

Severe Gummy Smile, Class II with 8mm Crowding Treated with Invisalign and Miniscrews

Abstract

A 27-year-old woman presented with a Class II malocclusion, 8mm of crowding and severe gummy smile. Her motive for the consultation was that she wished to improve her smile aesthetics and to achieve the desired final result without braces. The case was treated by dental arch transversal expansion, creating enough space for the mandible anterorotation and correcting the Class II. Temporary Anchorage Devices (TADs) were used for the Class II elastics, avoiding undesirable upper incisor retroclination. The anchorage also prevented the upper incisors from extruding and the gummy smile from worsening. After 16 months of treatment, satisfactory aesthetical and occlusal results were achieved. (*Int J Orthod Implantol* 2016;43:52-66)

Key words:

Invisalign, aligner treatment, gummy smile, Class II division II, severe crowding, TADs (miniscrews)

Introduction

Invisible orthodontic treatment is a common request nowadays. Severe gummy smile treated with aligners has been viewed as difficult. However, with the correct diagnosis and proper biomechanical alignment design, in conjunction with miniscrews, satisfactory results are achievable as documented in this case report.

Diagnosis

A 27-year-old woman presented with a gummy smile and crowding in both dental arches; her motive for the consultation was that she wished to improve her smile with aligner treatment.

Pre-treatment photographs indicated a convex profile (*Fig. 1*). The intra-oral examination showed the molar relationships were bilateral Class II. The overbite was +5mm (75%) with retroclined upper and lower incisors, diagnosed as a Class II division II malocclusion. The upper canines were completely outside the ideal dental arch (*Fig. 1*).

The smile evaluation showed a severe gummy smile in both the anterior and posterior regions (*Fig. 1*). The lack of dental arch transversal development was due in part to premaxillary area compression and crowding (-7mm upper, -8mm lower).



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■ **Fig. 1:**

Pre-treatment intraoral and facial photographs. A severe gummy smile and severe crowding with Class II division II malocclusion was noted.

The panoramic x-ray (Fig. 2) revealed no abnormalities in the root or alveolar bone levels. The analysis of the temporomandibular joint (TMJ) was within the normal limits. The lateral cephalometric radiograph and tracing (Fig. 2) indicated a skeletal Class II pattern (SNA 75°, SNB 70°, and ANB 5°) with a steep mandibular plane angle (SN-MP 41°). Both upper and lower incisors were retroclined (U1-SN 87°, L1-MP 85°), with retrusive lips (E-line UL -5mm; E-line LL -2mm)

The ABO Discrepancy Index (DI) was 25 as shown in the subsequent worksheet.

Treatment Plan

After discussing options with the patient, the following treatment goals were decided upon:

1. Non-extraction, aligner treatment in conjunction with TADs.
2. Align, level and expand the dentition in both dental arches, reducing buccal corridors.
3. Prevent worsening of anterior and posterior gummy smile by TADs.
4. Correct the Class II dental malocclusion assisted by TADs.
5. Reduce the overbite by light intrusion and proclination of the lower incisors.
6. Correct the upper and lower incisor retroclination by increasing lingual root torque.

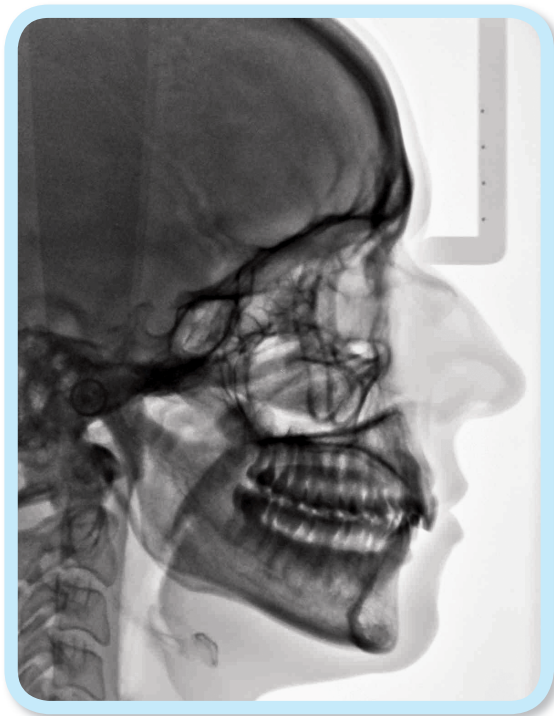
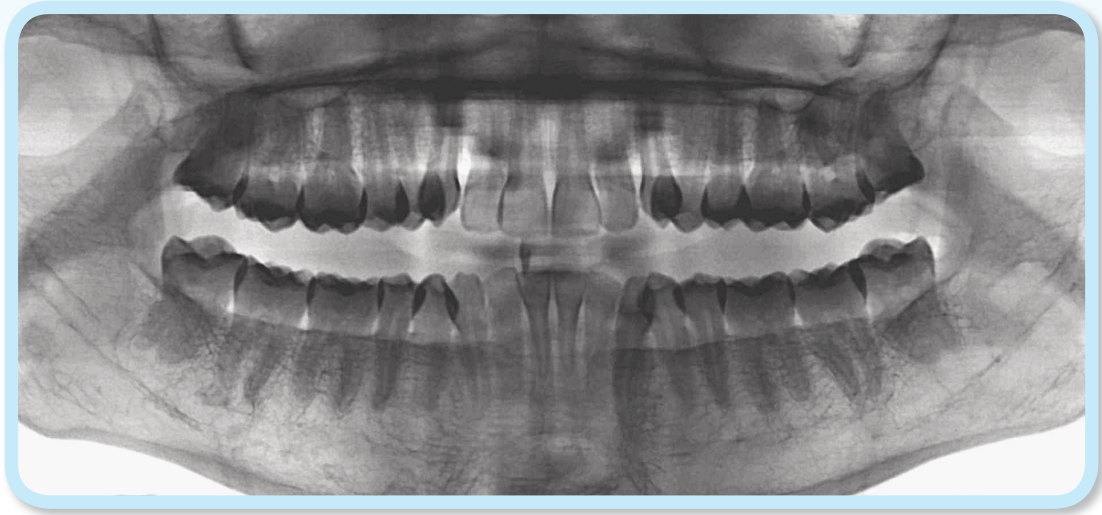
CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-Tx	POST-Tx	DIFF.
SNA°	75°	75°	0°
SNB°	70°	70°	0°
ANB°	5°	5°	0°
SN-MP°	41°	41°	0°
FMA°	34°	34°	0°
DENTAL ANALYSIS			
U1 TO NA mm	0 mm	0 mm	0 mm
U1 TO SN°	86°	91°	5°
L1 TO NB mm	5 mm	6.5 mm	1.5 mm
L1 TO MP°	91°	95.5°	4.5
FACIAL ANALYSIS			
E-LINE UL	-5 mm	-6 mm	1 mm
E-LINE LL	-2 mm	-3 mm	1 mm

Table 1: Cephalometric summary

Treatment Progress

A dental scan with iTero Element (Align Tech Inc., San Jose, CA) was taken to start the analysis and planning of the case. After several further Clinchecks (Invisalign System Align Tech Inc., San Jose, CA), modifications for the proper biomechanical design were confirmed.

A total of 48 aligners were used: 31 aligners in the first phase and 17 aligners in the second phase (additional aligners). The duration of use was mainly 10 days, although some were changed every 14 days. The treatment began with the delivery of the first 2 aligners. The patient was instructed to use the aligners between 20 to 22 hours a day, and was advised to remove them only while eating or brushing her teeth.



■ Fig. 2:

The cephalometric tracing indicated a skeletal class II pattern with a steep mandibular plane angle. Upper incisors were retroclined.

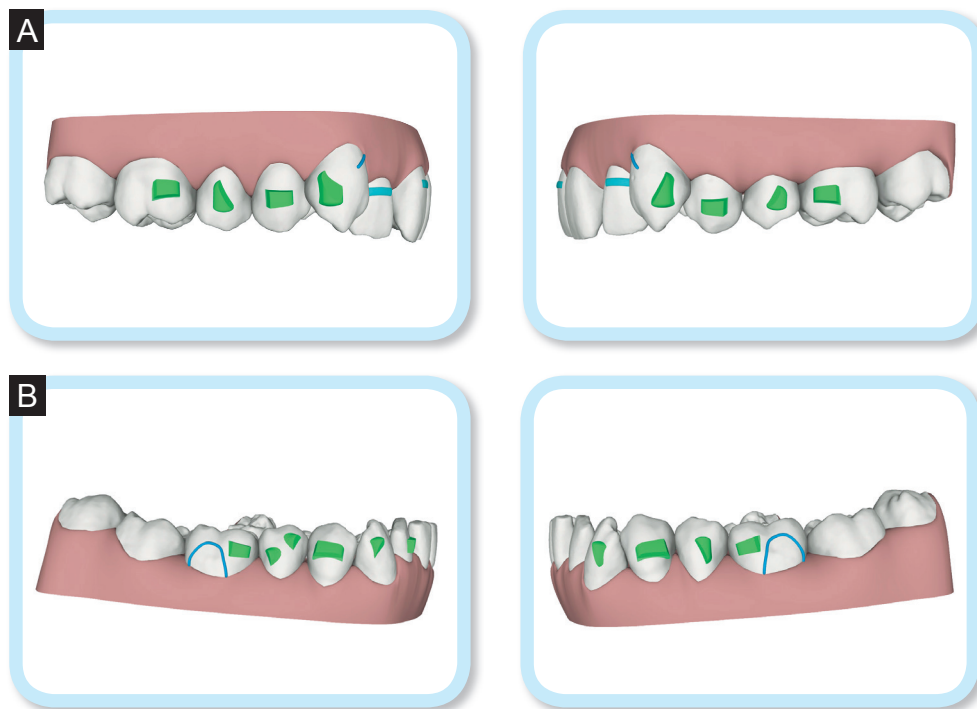
The selected attachments were:

UPPER MAXILLA (*per tooth*) (Fig. 3A):

- 1.6 Horizontal 4mm
- 1.5 Optimized
- 1.4 Horizontal 3mm
- 1.3 Optimized
- 2.6 Horizontal 4mm
- 2.5 Optimized
- 2.4 Horizontal 4mm
- 2.3 Optimized

MANDIBLE (*per tooth*) (Fig. 3B):

- 3.6 Horizontal 3mm
- 3.5 Optimized
- 3.4 Horizontal beveled to occlusal 4mm
- 3.3 Optimized
- 4.6 Horizontal 3mm
- 4.5 Optimized
- 4.4 Horizontal beveled to occlusal 4mm
- 4.3 Optimized
- 4.2 Horizontal beveled to gingival 3mm



■ Fig. 3: The attachments selected for the case were shown as above.

The attachments were placed in the second visit. The composite used as attachments was Tetric Evoceram (IVOCLAR VIVADENT Inc., NY, USA).

After placing the attachments, aligners 3 to 8 were delivered to the patient. The aligner shift frequency was every 10 days. During the use of these 8 aligners, the programmed movements were mainly expansion, proclination, and derotation of the molars, canines, and premolars.

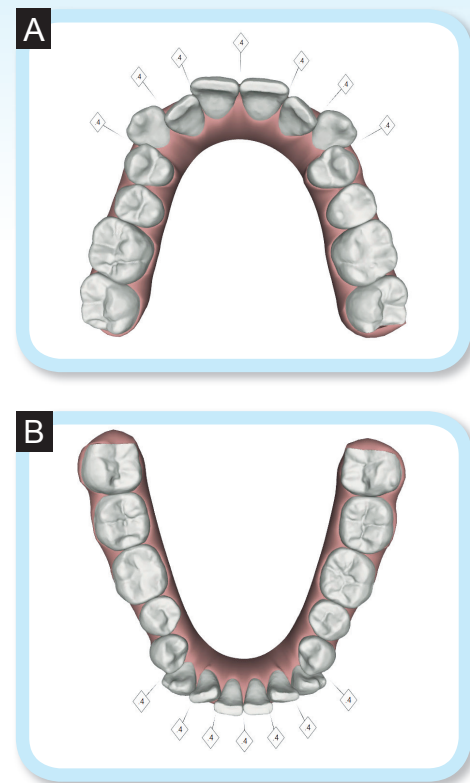
2 months later, aligners 9 to 16 were delivered and an appointment was scheduled to perform IPR and to insert the miniscrews.

Interproximal reduction (IPR) was performed at the 17th aligner. In the upper arch IPR from distal 13 to distal 23 and in the lower arch IPR from distal 33 to distal 43 (0.4mm in each contact point) was carried out to solve crowding, help to the intrusion movement of the incisors, and to reduce the existing black triangles between the incisors, which would then improve the smile aesthetics and enhance the shape and dental anatomy (Fig. 4). A symmetrical IPR was conducted in order to maintain centered dental midlines at the end of the treatment.

In this case the IPR performed was:

Maxilla: 0.4mm per contact point, from distal 13 to distal 33. (Fig. 4A)

Mandibular: 0.4mm per contact point, from distal 33 to distal 43. (Fig. 4B)



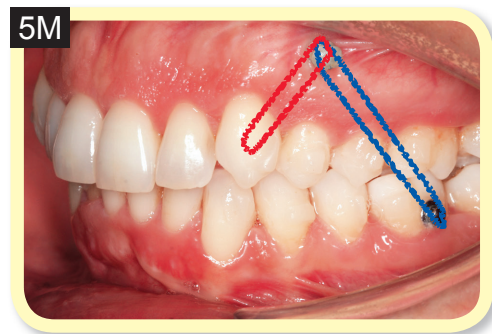
■ Fig. 4: IPR planning.

After 4 months of treatment of the 17th aligner, the transversal development of the upper arch had already been partially achieved, as well as a significant increase in torque on the upper incisors (Fig. 5). For aligner 17, a 1.6x9mm miniscrew (MIAS1609 Microdent system, Barcelona) was placed between the roots of the canines and the upper first premolars (Fig. 5). Class II elastics (3/16" 8oz) were used from the miniscrew to the tubes bonded on the lower first molars.

On aligner 20, having completed the proclination of the upper incisors, the upper incisor intrusion began

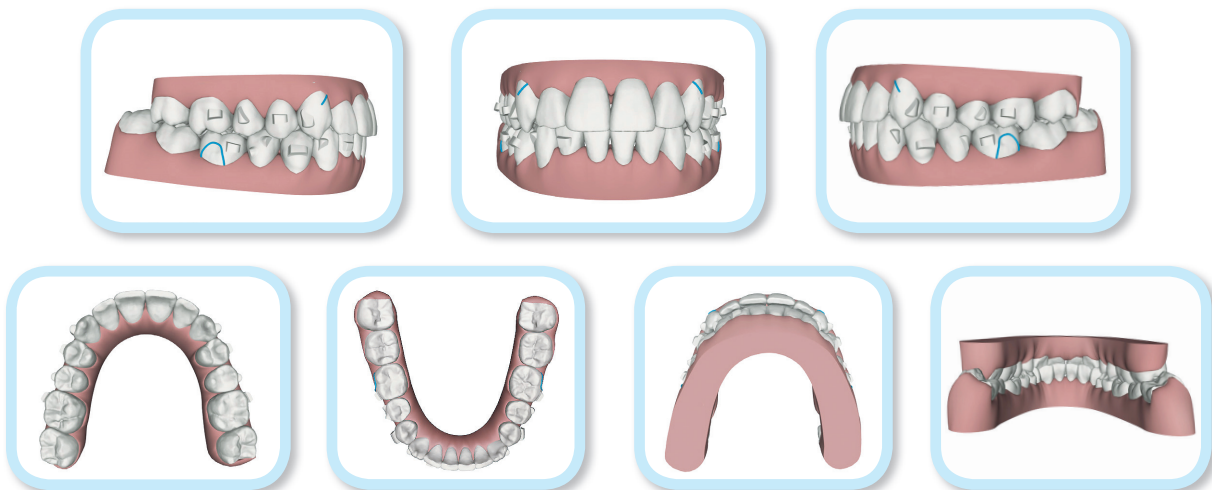
and the patient was instructed to simultaneously use a short elastic from the miniscrew to the cut located on 13 and 23, along with the Class II elastics she had been using. The size and strength of that second elastic was 1/8" 6½oz (Fig. 6). Namely, the miniscrew also provided anchorage to intrude the upper incisors, using elastics (1/8" 6 ½oz) from the miniscrew to a cut in the aligner located on the upper canines.

The first phase of treatment was completed on aligner 31, after 11 months of treatment. At that time a new scan was performed to plan the second phase of treatment for detailing and finishing this clinical case. The final result was planned (Fig. 7). In this second phase of treatment, 17 aligners were used and the patient continued to use both elastics.



■ Fig. 5: On the 17th aligner, Class II elastics 3/16" 18oz and miniscrew/button were used.

■ Fig. 6: On the 20th aligner, Class I elastics (1/8" 6½oz) were added (red) in addition to the Class II elastics (blue).



■ Fig. 7: Final result planned in 2nd phase (additional aligners).

After 15 months of treatment, an occlusal adjustment was performed to improve the stability of the case, removing occlusal interferences. An aesthetic detailing of the cuspids of the upper canines was performed at the request of the patient, so that they would have a more rounded appearance. On this visit, all attachments were removed and the patient kept the last aligner passively for 1 month in order to stabilize the immense change that had been achieved.

The malocclusion was resolved in 16 months using Invisalign (*Align Tech, Inc. San Jose, CA*) assisted by TADS.

Retention

2 ESSIX retainers were given to the patient to maintain the correct alignment and leveling of the dentition in both arches. The patient was instructed to use these retainers throughout the day during the first month post-treatment and afterwards only while sleeping.

Treatment Results

Satisfactory results for smile aesthetics, occlusion and alignment can be observed in the post-treatment extra-oral and intra-oral photographs (*Fig. 8*). Bilateral molar and canine Class I relationships have been achieved. Further documentation with radiographs, cephalometric measurements and tracings indicate the maxillary incisors have increased lingual root torque. The mandibular incisors have been proclined

(*Fig. 9*). The final result achieved is close to the planned and designed 3D Clincheck.

Discussion

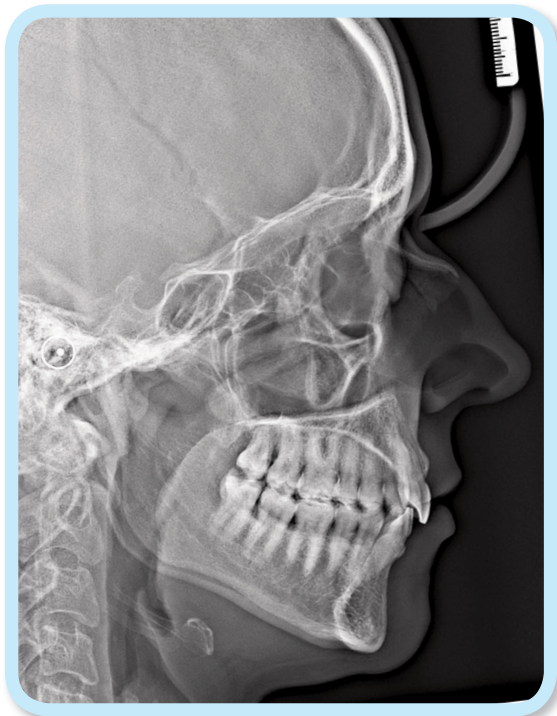
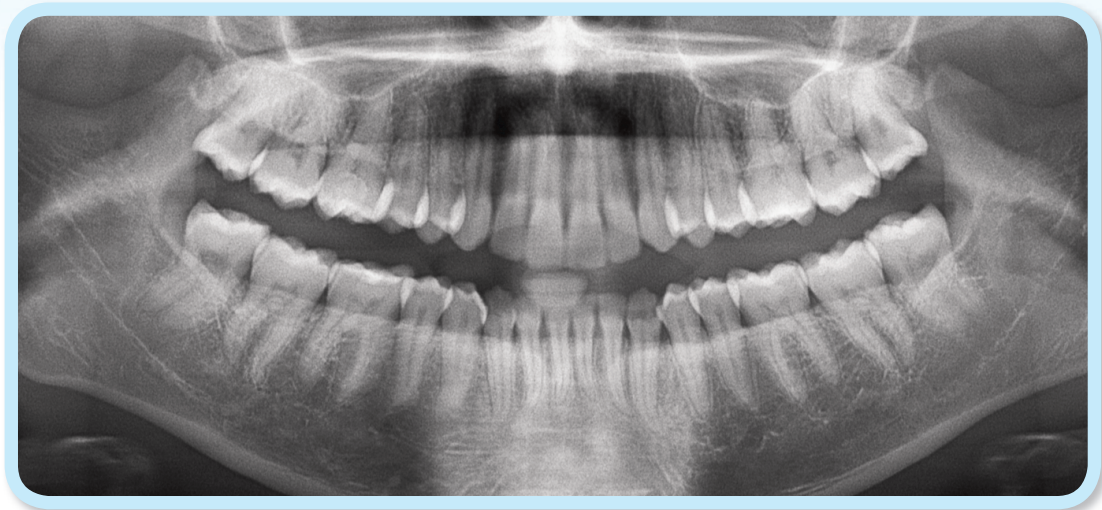
Class II cases with a deep overbite, severe gummy smile and maxillary compression to be treated with aligners has previously been viewed as difficult.^{1,2} However, a proper biomechanical design, incorporating miniscrews, helps to expand the aligners' indication range.³⁻⁵

Careful planning when using aligner systems is of the utmost importance.⁶ The appropriate sequence of movements have satisfactorily resolved clinical case problems.⁶ Most errors that occur with this type of orthodontic technique result from sequences of movements which are not planned according to the 3 phases of orthodontic treatment (*Transversal, Vertical, Sagittal*) and therefore an attempt to resolve phases without first completing the previous phase translates into movements that are not expressed clinically, giving rise to multiple errors. Knowing and understanding the biomechanics of dental movements with aligners rather than with braces is key to achieving good clinical outcomes.³

Maxillary compression, resolved with arch expansion, simultaneously created space for the anterior crowding and solved part of the vertical problems. Mesial-out rotation of the upper first molar during expansion helped to decrease the Class II molar relationship. The arch development in posterior teeth is proved effectively.⁷



■ **Fig. 8:**
Post-treatment intraoral and facial photographs. Satisfactory smile aesthetics, occlusion and alignment have been achieved. Bilateral Class I relationships have been achieved. Treatment time: 16 months.



■ Fig. 9: Post-treatment cephalometric and panoramic radiographs.

Class II elastics can be effective and work efficiently² after overjet creation by expanding and increasing upper incisor root torque. However, the biomechanics treating any case with Class II division II and severe gummy smile must be designed properly.

Miniscrews as anchorage for Class II correction proved to be very effective when seeking the effect of mandibular advancement. Producing the anchorage with the miniscrew rather than in the upper aligner, the upper anchorage is completely skeletal and the entire effect occurs at the mandibular level, thus avoiding such adverse effects as retroclination and the loss of torque on the upper incisors; also preventing deepening of the overbite or worsening the gummy smile. Deep overbite can also be resolved with this kind of Class II elastics,

due to mandible anterorotation and lower incisor proclination.⁸ The aligners practiced a light intrusion force^{9,10} over the upper anterior teeth which helped with gummy smile correction.

The Class I elastics from the miniscrews located between the upper premolars to upper aligner canine cut-out helped to simultaneously solve the Class II malocclusion. Due to these two miniscrews being located close to the maxillary center of resistance, the Class I elastics produced more body movement effect for the upper arch and lingual root torque effect on the upper incisors; thus, distalization with minimal side effects was achieved.

The case was finalized in a Class I molar and canine occlusion, with proper torque at the upper and lower incisors, and the correct transversal development



■ Fig. 10:

Cephalometric tracings before (black) and after (red) treatment showed slight intrusion and retraction of upper dentition and flaring of lower incisors. The maxillary incisors have increased lingual root torque. The mandibular incisors have been proclined.

of both dental arches. Furthermore, biomechanics assisted by miniscrews worked properly, achieving changes at the dental, gingival, and bone level that resulted in a great improvement in smile aesthetics.

Conclusions

It has been proven that the Invisalign System (Align Technology, San Jose, CA) works properly with miniscrews, to assist dental movements that may initially have seemed complex.

The use of miniscrews in this case favors the biomechanical design, by avoiding the adverse effects of retroclination and loss of torque on the upper incisors, which are normally produced by the continued use of elastics when they are anchored on to the aligners at the upper canine level.

Miniscrews in combination with elastics and aligners are useful in assisting movements as planned. Even severe gummy smiles can be treated with the proper design (Fig. 11).



■ **Fig. 11:**
Gummy smile has been corrected with miniscrews in 16 months.

Acknowledgement

Thanks to Dr. Huang, Chi for cephalometric tracings and editing; Teacher Paul Head for proofreading this article.

References

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Cast-Radiograph Evaluation

Case #

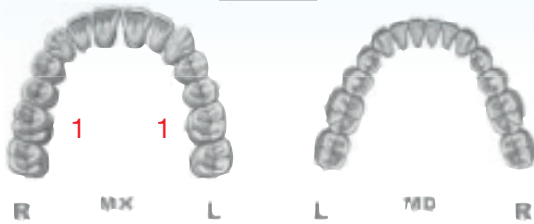
Patient

Total Score:

10

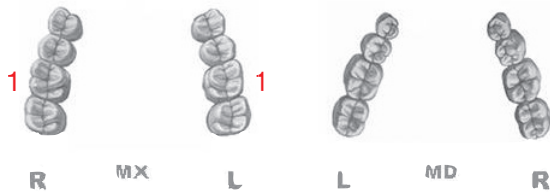
Alignment/Rotations

2



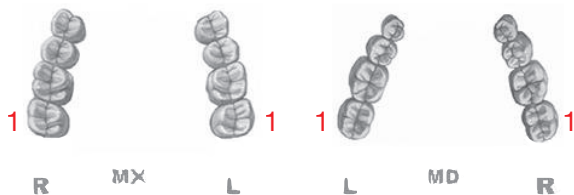
Marginal Ridges

2



Buccolingual Inclination

4



Overjet

0

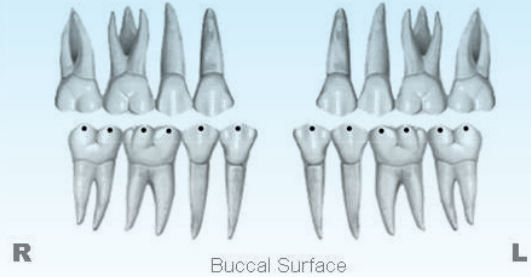


Occlusal Contacts

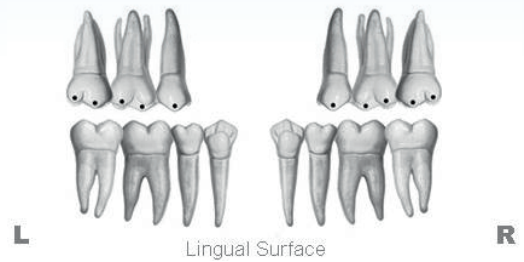
1

2

1



Buccal Surface



Lingual Surface

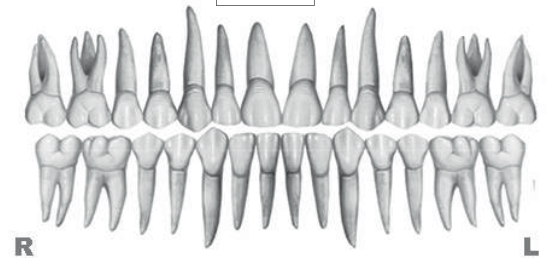
Occlusal Relationships

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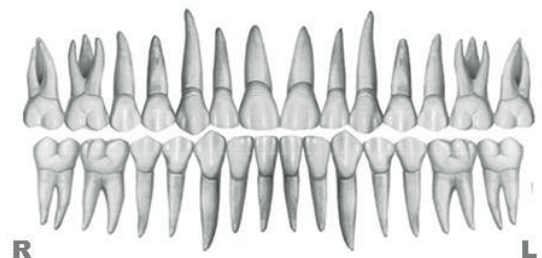
Interproximal Contacts

0



Root Angulation

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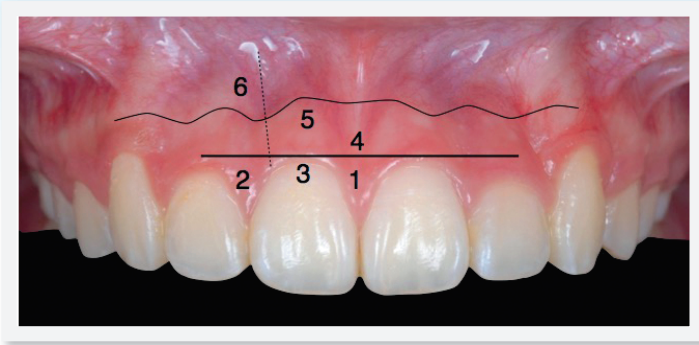


INSTRUCTIONS: Place score beside each deficient tooth and enter total score for each parameter in the white box. Mark extracted teeth with "X". Second molars should be in occlusion.

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

Total Score: = 3

1. Pink Esthetic Score



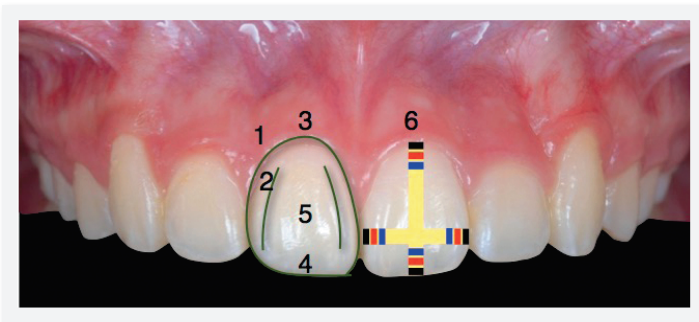
1. Mesial Papilla	0	1	2
2. Distal Papilla	0	1	2
3. Curvature of Gingival Margin	0	1	2
4. Level of Gingival Margin	0	1	2
5. Root Convexity (Torque)	0	1	2
6. Scar Formation	0	1	2

Total = 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)



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

Total = 1



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