III malocclusion can be corrected with orthodontics via camouflage treatment, TAD anchorage, and/or orthognathic surgery. The majority of patients in Taiwan decline orthognathic surgery because of morbidity, potential complications, and expense.[2] TAD anchorage with fixed appliances is usually preferred,[3] but some patients also decline TADs. For the latter group, even conservative correction with extractions is very challenging.

This article presents a severe skeletal Class III malocclusion which was best treated with orthognathic surgery to achieve an idea result.

Fig. 1: Pre-treatment facial and intraoral photographs

However, the patient was not concerned about facial esthetics, so he declined orthognathic surgery and TADs. He was only interested in having his occlusion corrected with camouflage treatment and extractions.

Diagnosis and Etiology

The principal concern for the present patient was the inability to bite and chew with his front teeth. Medical and dental histories were non-contributory. The facial profile was concave (*G-Sn-Pg' -14˚*) with a retrusive upper lip (*-4mm to the E-Line*) and a protrusive lower lip (*3mm to the E-Line*). Compared to the facial midline, the upper and lower dental midlines were 2 and 3mm to the right, respectively (*Fig. 1*). Plaster casts revealed severe Class III canine and molar relationships (*>10mm*) bilaterally with an openbite of 4mm (*Fig. 2*). Temporomandibular joint (*TMJ*) morphology was normal in the open and closed positions (*Fig. 3*). There were no signs or symptoms of temporomandibular dysfunction (*TMD*).

Fig. 2: Pre-treatment study models (casts)

The cephalometric evaluation (*Table 1*) revealed decreased facial convexity (*G-Sn-Pg -13˚*) and a prognathic mandible (*SNA 89˚, SNB 98˚, ANB -9˚*). The mandibular plane angle was flat (*SN-MP 26˚, FMA 19˚*), the angle of the lower incisors (*88.5˚*) was

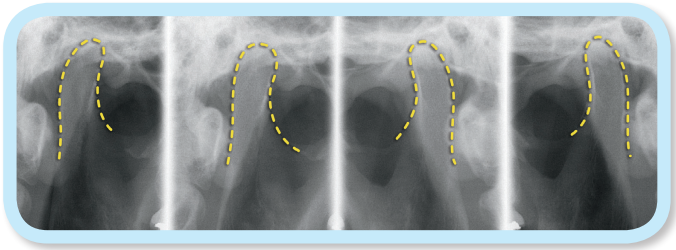


Fig. 3: Transcranial radiographs of the temporomandibular joints (TMJs) prior to treatment are shown from the left: Right TMJ closed, Right TMJ open, Left TMJ open, and Left TMJ closed.

CEPHALOMETRIC SUMMARY			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA˚ (82°)	89˚	91˚	2˚
SNB˚ (80°)	98˚	96˚	2˚
ANB˚ (2°)	-9˚	-5˚	4˚
SN-MP˚ (32°)	26˚	25˚	1˚
FMA˚ (27°)	19˚	18˚	1˚
DENTAL ANALYSIS			
U1 To NAmm (4mm)	9	12	3
U1 To SN˚ (104°)	128˚	130˚	2˚
L1 To NBmm (4mm)	9	1	8
L1 To MP˚ (90°)	88.5˚	66.5˚	22˚
FACIAL ANALYSIS			
E-LINE UL (-1mm)	-4	-4	0
E-LINE LL (0mm)	3	-1.5	4.5
%FH: Na-ANS-Gn (56%)	58%	59%	1%
Convexity: G-Sn-Pg' (13°)	-14˚	-13˚	1˚

Table 1: Cephalometric summary

within normal limits (*WNL*), but the upper incisors had an increased axial inclination (*128˚*) (*Fig. 4*). The panoramic radiograph reveals that LL6 had a crown with failed root canal therapy (*Fig. 5*). All four wisdom teeth were erupted and reasonably well aligned. The American Board of Orthodontics (*ABO*) Discrepancy Index (*DI*) was 100 as shown in the subsequent worksheet. The most significant problems were the anterior crossbite (*50 points*), anterior open bite (*17 points*), and occlusion discrepancy (*17 points*).

Treatment Objectives

(1) Correct the functional occlusion with dental compensation as needed.

(2) Achieve Class I canine and molar relationships.

(3) Close the openbite.

(4) Improve facial esthetics.

(5) Correct the midline discrepancy.

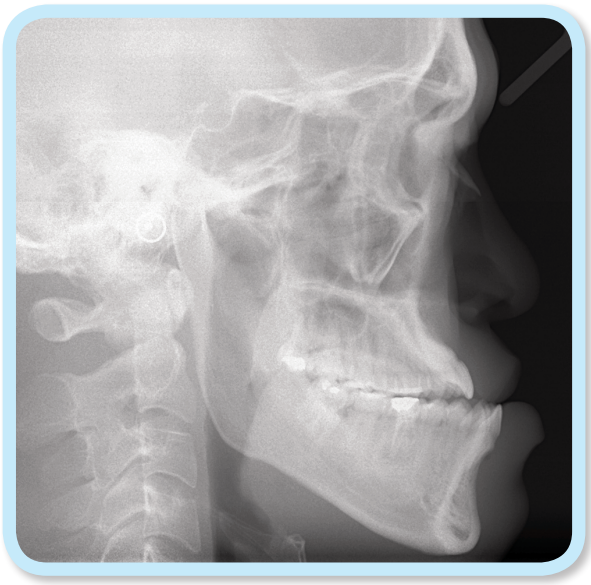


Fig. 4: Pre-treatment cephalometric radiograph

Fig. 5: Pre-treatment panoramic radiograph

Treatment Alternatives

Option 1: the most ideal correction was with orthognathic surgery because of the large sagittal discrepancy (*ANB -9˚*), negative overjet (*9mm*), and openbite (*4mm*).

Option 2: conservative, camouflage approach involving bilateral extraction of the lower 6s, and retraction of the lower arch with mandibular buccal shelf bone screws (*TAD*) anchorage and Class III elastics.[4]

Option 3: similar camouflage approach as option 2 but without TAD anchorage.

The patient was a medical doctor. He well understood the risks of surgery[5] and was strongly opposed to orthognathic surgery (*Option 1*). He also preferred to avoid TADs so he chose Option 3. It was explained that this conservative orthodontic approach was very challenging and the outcomes were unpredictable. There may be problems with incisal inclination, and the chin may appear more prominent after treatment. It was also necessary to extract the U8s because they would not be in occlusion after treatment. After a thorough

discussion of the pros and cons for each approach, the patient still preferred the last option and provided informed consent for treatment.

Treatment Progress

A 0.022-in Damon Q® (*Ormco, Brea, CA*) passive self-ligating (*PSL*) fixed appliance was selected. After removing U8s and both L6s, low torque brackets were bonded upside down on the lower incisors to achieve increased root-lingual torque, and high torque brackets were placed on the lower canines. The brackets were intentionally bonded more gingivally to help resolve the openbite. The initial archwire was 0.014-in copper-nickel-titanium (*Table 2*).

One month later, the maxillary arch was bonded with the same PSL appliance; central incisors and canines were bonded with low torque brackets. The initial archwire was 0.014-in copper-nickel-titanium. Early light short Class III elastics (*Quail, 3/16-in, 2-oz; Ormco*) were used from U6s to L4s to correct the sagittal discrepancy.

In the following months, the sequences for the upper archwire were 0.018-in CuNiTi, 0.014x0.025-in CuNiTi, and 0.017x0.025-in TMA. In the third and fourth months, the sequence for the lower archwire was 0.014x0.025-in CuNiTi and 0.017x0.025-in TMA. In the sixth month, the maxillary and mandibular archwires were changed to 0.016x0.025-in SS and

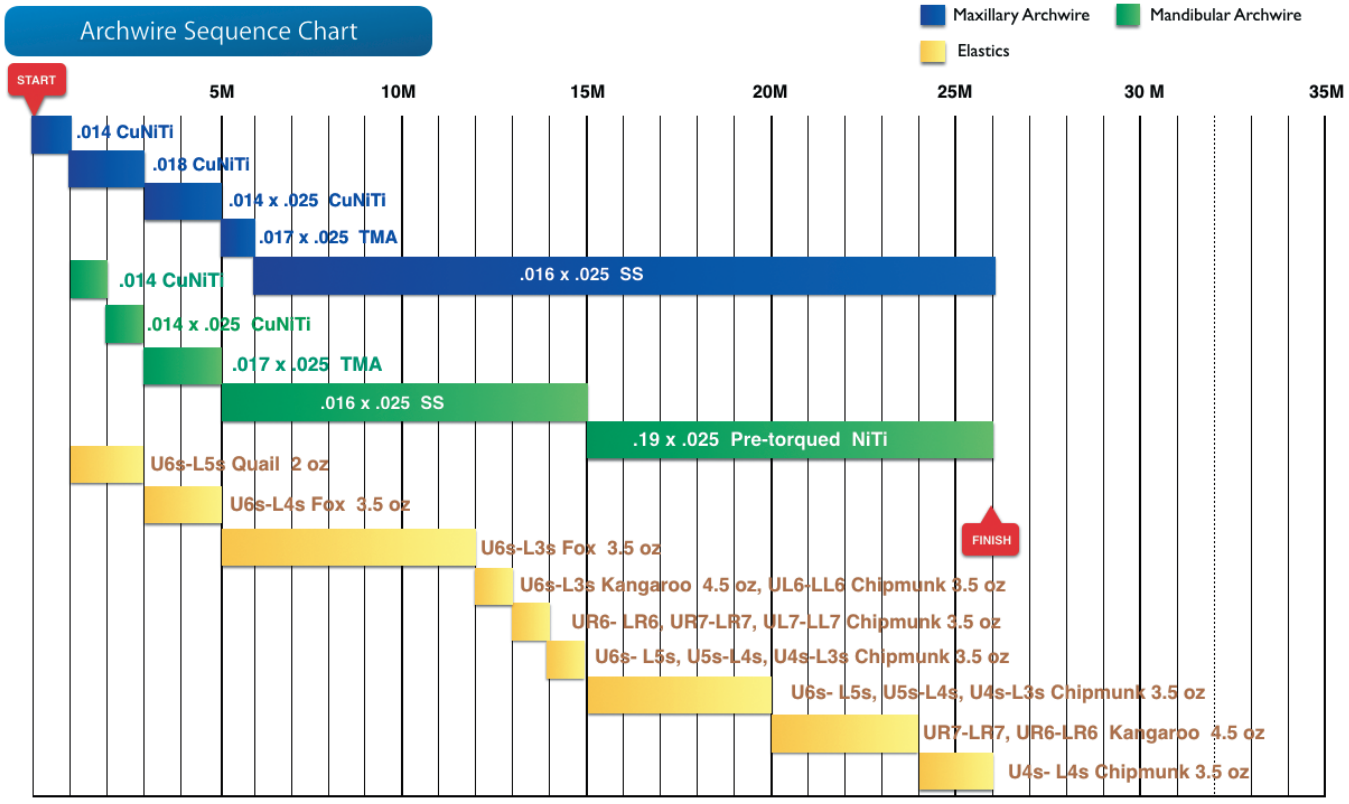


Table. 2: Archwire sequence chart

0.016x0.025-in SS with 15˚ of lingual root torque respectively. Short Class III elastics were changed to long Class III elastics (*Fox,1/4-in, 3.5-oz; Ormco*) from the U6s and U7s to the L3s to improve the sagittal discrepancy. Buttons were bonded on the L4s and L8s to attach power chains (*Table 2*).

In the tenth month, the openbite was closed and there was incisal interference. Anterior bite turbos were bonded on the lower incisors to help correct the anterior crossbite. Positive overjet was noted in the 12th month, so the anterior bite turbos were removed. In the 14th month, short Class III elastics were applied (*Chipmunk, 1/8-in, 3.5-oz; Ormco*) from U6 to L5, U5 to L4, and U4 to L3.

In the 15th month, the extraction spaces were closed. In the 19th month, the positive overjet of 2mm was persistent. Lingual torque in the anterior portion of the lower archwire and short Class II elastics (*Chipmunk,1/8-in, 3.5-oz; Ormco*) were applied from L6 to U5, L5 to U4, and L4 to U3.

Treatment progress is documented in a progressive series of intraoral photographs in the following frontal (*Fig. 6*), right buccal (*Fig. 7*), left buccal (*Fig. 8*), maxillary occlusal (*Fig. 9*), and mandibular occlusal (*Fig. 10*) views. After 26 months of orthodontic treatment, fixed appliances were removed. Maxillary and mandibular clear overlay retainers were delivered to wear full-time for the first six months and nights only thereafter. A fixed retainer was bonded from the lower second premolars to the lower second molars to prevent the reopening of the L6 extraction sites.

Treatment Results

The facial profile was improved, and the facial esthetics were more harmonious, but the chin appeared more protrusive. A near ideal dental alignment was achieved, including normal overbite and overjet with bilateral Class I buccal segments. The anterior crossbite and open bite were both corrected, resulting in a pleasant smile arc with a more youthful facial appearance (*Figs. 11 and 12*).

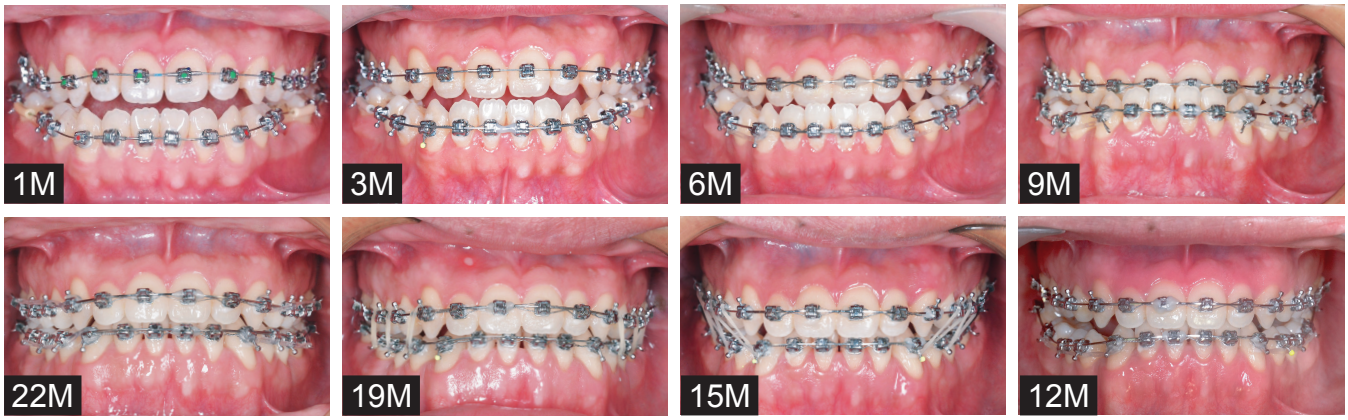


Fig. 6:
Frontal views of the treatment sequence is shown at treatment times in months: 1M, 3M, 6M, 9M, 12M, 15M,19M, and 22M in a clockwise order.

Fig. 7:
Right views of the treatment sequence is shown at treatment times in months: 1M, 3M, 6M, 9M, 12M, 15M,19M, and 22M in a clockwise order.

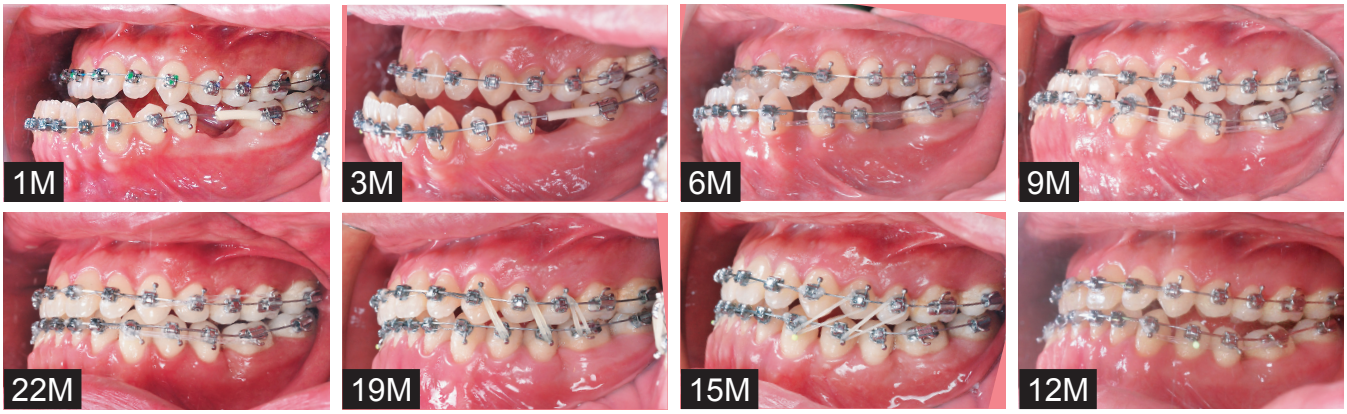


Fig. 8:
Left views of the treatment sequence is shown at treatment times in months: 1M, 3M, 6M, 9M, 12M, 15M,19M, and 22M in a clockwise order.

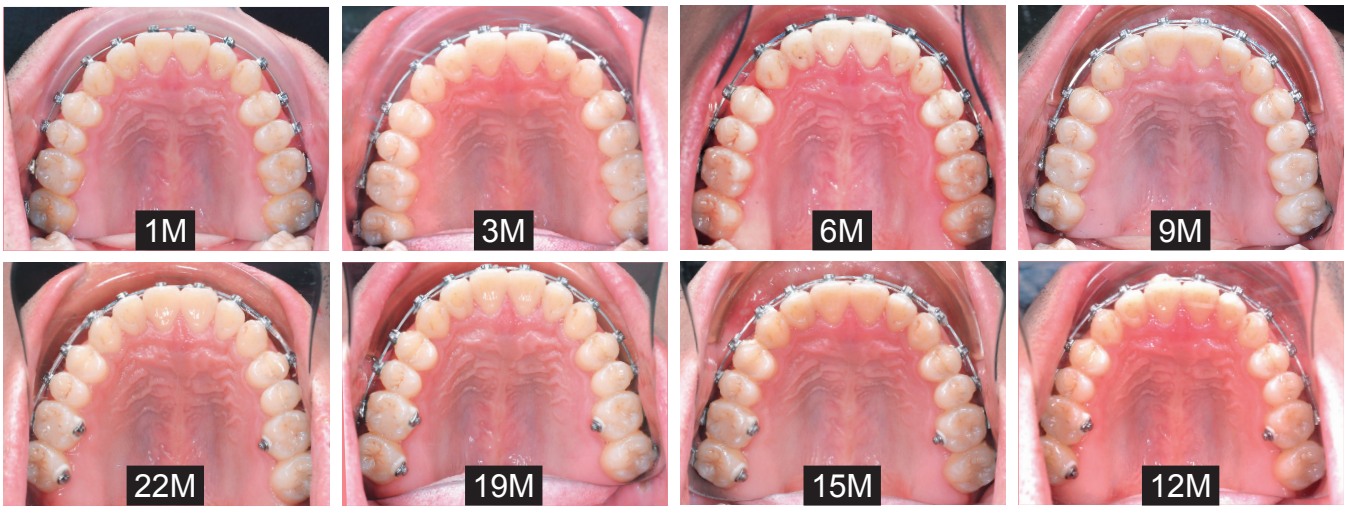


Fig. 9: The progress of the upper arch is shown at treatment times in months: 1M, 3M, 6M, 9M, 12M, 15M,19M, and 22M in a clockwise order.

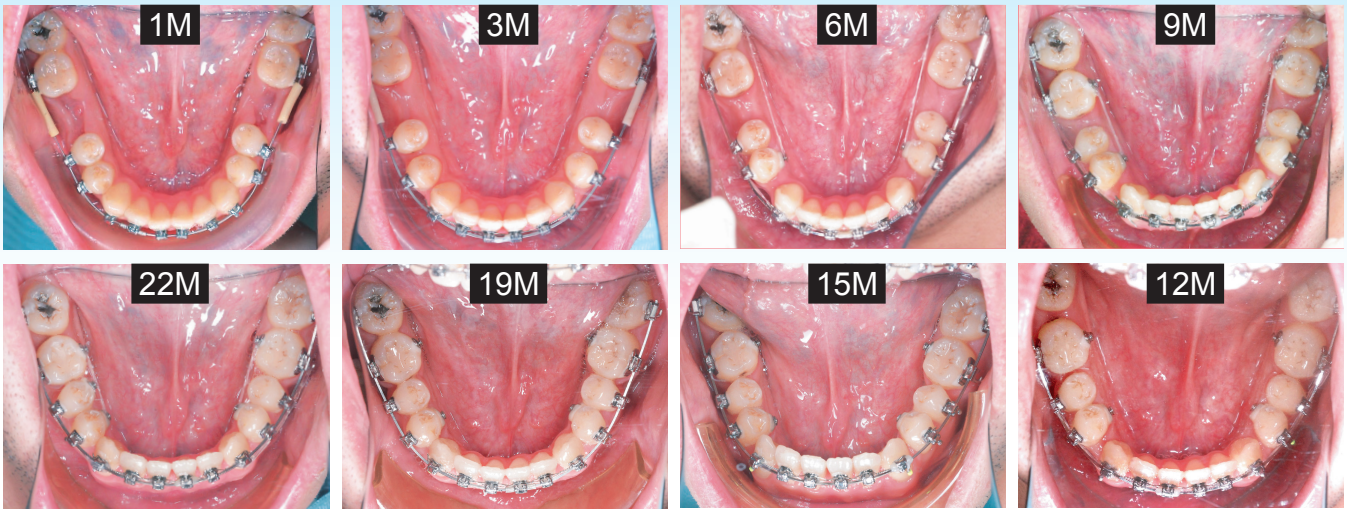


Fig. 10: The progress of the lower arch is shown at treatment times in months: 1M, 3M, 6M, 9M, 12M, 15M,19M, and 22M in a clockwise order.

Fig. 11: Post-treatment facial and intraoral photographs

Except for tipping of the L5s and L7s, the post-treatment panoramic radiograph documented adequate root alignment (*Fig. 13*). Superimposed cephalometric tracings revealed an increased axial inclination of the maxillary incisors (*130°*) and a decreased axial inclination of the mandibular incisors (*66.5°*). Furthermore, the lower incisors and lip were retracted. In addition to the counterclockwise rotation of the lower arch, the face appeared less prognathic because the mandible was rotated clockwise (*Figs. 14 and 15*). The ABO Cast-Radiograph Evaluation (*CRE*) score was 29 points (*Worksheet 2*). The major CRE discrepancies were alignment (*5 points*), marginal ridges (*5 points*), bucco-lingual inclination (*5 points*), and overjet (*5 points*). Pink and White dental esthetic score was 4.

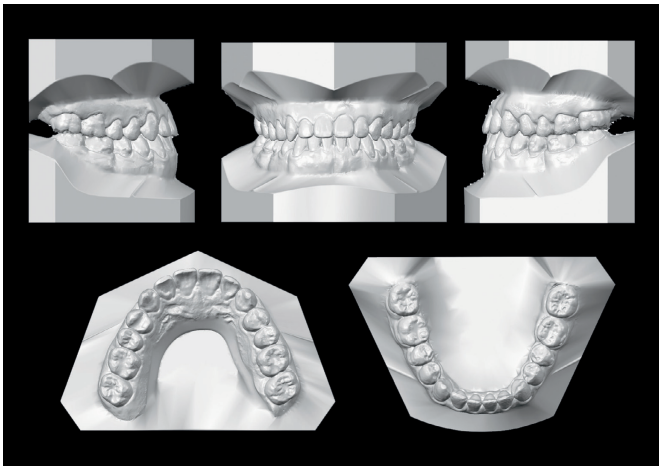


Fig. 12: Post-treatment study models (casts)

Fig. 13: Post-treatment panoramic radiograph

Discussion

Considerations when planning and treating Class III malocclusions

Three different therapeutic approaches were considered for the orthodontic treatment of this Class III malocclusion: orthognathic surgery, TADs, and extractions. The 3-Ring Diagnosis, developed by Dr. John Lin, is an effective method for diagnosing Class III malocclusions that are amenable to conservative therapy.[2] There are three favorable indicators when evaluated in C_R: 1. orthognathic profile (*acceptable facial balance*), 2. buccal segments that are approximately Class I, and 3. a functional shift to C_O. The present patient fit none of these criteria, so conservative treatment was very challenging. However, he did have other favorable factors: a deceased mandibular plane angle and only a moderate open bite (*Fig. 16*).[3,4] Because of the concave profile (*convexity: G-Sn-Pg-13°*) and bilateral >10mm Class III relationship of the buccal segments, mandibular set-back surgery was clearly indicated. However, the patient declined that option because facial esthetics were not an important consideration. Furthermore, he was concerned about surgical complications such as nerve injury (*50%*), temporomandibular disorder (*TMD*) (*14%*),

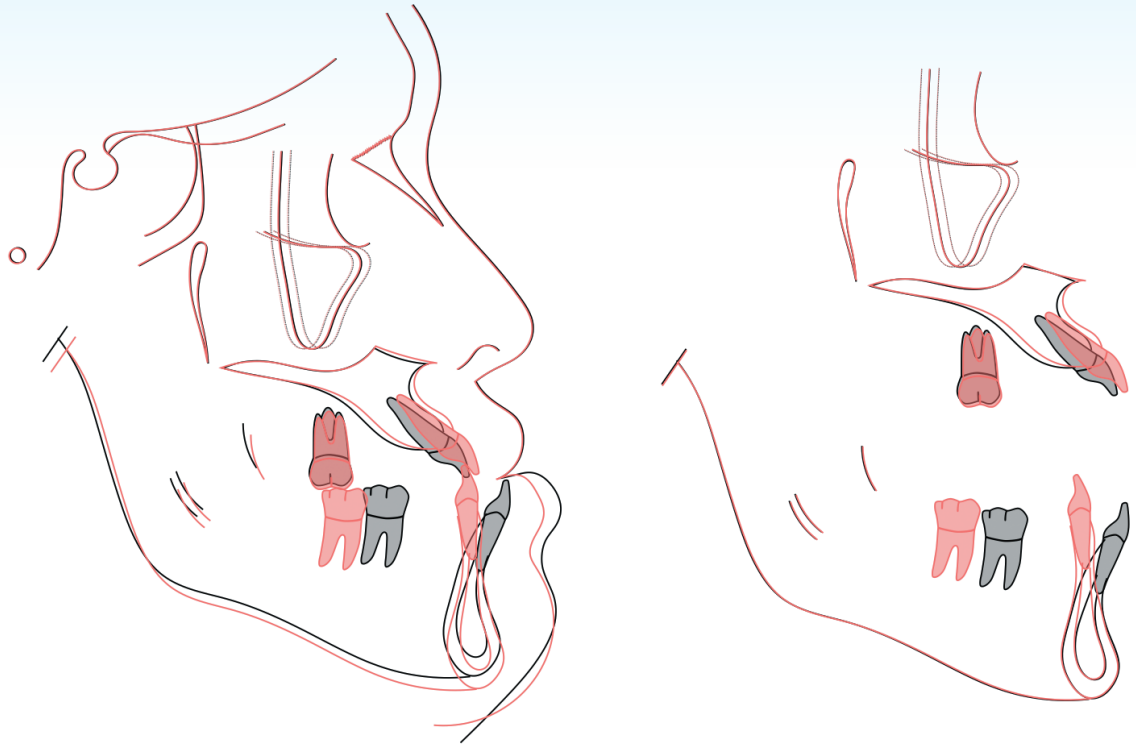


Fig15:
Superimposed tracings of the initial (black) and final (red) cephalometric films reveal the skeletal and dental changes that occurred during treatment. After treatment, 10mm lingual retraction of the lower incisors was noted.

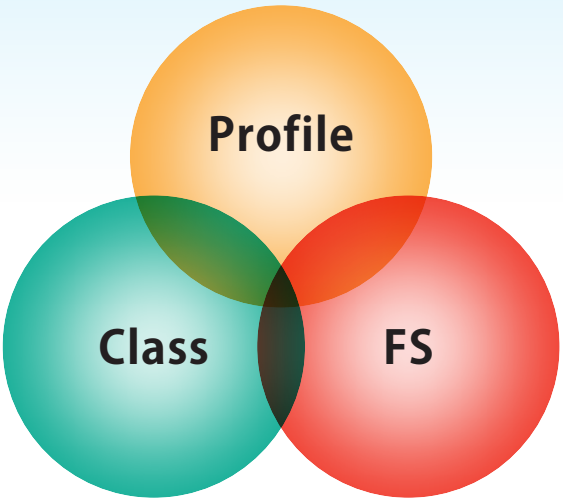
hemorrhage (9%), hearing problems (7%), infections (7%), and relapse (4%).[4] Avoiding orthognathic surgery usually requires the use of intermaxillary Class III elastics, extractions, and/or TAD anchorage to achieve dental compensation.[5]

(1) Class III Elastics

Orthodontic compensation with or without extractions usually involves intermaxillary Class III elastics. The whole maxillary dentition acts as anchorage to retract the mandibular arch.[6] The usage of Class III elastics protracts the upper arch, retracts the lower arch, tips upper incisors labially, and tips lower incisors lingually.[7] To counteract the adverse effects of Class III elastics, resistant anterior moments in the brackets and archwires are required.[6]

(2) Extraction

In camouflage treatments, extraction spaces can be used to produce dental compensation for the jaw discrepancy. Space management, crowding and spaces, are important considerations for planning extractions which are usually premolars or molars.[6]



Profile: Orthognathic profile at C_R position
Class: Canine and molar classification
FS: Functional shift ($C_O \neq C_R$)

Fig. 16:
Lin's Class III diagnostic system evaluates facial profile and molar classification in C_R, as well as the functional shift from C_R to C_O. If the profile is acceptable in C_R, the molars are in or near Class I, and there is a significant functional shift, the patient can usually be effectively managed with conservative camouflage treatment.

Extraction of upper second premolars and lower first premolars

This is a common approach for resolving moderate to severe crowding in the lower arch when there is little or no crowding in the maxillary arch.[8]

Extraction of lower first premolars

When the upper arch is well aligned or can be corrected with dental expansion, extraction of only the lower first premolars is useful for resolving crowding and retracting the mandibular incisors.[8]

Extraction of molars

The extraction of four premolars may fail to provide adequate space to resolve severe Class III malocclusion. Extraction of a compromised molar is indicated rather than removing a sound premolar, but the large asymmetric space is problematic for orthodontic space closure. Removal of the contralateral molar may be indicated to achieve symmetry. Bilateral extraction of molars may be a good option if the upper and lower arches are well aligned, or when the lower crowding is modest. Molar extraction must be approached carefully in growing patients because lack of posterior stops in occlusion may handicap the development of the mandible.[6]

Extraction of a molar is not usually advantageous for relieving crowding in the lower anterior segments, but it provides more space (*10-11mm*) for retraction of the anterior segment compared with extraction of a premolar (*7mm*). The treatment time for a molar extraction approach is expected to increase treatment time 6-8 months.[9,10]

Which molar should then be extracted? Evaluation of mandibular molar health is imperative, because these teeth are a major aspects of functional occlusion.[9] Molars compromised with fractured cusps, extensive caries, hyperplastic lesions, apical pathology, or extensive restorations may be good candidates for extraction.[6]

(i) Third Molar

If a third molar is missing and the space required is minimal, mandibular buccal shelf bone screws are effective for retracting the entire lower arch. The TADs are also useful for Class II elastics to control the labial tipping of the upper anterior segment caused by Class III elastics. This approach is only useful for correcting anterior crossbite with the use of TAD anchorage preferably in the mandibular buccal shelf.[10]

(ii) Second Molar

If the third molars are present, second molar extraction is effective for correction of anterior crossbite.[11] However, severe malocclusions may require the anchorage of mandibular buccal shelf bone screws. The advantages of these mechanics are a more anterior position of the extraction space in the arch which facilitates first molar retraction to close the space. This approach also avoids complications for the surgical removal of third molars. They can be uprighted, and closure of the second molar space is a relatively simple process. [8]

(iii) First Molar

If the mandibular second and third molars are present, extraction of first molars is effective for creating a large space (*10-11mm*) to manage sagittal and vertical problems to achieve Class I molar relationship.[12] Extraction of first molars may be capable of correcting anterior crossbite without the use of TADs, particularly if cooperation is good with Class III elastics (*Fig. 15; Table 2*). The disadvantages for this approach are that it is time-consuming, and that mandibular second molars have a tendency to tip mesially and lingually, requiring additional orthodontic mechanics.[9] Among the three extraction options, mandibular first molars offer the greatest potential. Hence, high torque brackets were indicated for the lower incisors because it would result in the greatest retroclination.

(3) Placement of TADs

With bone screw anchorage, dental discrepancies can be effectively treated within the limits of the skeletal support. Compared to Class III elastics, the osseous anchorage of TADs helps to avoid excessive upper incisor proclination, which results in a more acute nasolabial angle.[13] On the contrary, TAD anchorage contributes to retraction of the lips which makes the chin appear more prominent. Since camouflage treatment aligns the dentition on a compromised skeletal base, it is difficult to achieve desirable dentofacial esthetics. The current patient was informed about the deficiencies of camouflage treatment, but he still insisted on orthodontics with only extraction of L6s.

Integrating this knowledge into the present case

To achieve Class I molar relationship, an 11mm space was required bilaterally. The LL6 had extensive periapical pathology so it was a candidate for extraction. To create a similar contralateral space, it was necessary to extract the LR6 also. In the absence of TAD anchorage, Class III elastics were critical for correction of the crossbite. Short Class III elastics

(*U6s to L5s*) were applied from the beginning of the treatment. When the wire was changed to 0.016x0.025-in SS, then long Class III elastics (*U6s and U7s to L4s*) were used.

With these mechanics, lingual tipping of the lower incisors was expected, so upside-down low torque brackets were used to deliver a high root lingual torque. An additional 15˚ of lingual root torque was delivered with the sequence of lower archwires (*Table 2*).

To prevent mesial tipping of L7s, rectangular archwires (*0.016x0.025-in SS*) were used for space closure with minimal tipping in the sagittal and frontal planes.[9] Power chains were attached to the buttons bonded on the L4s and L8s to balance buccal and lingual space closure force.[14,15]

In the sixth month, the openbite was closed, resulting in incisal interface that inhibited the correction of the anterior crossbite. Anterior bite turbos were bonded on the lower four incisors at 10 months (*10M*) (*Fig. 6: 9M and 12M*). After 1 month, the crossbite was corrected to a positive overjet, and the turbos were removed.

In the 15th month, the extraction spaces were closed (*Fig. 10*), so the remainder of active treatment focused on completing the buccal correction and settling the occlusion. Bilateral Class III intermaxillary elastics were used (*U6-L5, U5-L4, and U4-L3*). The cooperation of the patient with the elastics was excellent, and TADs were not necessary. In the 19th month, a 2mm positive overjet was noted, so short Class II elastics (*L6-U5, L5-U4, L4-U3*) were prescribed (*Fig. 7: 15M and 19M*). However, the 2mm positive overjet was not a problem because it was regarded as an overcorrection.

After the orthodontic closure of the extraction sites, it is common to find interdental gingival clefts which may favor reopening of the space.[16] Surgical removal of clefts may be necessary to maintain the outcome as well as to preserve periodontal health.[9] No periodontal surgery was performed but a splinting wire was bonded between the lower second premolars and second molars to prevent relapse.

Conclusions

Severe skeletal Class III malocclusion is typically an orthognathic surgical problem. However, with excellent patient compliance, bilateral extraction of lower first molar, and extensive use of Class III elastics, severe skeletal Class III malocclusion can be treated to an optimal result without orthognathic surgery nor TADs.

References

1. Jaradat M. An Overview of Class III malocclusion (prevalence, etiology and management). J Adv Med Med Res 2018;25(7): 1–13.
2. Lin JJ. Creative orthodontics blending the Damon System & TADs to manage difficult malocclusion. 2nd ed. Taipei, Taiwan: Yong Chieh; 2010. p. 263-71.
3. Tseng LL, Chang CH, Roberts WE. Diagnosis and conservative treatment of skeletal Class III malocclusion with anterior crossbite and asymmetric maxillary crowding. Am J Orthod Dentofacial Orthop 2016;149(4):555–66.
4. Chen HH, Chang CH, Roberts WE. Oligodontia and Class II malocclusion treated with orthodontics, bone augmentation, and an implant-supported prosthesis. Int J Orthod Implant 2014;36:52–69.
5. Jędrzejewski M, Smektała T, Sporniak-Tutak K, Olszewski R. Preoperative, intraoperative, and postoperative complications in orthognathic surgery: a systematic review. Clin Ora l Investig 2015;19(5):969–77.
6. Hu H, Chen J, Guo J, Li F, Liu Z, He S, Zou S. Distalization of the mandibular dentition of an adult with a skeletal Class III malocclusion. Am J Orthod Dentofac. Orthop 2012;142(6):854–62.

Fig.17: Facial and intraoral photographs 2 years post-treatment document the current condition of the patient.

7. Ferreira FPC, Goulart M da S, de Almeida-Pedrin RR, Conti AC de CF, Cardoso M de A. Treatment of Class III malocclusion: atypical extraction protocol. Case Rep Dent 2017, Article ID 4652685, 9 pages
8. Akhoon AB, Mushtaq M, Ishaq A Borderline Class III patient and treatment options: A comprehensive review. Int J Med Heal Res 2018;4(2):14–6.
9. Ruellas AC, Baratieri C, Roma MB, Izquierdo Ade M, Boaventura L, Rodrigues CS, Telles V. Angle Class III malocclusion treated with mandibular first molar extractions. Am J Orthod Dentofac Orthop 2012;142(3):384–92.
10. Yeh HY, Lin JJ, Roberts WE Conservative adult treatment for severe Class lll, openbite malocclusion with bimaxillary crowding. Int J Orthod Implantol 2014;34:12–23.
11. Lin J, Gu Y. Lower second molar extraction in correction of severe skeletal Class III malocclusion. Angle Orthod 2006;76(2):217–25.
12. Tomonari H, Yagi T, Kuninori T, Ikemori T, Miyawaki S. Replacement of a first molar and 3 second molars by the mesial inclination of 4 impacted third molars in an adult with a Class II Division 1 malocclusion. Am J Orthod Dentofac Orthop 2015;147(6):755–65.
13. Huang S, Chang CH, Roberts WE. A severe skeletal Class III open bite malocclusion treated with nonsurgical approach. Int J Orthod Implantol 2011;24:28–39.
14. Cheng J, Lee A, Chang CH, Roberts WE. Skeletal Class ll malocclusion with convex profile, horizontal impaction and gummy smile: substituting third for second molars. J Digit Orthod 2018;52:50–66.
15. Lin SL, Chang CH, Roberts WE. Uprighting and protracting a horizontally impacted lower third molar in an adult. Int J Orthod Implantol 2014;34:58–77.
16. Rivera Circuns AL, Tulloch JF. Gingival invagination in extraction sites of orthodontic patients: their incidence, effects on periodontal health, and orthodontic treatment. Am J Orthod 1983;83(6):469–76.

Discrepancy Index Worksheet

TOTAL D.I. SCORE 100

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 = 50

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 = 17

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 = 0

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. additional 9 pts.

Total = 17

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 4

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° 7 x 1 pt. = 7

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° _____ x 1 pt. = _____

Total = 12

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 _____ x 2 pts. = _____

Identify:

Total = 0

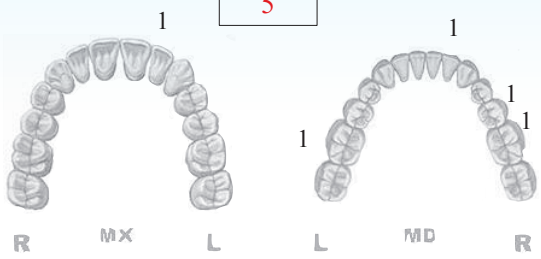
Cast-Radiograph Evaluation

Case # **Patient**

Total Score: 29

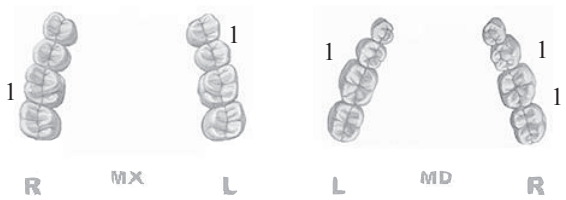
Alignment/Rotations

5



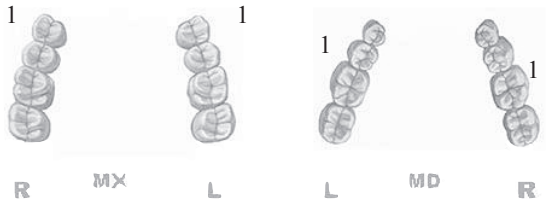
Marginal Ridges

5



Buccolingual Inclination

4

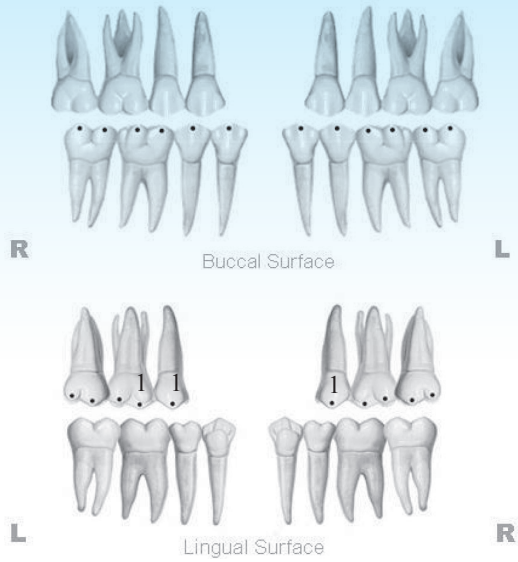


Overjet

5

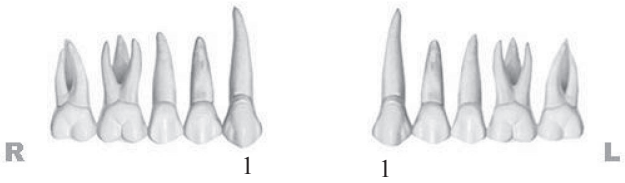
Occlusal Contacts

3



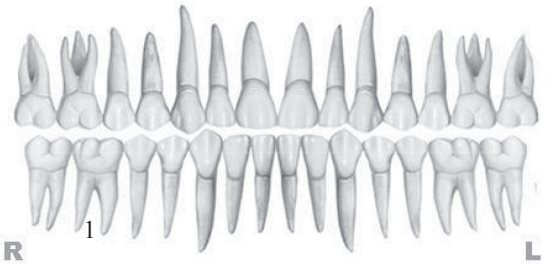
Occlusal Relationships

2



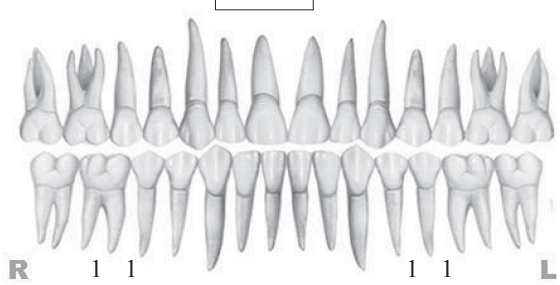
Interproximal Contacts

1



Root Angulation

4



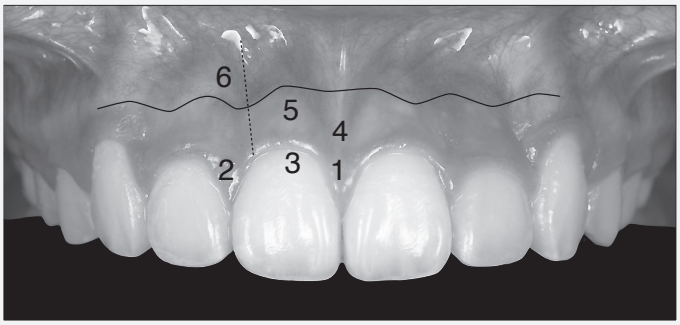
INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

IBOI Pink & White Esthetic Score

Total Score: = 4

1. Pink Esthetic Score

Total = 0

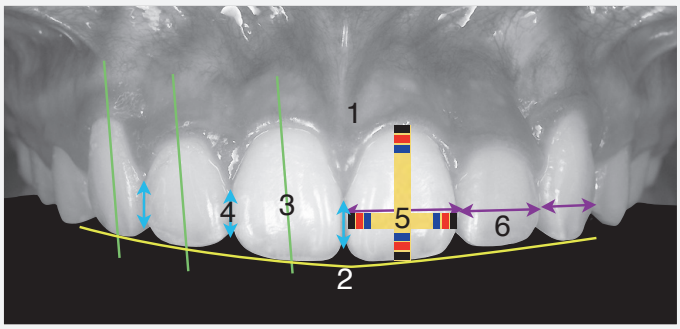


1. M & D Papillae	0	1	2
2. Keratinized Gingiva	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

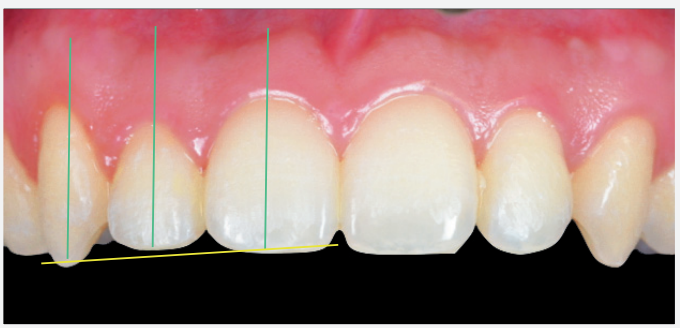
1. M & D Papilla	(0)	1	2
2. Keratinized Gingiva	(0)	1	2
3. Curvature of Gingival Margin	(0)	1	2
4. Level of Gingival Margin	(0)	1	2
5. Root Convexity (Torque)	(0)	1	2
6. Scar Formation	(0)	1	2

2. White Esthetic Score (for Micro-esthetics)

Total = 4



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