Article Title:

Diagnosis and Conservative Treatment of Skeletal Class III Malocclusion with Anterior Crossbite and Asymmetric Maxillary Crowding

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Highlights:

1. Without extractions or orthognathic surgery, a differential diagnosis, utilizing three methods (DI, 3-Ring and Extraction Decision Tree) revealed that the patient's desire for conservative treatment was feasible.

2. Despite 12mm of asymmetric crowding in the maxillary arch, the problem was treated to an optimal result without excessive arch expansion and incisal flaring by using PSL brackets.

3. For the present patient, the anterior cross bite and deep bite were corrected simultaneously in ~5 months, utilizing anterior BTs and early light class III elastics as the principle active mechanics.

Diagnosis and Conservative Treatment of Skeletal Class III Malocclusion with Anterior Crossbite and Asymmetric Maxillary Crowding

Abstract

A 28-year-9-month male presented for orthodontic consultation for skeletal Class III malocclusion (ANB -3^0) with a modest asymmetric Class II/III molar relationship, complicated by an anterior crossbite, deep bite, and 12mm of asymmetric maxillary crowding. Despite the severity of a malocclusion, Discrepancy Index (DI) = 37, the patient desired non-invasive camouflage treatment. Lin's 3-Ring diagnosis revealed that treatment without extractions or orthognathic surgery was a viable approach. Arch length analysis indicated that differential interproximal enamel reduction (IPR) could resolve the crowding and midline discrepancy, but a miniscrew in the infrazygomatic crest (IZC) was needed to retract the right buccal segment. The patient accepted the complex, staged treatment plan with the understanding that it would require ~3.5 years. Fixed appliance treatment with passive self ligating (PSL) brackets, early light short elastics (ELSE), bite turbos (BTs), IPR, and IZC retraction opened the vertical dimension of occlusion (VDO), improved the ANB 2^0 and achieved an excellent alignment, as evidenced by a CRE of 26 and a Pink and White (P&W) dental esthetic score of 3. The worksheets for the DI, CRE, and P&W scores are attached within this case report.

Key words: Skeletal Class III, anterior crossbite, deep-bite, 3-ring diagnosis, bite turbos (BTs), interproximal enamel reduction (IPR), early light short elastics (ELSE)

Introduction

Angle's[1] classification for malocclusion focused on the occlusal relationship of the first molars, so it can be misleading for many malocclusions. Likewise anterior crossbites may be deceptive, particularly when associated with a prognathic skeletal pattern and concave face. An unusual case is presented that appears to be a modest problem based on the molar discrepancy, but it is a severe malocclusion, based on an American Board of Orthodontics (ABO) Discrepancy Index (DI) score of 37. Furthermore, the face, anterior crossbite, and the ANB angle of -3^0 are consistent with a skeletal Class III malocclusion. Despite the severity of the problem, the patient insisted on the most conservative treatment possible, so a careful differential diagnosis was critical to determine if a relatively noninvasive approach was indicated or even possible.

Anterior crossbites with a Class III skeletal pattern present a layer of complexity that is not readily diagnosed unless a systematic test is used such as Lin's 3-Ring diagnosis method.[2,3] A careful application of the DI and 3-Ring methods demonstrated that conservative treatment was feasible.

However, optimal sagittal alignment of the dentition required a stainless steel miniscrew (OrthoBoneScrew® (OBS) Newton's A, Hsinchu, Taiwan) in the right infrazygomatic crest (IZC) to retract the right buccal segment.

Diagnosis and Etiology

A 28-year-9-month-old male presented for orthodontic consultation with the following chief concerns: thin upper lip, irregular dentition and poor smile esthetics. Figure 1 There was no contributing medical or dental history. Clinical examination revealed a retrusive upper lip, deep anterior cross-bite of all maxillary incisors, and posterior lingual crossbite of the maxillary right second premolar and irregular dental attrition of the maxillary right central incisor. Figure 1 The overbite was 7mm and overjet was -3 mm. There was present 12mm of asymmetric crowding in the upper arch; Asymmetric Class II (right); and Class III (left) buccal segments associated with a midline deviation of the maxilla that was 3mm to the right. Figure 2 Radiographic and cephalometric survey before treatment is provided respectively. Figure 3 The cephalometric measurements are summarized in the following. Table 1 Superimposed cephalometric tracings before and after treatment document the skeletal and dental changes. Figure 7 The severely worn facet on the maxillary right central incisor (#8) required coordinated orthodontic alignment and restorative care. Figure 8

Specific Objectives of Treatment

Maxilla (all three planes):

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

Mandible (all three planes):

- A - P: Maintain
- Vertical: Clockwise rotation to improve the ANB angle
- Transverse: Maintain

Maxillary Dentition

- A - P: Protract incisors and retract the molars
- Vertical: Slightly increase
- Inter-molar Width: Slightly increase

Mandibular Dentition

- A - P: Retract

- Vertical: Intrude incisors
- Inter-molar / Inter-canine width: Maintain

Facial Esthetics

- Increase the upper lip protrusion
- Increase the vertical dimension of occlusion (VDO) to achieve an orthognathic profile

Treatment Alternatives

After a careful evaluation of the patient's problems, three tentative treatment plans were proposed. Treatment plan A was extraction of the upper second premolars and the lower first premolars. Treatment plan B was insertion for two miniscrews in the buccal shelf of the mandible to retract the entire lower arch. Treatment plan C was non-extraction camouflage treatment, using Class III elastics to retract the lower labial segment and protract the upper labial segment. The patient chose the most conservative option, treatment plan C. However, this relatively noninvasive approach required extensive IPR of the anterior maxillary arch, and an OBS in the IZC to retract the right buccal segment. The patient was informed that this conservative approach would require 3-4 years of treatment, primarily because of the sequence of procedures necessary to resolve 12mm of asymmetric crowding in the maxillary arch, without extracting teeth. The patient accepted this treatment limitation.

1. No extractions or orthognathic surgery
2. Damon Q® brackets (Ormco, Glendora, CA): standard torque PSL brackets bonded upside down on teeth #6-11 to resist the flaring effect of Class III elastics
3. Open coil springs between teeth #3-5 and #6-8 for opening space to relieve crowding
4. BTs on #22 and 27 initially, and then on #24 and 25 as the bite opens
5. Class III ELSE to assist with anterior cross-bite correction and open the VDO
6. OBS in the right IZC to retract the right buccal segment
7. Restore tooth #8 with a porcelain veneer or composite resin

Appliances and Treatment Progress

The 0.022" slot Damon Q standard torque brackets were bonded on the lower arch. Bite turbos were bonded on the lingual surface of teeth #22 and 27, to open the bite and facilitate anterior crossbite correction. Figure 9a, b, c. One month later the upper arch was bonded with standard torque brackets, but those on teeth #6-11 were bonded upside down to deliver negative torque. Table 2 Initially, there was inadequate space to bond teeth #4 and 7, so open coil springs were placed on the archwire, and those

teeth were bonded with upside down, standard torque brackets as soon as adequate space was available. The length of the active NiTi springs for space opening was 1-1.5X bracket-widths longer than the space needed. Tooth #8 was severely worn with dentine exposure. The amount of lost tooth structure was estimated to be ~2mm in the axial dimension, so the bracket position for tooth #9 was 6mm from the incisor edge, while the corresponding distance for tooth #8 was only 4mm Figure 10. The goal was to achieve optimal gingival alignment and then restore the #8 tooth structure as needed. The initial arch-wires were 0.014" CuNiTi. Class III ELSE (Quail 3/16" 2 oz) (Ormco, Glendora, CA) were placed from teeth #21 to 14 and #28 to 3. Figure 11,12 BTs were bonded on the lingual surface of #24 and 25. Figure 13 The stepwise opening of the bite with BTs was for patient comfort. The patient was instructed to wear 2oz ELSE full time, and to replace them with new ones at least four times per day, preferably after meals or snacks. By the 5th month of treatment, the anterior crossbite was corrected, the BTs were removed, and the lower arch wire was changed to 0.014x0.025" CuNiTi. In the 7th month, the upper arch wire was changed to 0.014x0.025" CuNiTi. Drop-in hooks (Ormco, Glendora, CA) were fitted into the vertical slot of the maxillary canines to secure class II elastics (Fox 1/4" 3.5 oz), which accomplished A-P correction while promoting development of the smile arc. The change from Class III to Class II elastics at 7 months was necessary due to the opening of the bite and 2^0 improvement in the ANB angle. Figure 14

In the 8th month, the open coil springs were reactivated with a light-cured resin ball or a crimpable stop. Figures 15-17 In the 10th month, the lower anteriors were too lingually inclined, so the archwire was changed to a 0.016x0.025" NiTi, pre-torqued with 20° of lingual root torque. In the 15th month of active treatment, the upper archwire was replaced by 0.017x0.025" TMA. By 18 months, there was still inadequate space to align tooth #4 and additional coil spring activation was contraindicated. In the 21st month, OBSs were inserted at the right IZC, and an elastomeric chain was attached to retract the upper right canine. Figures 18 and 19 Three months later (24 months of treatment), no significant space opening to align tooth #4 had been achieved. In the 25th month of the treatment, IPR was performed from #7-10 and along the mesial aspect of #3. Figures 20, 21, and 22 Then teeth #6-10 were tied together with a power tube. In the 27th month, space opened on the mesial side of #4. In the 28th month, a button was bonded on tooth #4 and an elastomeric chain was used for buccal traction to align it. Figure 23 In the 32nd month, #4 was engaged on a 0.014" NiTi archwire. Figure 24 At 38 months of treatment, tooth #4 was finally aligned. Figure 25 Two weeks prior to the completion of active treatment, the upper archwire was sectioned distal to cuspids, and box elastics (Fox 1/4" 3.5 oz) were used to improve occlusal contacts. After 42 months (3.5 years as projected) of active treatment, all appliances were removed and two retainers were delivered: upper clear overlay and a maxillary anterior 2-2 fixed.

Results Achieved

Maxilla (all three planes):

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

Mandible (all three planes):

- A - P: Maintained
- Vertical: Clockwise rotation to increase the VDO and ANB
- Transverse: Maintained

Maxillary Dentition

- A - P: Flared incisors (102 to 114.5°)
- Vertical: molars retracted and extruded
- Inter-molar / Inter-canine Width: Maintained

Mandibular Dentition

- A - P: Maintained
- Vertical: Incisors were intruded, molars were extruded.
- Inter-molar / Inter-canine Width: Maintained

Facial Esthetics:

- Produced a facial profile with normal convexity

Retention

A fixed retainer was bonded on all maxillary incisors. A clear overlay retainer was delivered for the upper arch and the patient was instructed to wear it full time for the first 6 months and nights only thereafter. Instructions were provided for oral hygiene and maintenance of the retainers.

Final Evaluation of Treatment

Both arches were well aligned and optimally inter-digitated in a near ideal Class I occlusion, with coincident dental. Figure 5 The facial profile was improved primarily by increasing the relative prominence of the upper lip and increasing the VDO. Figure 4 Comparing the pre-treatment and post-treatment cephalometric tracings reveals that SN to mandibular plane angle increased 1° due to the clockwise rotation of the mandible. Figure 6 The axial inclination of the upper incisors to SN increased from 102 to 114.5°. Table 1 The lower incisors were intruded, but all of the molars were extruded. Figure 7 The CRE CRE

score was 26 points as shown in the subsequent work sheet. Most of the points deducted were for a lack of occlusal contacts (6 points). Dental esthetics was excellent as documented by the P&W dental esthetic index of 3, as scored in the form at the end of this report. P&W Although the conservative treatment plan required 3.5 years of active treatment, the patient was very pleased with the results.

Discussion

Conservative treatment of a class III skeletal malocclusion is popular with patients but is challenging for orthodontists. There were four principal factors contributing to the successful conservative management: 1. accurate diagnosis, 2. advanced fixed appliances, 3. custom auxiliaries, and 4. interproximal enamel reduction.[2, 3] After determining the complexity of a malocclusion with the DI, DI a realistic diagnosis and treatment plan are facilitated by two stepwise differential tests: 3 Ring Diagnosis System Figure 26 and the Extraction Decision-Making Tree. Table 3

Skeletal Class III malocclusion is often confused with pseudo Class III problems[4] which typically have a functional shift (FS) and/or anterior crossbite with Class I buccal segments. Lin[5] reported that the prevalence of skeletal class III malocclusion is about 1.65% in Taiwan, but pseudo class III problems (Class I with anterior crossbite) are found in approximately 2.31% of children 9-15 years of age. The Three-Ring Diagnosis method Figure 26 was developed to help predict the prognosis for anterior cross-bite correction.[6] The clinical data revealed that 90% of anterior cross bite corrections were stable if the following diagnostic criteria were met:

- Profile: an acceptable facial profile in centric relation (C_R)
- Class: canines and molars in or near a Class I relationship
- FS: a functional shift is evident

Good candidates for conservative (camouflage) treatment have an orthognathic profile (acceptable facial balance) in centric relation (C_R), buccal segments that are approximately Class I, and a FS.[7] There were other favorable indicators such as a marginally low to average mandibular plane angle and no open bite. Orthodontic camouflage to treat a class III malocclusion may result in increased axial inclination of the maxillary incisors and decreased axial inclination of the mandibular incisors, particularly if there is an underlying class III skeletal discrepancy.[8] If it is necessary to retract the mandibular incisors, an axial inclination of at least 88^0 is desirable.[9]

The Chang[10] decision-making tree Table 3 was used to assess the necessity for extractions. The two factors favoring extraction were protrusive profile and crowding >7mm in the upper arch. However, maxillary extractions would complicate the correction of the anterior cross bite and may result in mid-face

deficiency. Furthermore, the patient was strongly opposed to extractions, so the non-extraction option was selected, with the understanding that extensive IPR as well as IZC anchorage were necessary.

PSL brackets with light wires facilitate the conservative correction of Class III malocclusions.[7] The bracket is a tube-like appliance capable of delivering continuous light force that is similar to the MEAW (Multiloop Edgewise Arch Wire) effect.[7,11,12] If a patient meets the three criteria of the 3-Ring diagnosis, straight wires and Class III elastics are usually sufficient to correct the malocclusion.[2] For the present patient, Class III ELSE were used initially with BTs, but were then replaced with Class II elastics as soon as the bite opened and the anterior crossbite was corrected. These are common mechanics for patients with an anterior crossbite and Class I buccal segments. If it is necessary to manage an asymmetry and/or retract the entire lower arch, bilateral buccal shelf OBSs are indicated.[7, 12, and 13]

Proper torque control with PSL brackets and light NiTi wires can be challenging.[14] For the present patient, dental axial inclinations were managed with low torque brackets **Table 2**, pre-torqued arch-wires, and TAD anchorage to retract the right buccal segment. Controlling torque with the selection of brackets is particularly effective with PSL brackets[1 5.16] **Table 2**. Low torque was used on the upper incisors to compensate for the side-effects of the class III elastics, i. e. flaring of maxillary incisors and excessive retraction of mandibular incisors.[17] If low torque brackets are insufficient for controlling axial inclinations, bonding standard torque brackets upside down is a viable alternative[15-17] **Table 2**. If a rectangular archwire fails to generate adequate root torque, a 20° pre-torqued archwire such as 0.016x0.025" or 0.019x0.025" is recommended. Since the present patient had standard torque brackets bonded on the mandibular teeth, a 0.016x0.025" Ni-Ti archwire with 20° of torque was inserted 10 months into treatment to correct the axial inclinations in the anterior segment.[17] This problem could have been prevented by using higher torque brackets in the lower anterior segment initially **Table 2**.

Correction of deep bite can be achieved by molar extrusion, incisor intrusion or both. The current patient's deep bite was corrected with anterior BTs, which intruded the lower incisors and allowed the posterior segments to extrude. **Figure 7** An advantage for anterior BTs at the beginning of treatment was to serve as vertical stops for the deep overbite, as well as to unlock the posterior interdigitation, to allow the malocclusion greater freedom for three dimensional tooth movement. [15-17] BTs for class III treatment have additional advantages: 1. protect the enamel from attrition, 2. prevent accidental bracket debonding, 3. improve the effect of light wires for 3D tooth movement such as correction of posterior crossbites, 4. improve the response to ELSE, and 5. help correct mandibular plane angle problems.[15] For deep anterior crossbites, a stepwise opening of the bite with BTs is more comfortable for the patient. **Figure 9a-c, 12, and 13**

For the present patient, the anterior cross bite and deep bite were corrected simultaneously in ~5 months, utilizing class III elastics as the principle active mechanics.[15-17] Starting 2 oz ELSE during the leveling phase enhanced the treatment efficiency by helping to level the arches and achieve correction in the sagittal plane.[14,15] The side-effects of the class III elastics are labial tipping of upper incisors, extrusion of maxillary molars, and distal tipping of lower molars.[15-17] Since these effects were considered favorable for the present patient, class III elastics were used rather than inserting bone screws in the buccal shelf of the mandible.[12]

At 21 months a OBS was placed at the right IZC to provide anchorage to retract the canine, avoid incisor flaring, and retract the molars. However, these mechanics failed to open adequate space for alignment of #4. **Figures 18 and 19** So IPR was performed with an air rotor and abrasive finishing strips in the anterior segment of the upper arch to reduce black triangles, gain space for alignment of #4, improve tooth proportion, and establish more ideal interproximal contacts. [18-19]. **Figures 20, 21, and 22**

The pink and white (P&W) esthetic score evaluates anterior maxillary esthetics by analyzing clinical photographs. Refer to the scoring form at the end of this case report. The form includes two esthetic assessments: 1. Pink is a gingival evaluation, and 2. White is a score of dental micro-esthetics. The column on the right lists six variables that are scored from 0-2 for each assessment. The actual P&W score is marked with red circles for the six variables in the areas highlighted in blue.[21] The deficiencies scored were blunted mesial and distal gingiva papillae, creating small dark triangles between the incisors, inadequate incisal curve (smile line), and apparent deviation from ideal incisal root angulation. Three points or less on the P&W score is considered an excellent result, particularly for patients with incisal abrasion.

The anterior cranial base superimposition **Figure 7** shows that the mandible rotated posteriorly about 4mm but the FMA only opened 1 degree, because the posterior mandible moved inferiorly. This unusual pattern of mandibular rotation may indicate a morphologic problem in the TMJ(s). In retrospect, it may have been wise to utilize a CBCT prospectively to evaluate the joints. Furthermore, a CBCT may be a wise precaution for assessing all skeletal malocclusions that require surgery and/or temporary anchorage devices.

Conclusion

This difficult skeletal malocclusion (ANB -3^0, DI = 37) was treated to an excellent result (CRE = 26) without extractions or orthognathic surgery. A differential diagnosis, utilizing three methods (DI, 3-Ring and Extraction Decision Tree) revealed that the patient's desire for conservative treatment was feasible. A carefully sequenced treatment plan achieved an excellent result for this severe malocclusion, but it did require 3.5 years of treatment. In retrospect, the treatment time may have been decreased by introducing IPR and IZC anchorage earlier in the sequence, but the necessity for those more invasive measures was not clear until ~18 months into treatment. Despite 12mm of asymmetric crowding in the maxillary arch, the problem was treated to an optimal result without excessive arch expansion and incisal flaring.[20]

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Figure Legends:

Figure 1. Pretreatment facial and intraoral photographs

Figure 2. Pretreatment study models (casts).

Figure 3. Pretreatment panoramic radiograph, lateral cephalometric radiograph and cephalometric tracing, showing a protruded lower lip and crowding of upper arch.

Figure 4. Posttreatment facial and intraoral photographs

Figure 5. Posttreatment study models (casts).

Figure 6. Posttreatment panoramic radiograph, lateral cephalometric radiograph and cephalometric tracing, showing improved profile and the parallel alignment of all tooth roots.

Figure 7. Initial (black) and finish (red) cephalometric tracings are superimposed on the anterior cranial base (left), as well as on the stable skeletal structures of the maxilla (upper right), and mandible (lower right).

Figure 8. A severely worn facet along the incisal surface of tooth #8 had dentinal exposure.

Figures 9a, 9b, and 9c. Bite turbos on the lingual side of #22 and 27 were used to disarticulate the occlusion (open the bite). Bite turbos for lower incisors are made with a Mini-Mold (Ortho-Arch, Schaumburg, IL) for a 5mm bite ramp bonder (upper). The mold (bonder) is filled with composite resin, positioned against the lingual surface of the tooth, and then cured with light (lower).

Figure 10. Two open coil springs were inserted to create space for teeth #4 and 7. Standard torque brackets were bonded upside down on teeth #6, 8, 9, 10, and 11. The bracket position for teeth #8 and 9 were at the same level relative to the gingival margin.

Figure 11. Class III ELSE from teeth #3-28 (Quail 3/16" 2 OZ.)

Figure 12. Class III ELSE are applied between teeth #14 and 21. Note that tooth #9 bites on bite turbo.

Figure 13. Bite turbos are bonded at the lingual surface of lower anteriors to prevent bracket interference while correcting the cross bite. They also assisted with intrusion of teeth #22-27.

Figure 14. In the 5th month of treatment, the anterior cross-bite was corrected so the anterior bite

turbos were removed. At the same appointment, the lower arch wire was changed to 0.014x0.025" CuNiTi.

Figure 15. The open coil spring was reactivated by adding a light-cured resin ball.

Figure 16. The open coil spring is reactivated by installing a crimpable stop mesial to the maxillary first molar.

Figure 17. At 18 months of treatment there was still inadequate space to align tooth #4.

Figures 18 and 19. At 21 months, an OrthoBoneScrew (OBS) (Newton's A, Hsinchu, Taiwan) was placed in the right infrazygomatic crest (IZC) and a power chain was attached from tooth #6 to the OBS to retract the right buccal segment as the space was opened for tooth #4. At 24 months, no space was gained to align tooth #4.

Figures 20, 21, and 22. At 25 months, IPR was performed on the mesial surface of tooth #3 (left) and inter-proximally from teeth #7-10 (center). All adjusted surfaces were polished with abrasive strips (right). A coil spring was placed at 25 months (upper left) to open space for tooth #4 by pushing the premolar and canine mesially to close the anterior space that was created by IPR.

Figure 23. After 30 months a button was bonded on the buccal surface of tooth #4 and an elastic chain was attached. It was activated by attaching the opposite end to the IZC miniscrew.

Figure 24. At 36 months a bracket was bonded on the buccal surface of tooth #4 and it was engaged on an 0.014" CuNiTi archwire.

Figure 25. At 38 months tooth #4 was aligned and a 0.017x0.025" TMA archwire was engaged.

Figure 26. The class III diagnosis system developed by Dr. Lin has simplified the complicated diagnostic procedure for assessing anterior crossbite.[6]

Table 1. Cephalometric summary

Table 2. DamonQ (DQ) Torque brackets are available in high, standard and low torque for both arches, as indicated. For the upper arch (U1, U2, and U3) the bracket can be placed upside down to deliver super low torque, as indicated.

Table 3. The Chang[10] decision-making tree summarizes aids used to decide on an extraction vs. non-extraction treatment plan.

Worksheet 1. The American Board of Orthodontics (ABO) Discrepancy Index (DI)

Worksheet 2. The American Board of Orthodontics (ABO) Cast-Radiograph Evaluation (CRE)

Worksheet 3. Pink and White esthetic score

Figure 1

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Figure 2

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Figure 3

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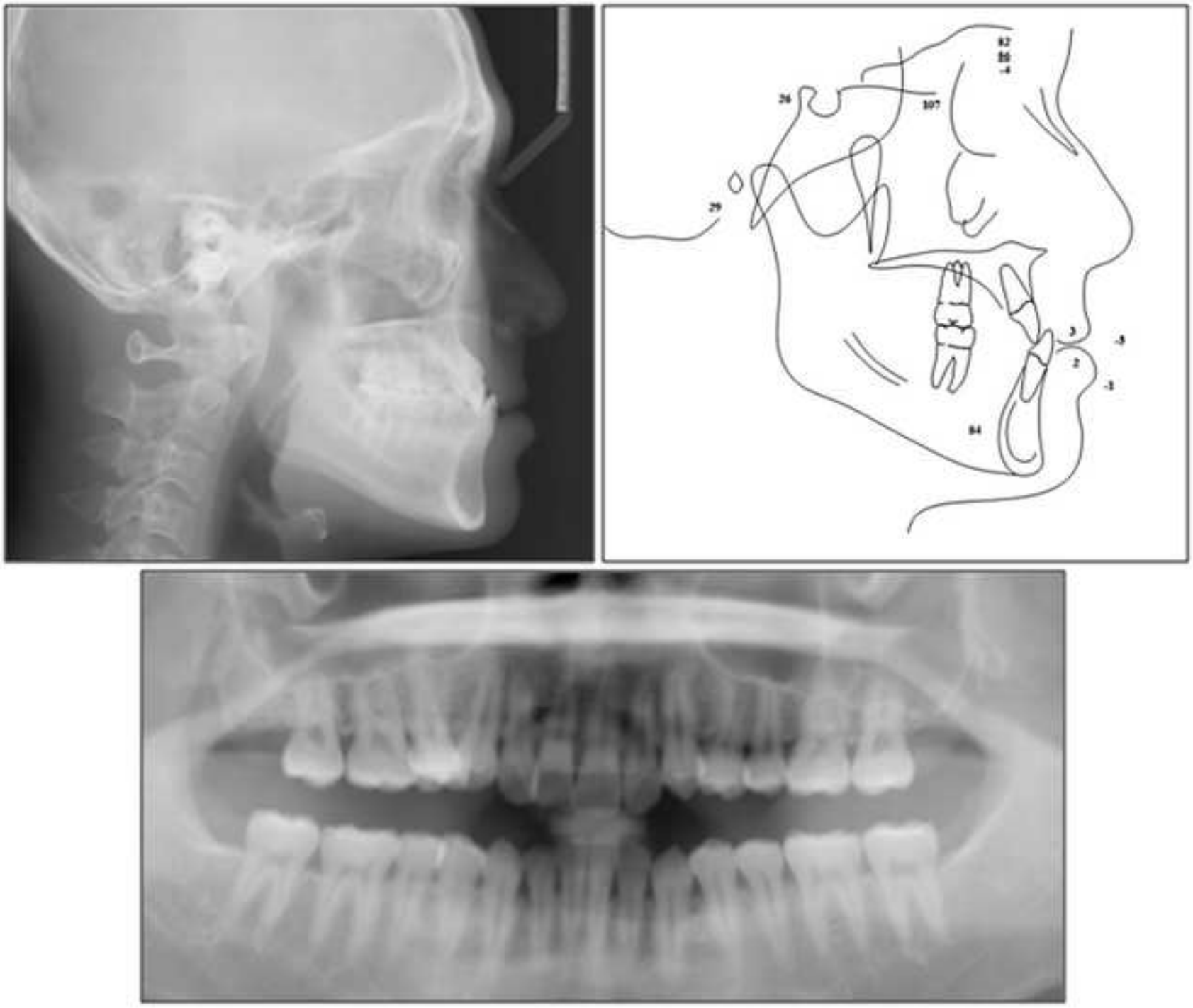

Figure 4

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Figure 5

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Figure 6

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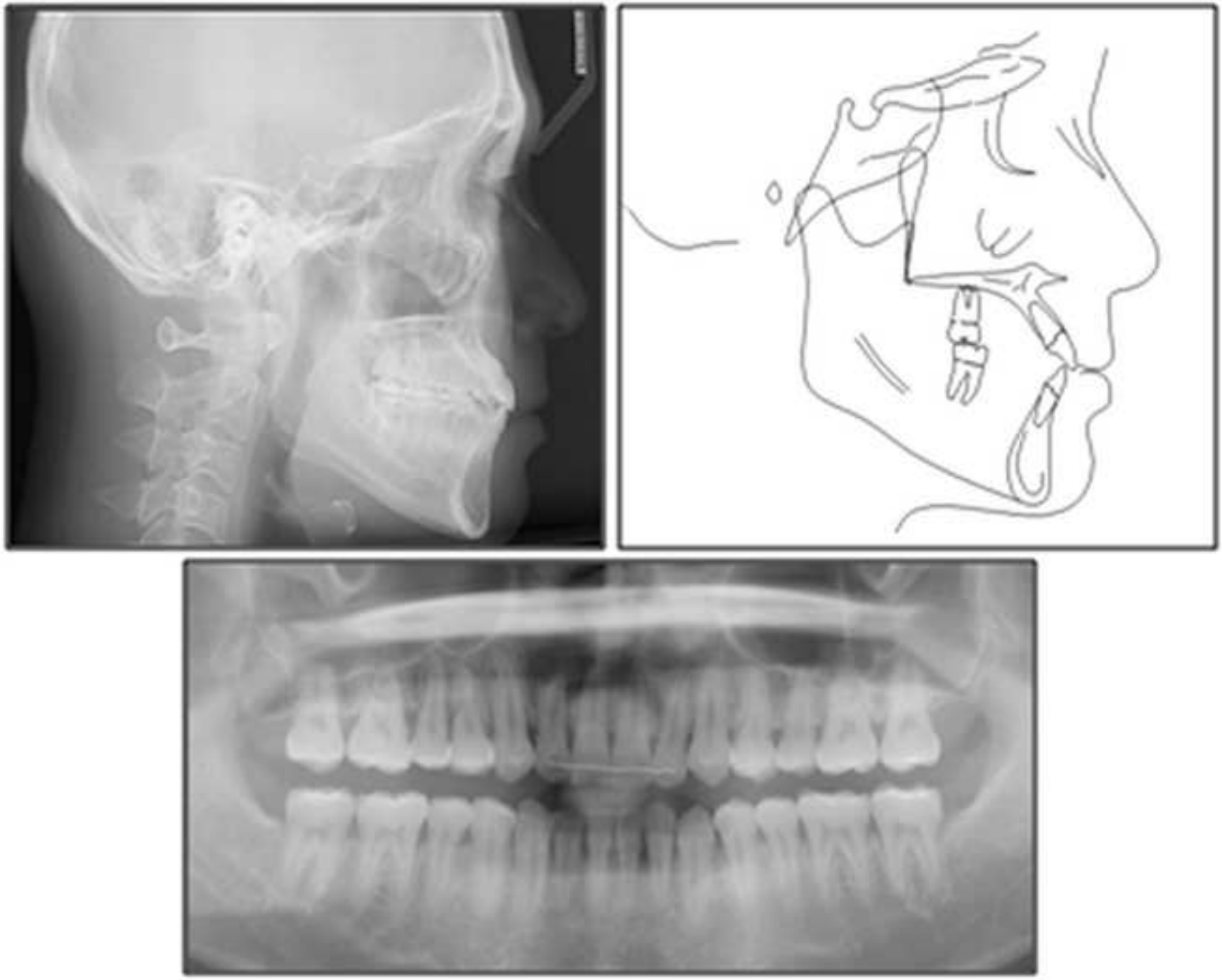

Figure 7

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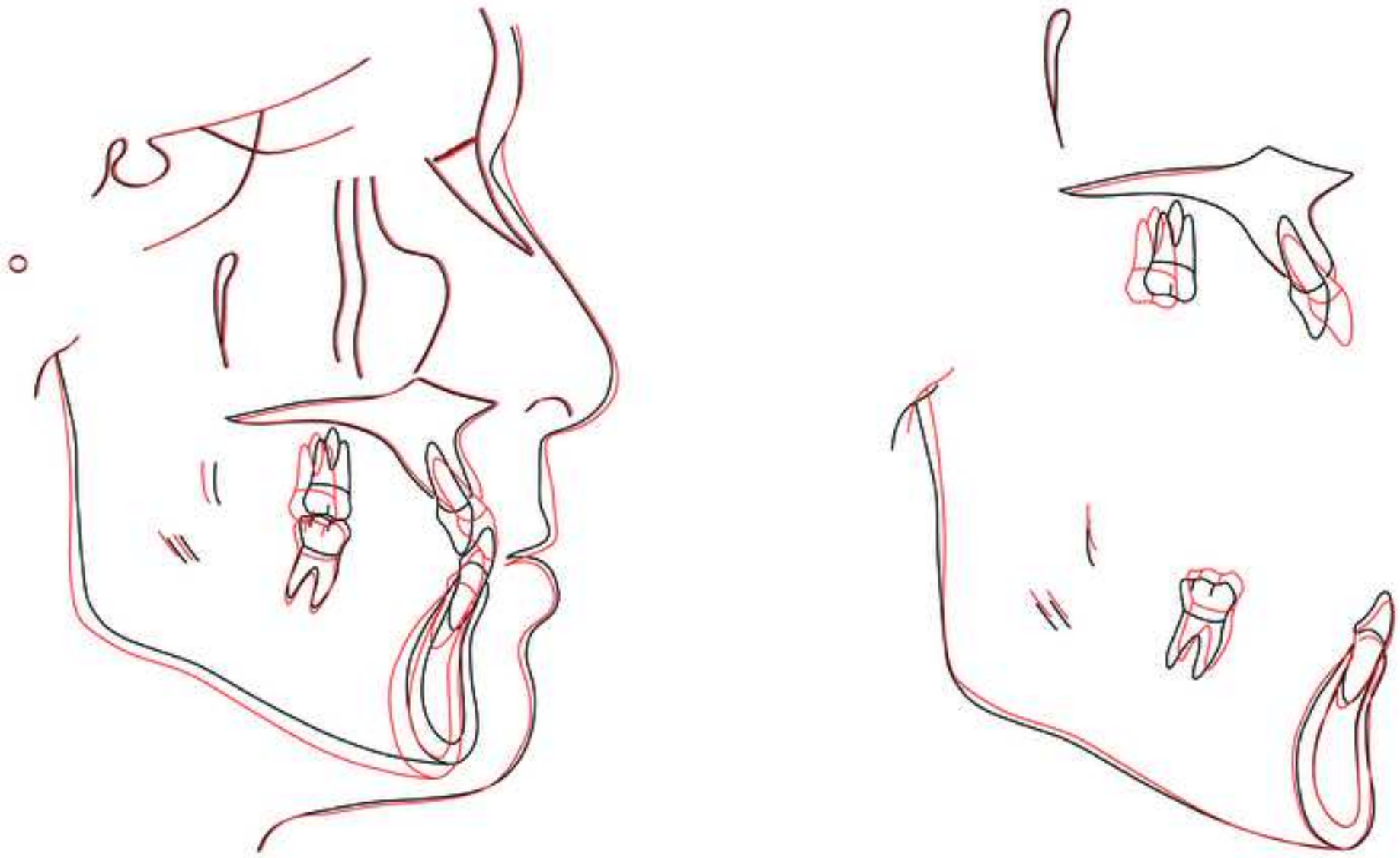

Figure 8

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Figure 9_14

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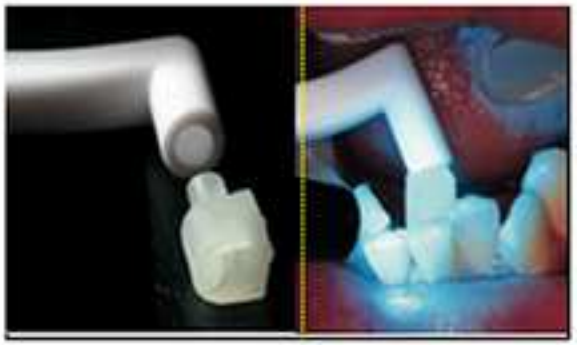
9a



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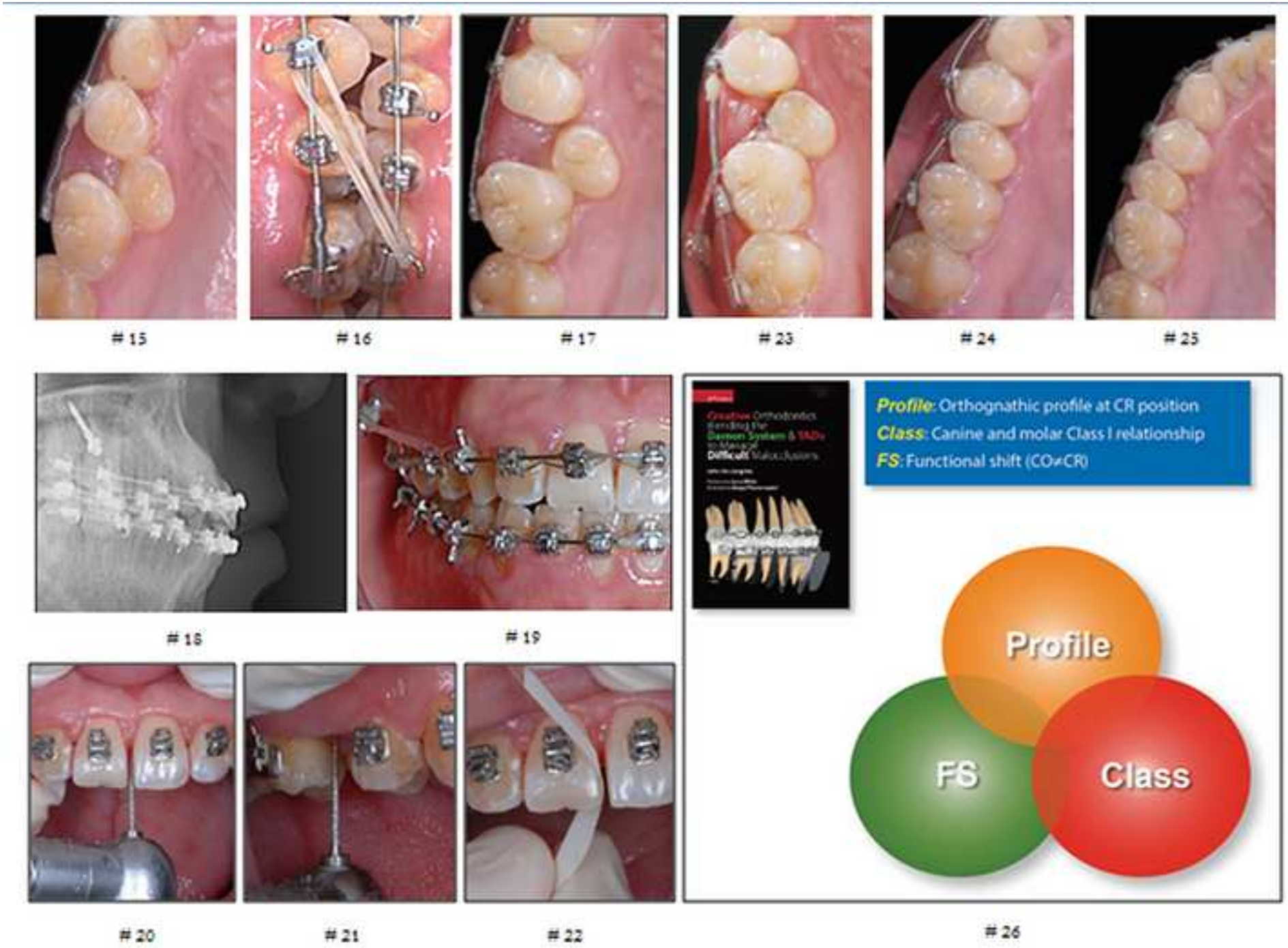

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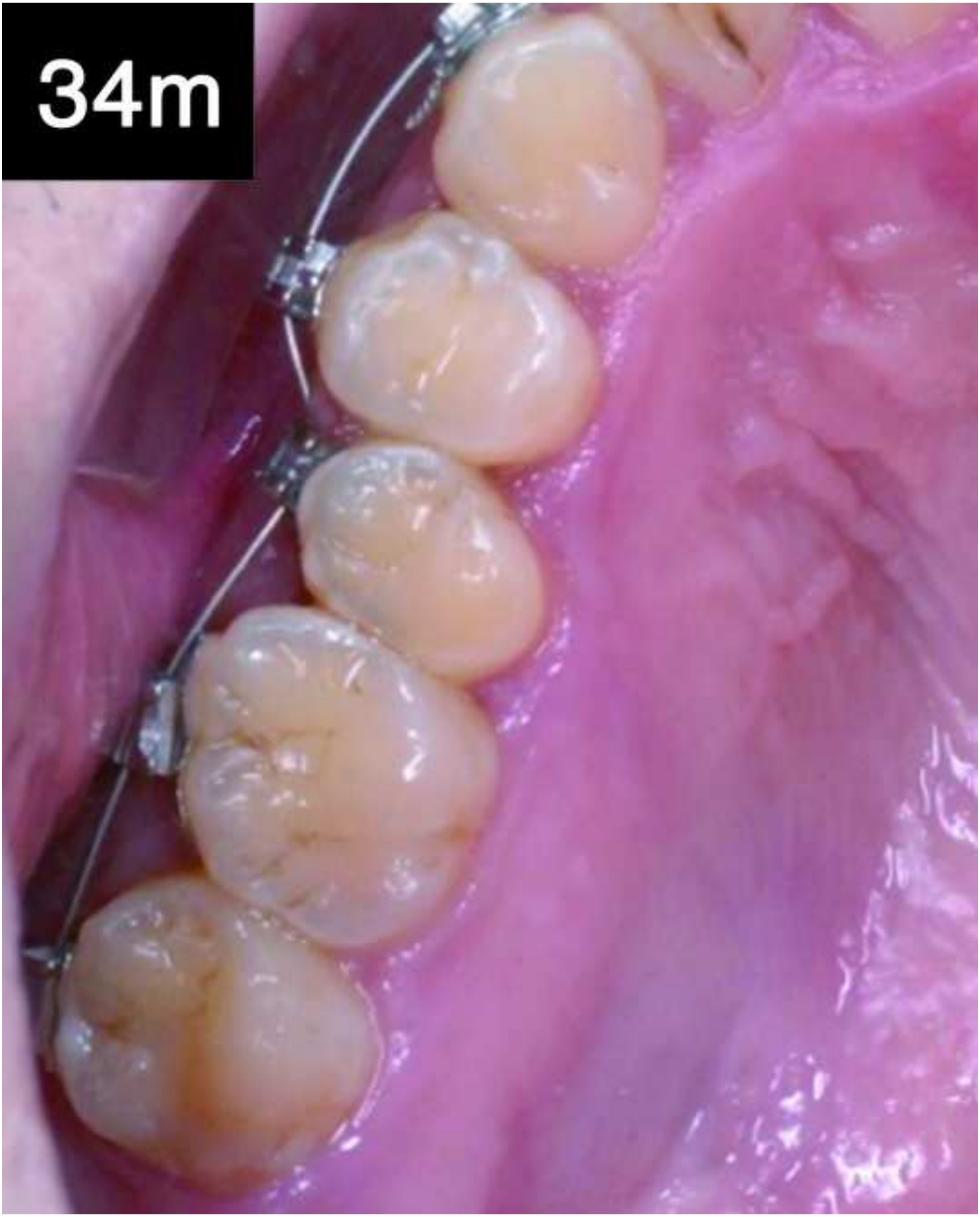

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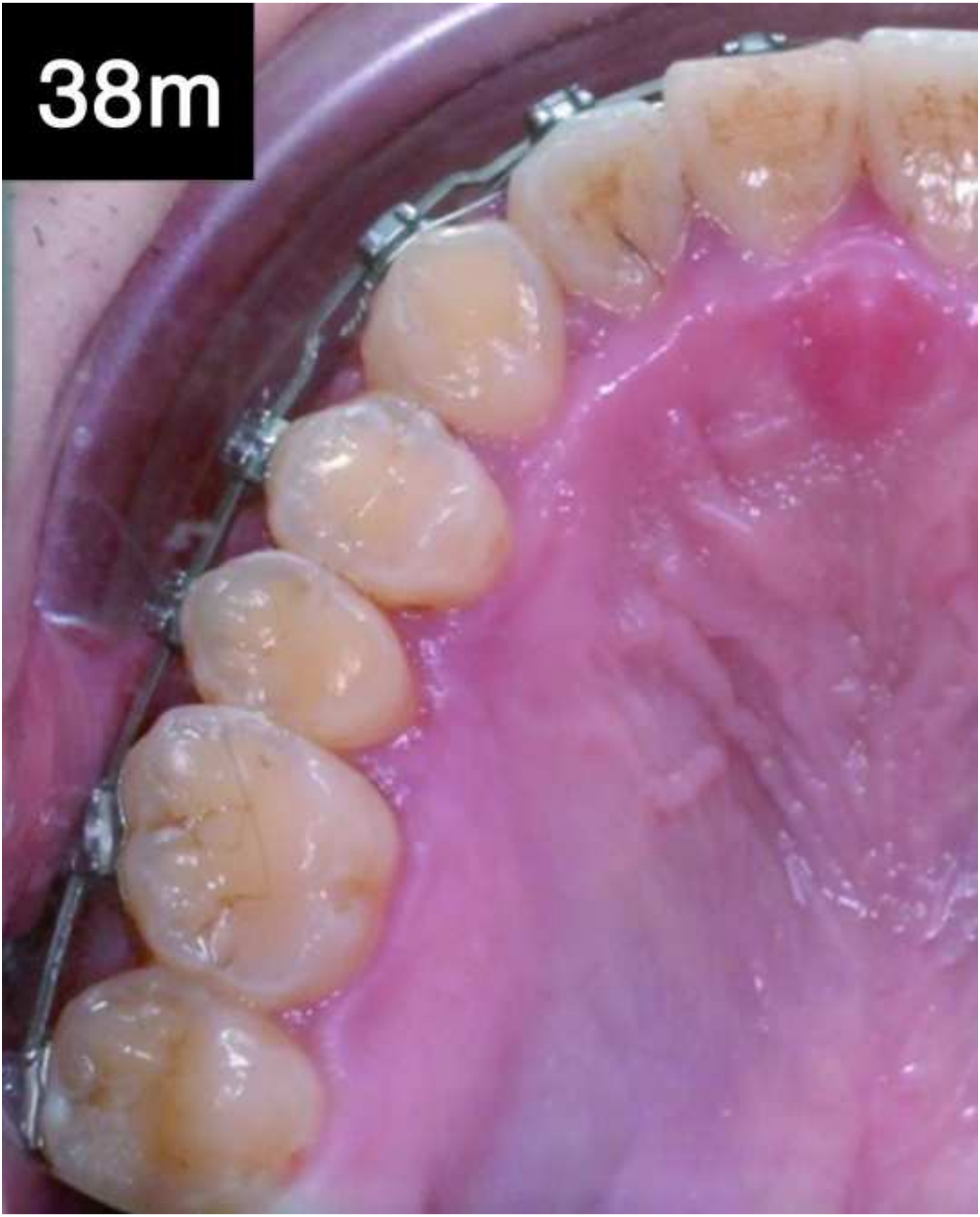

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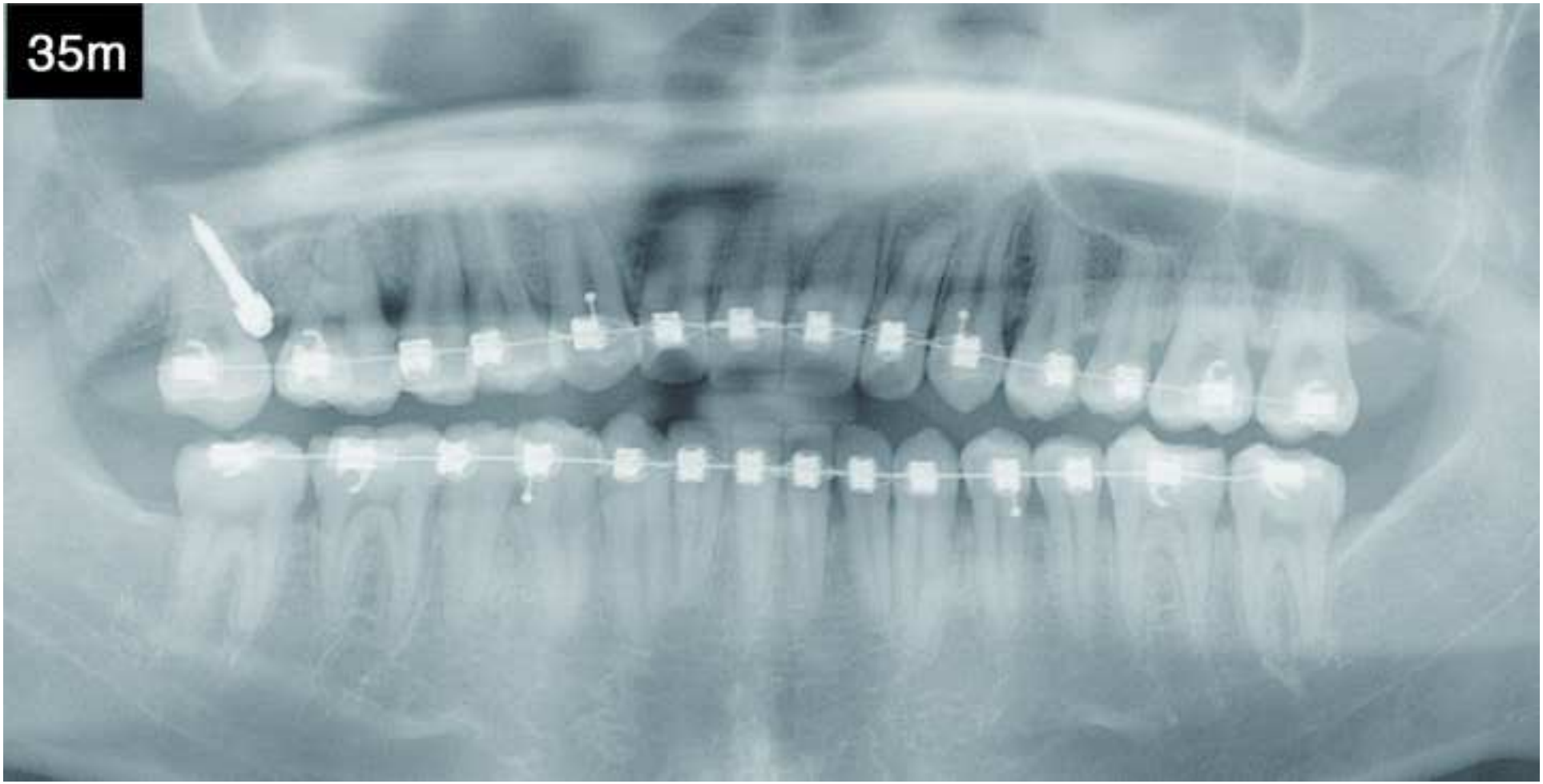

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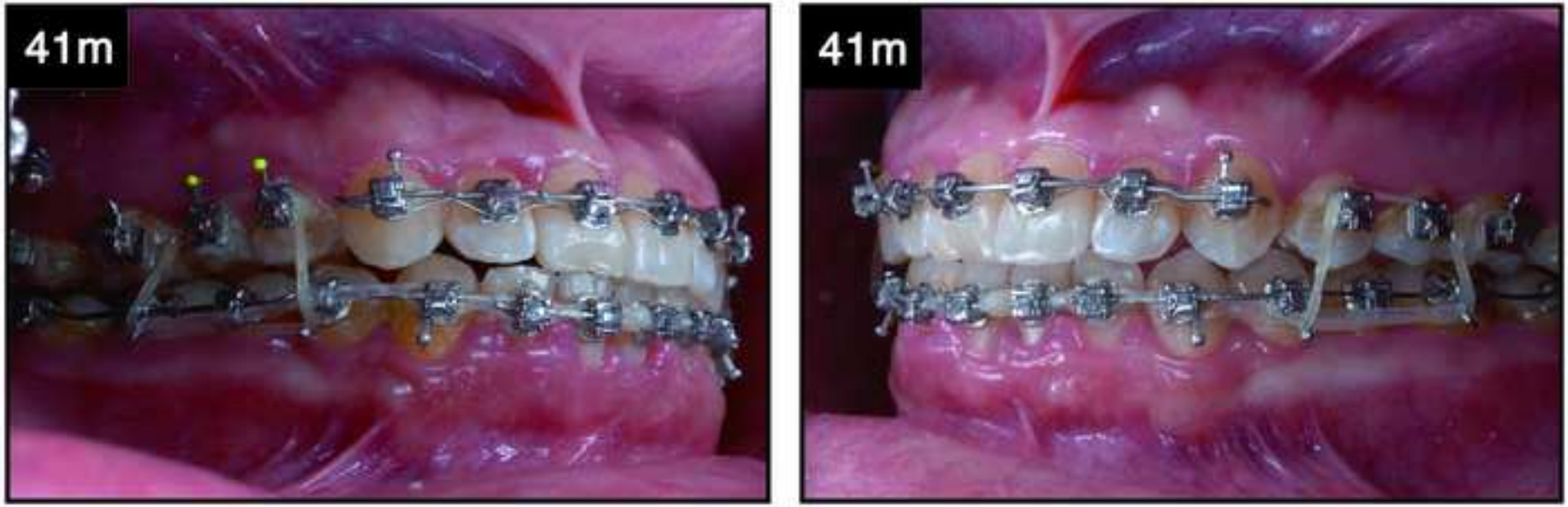

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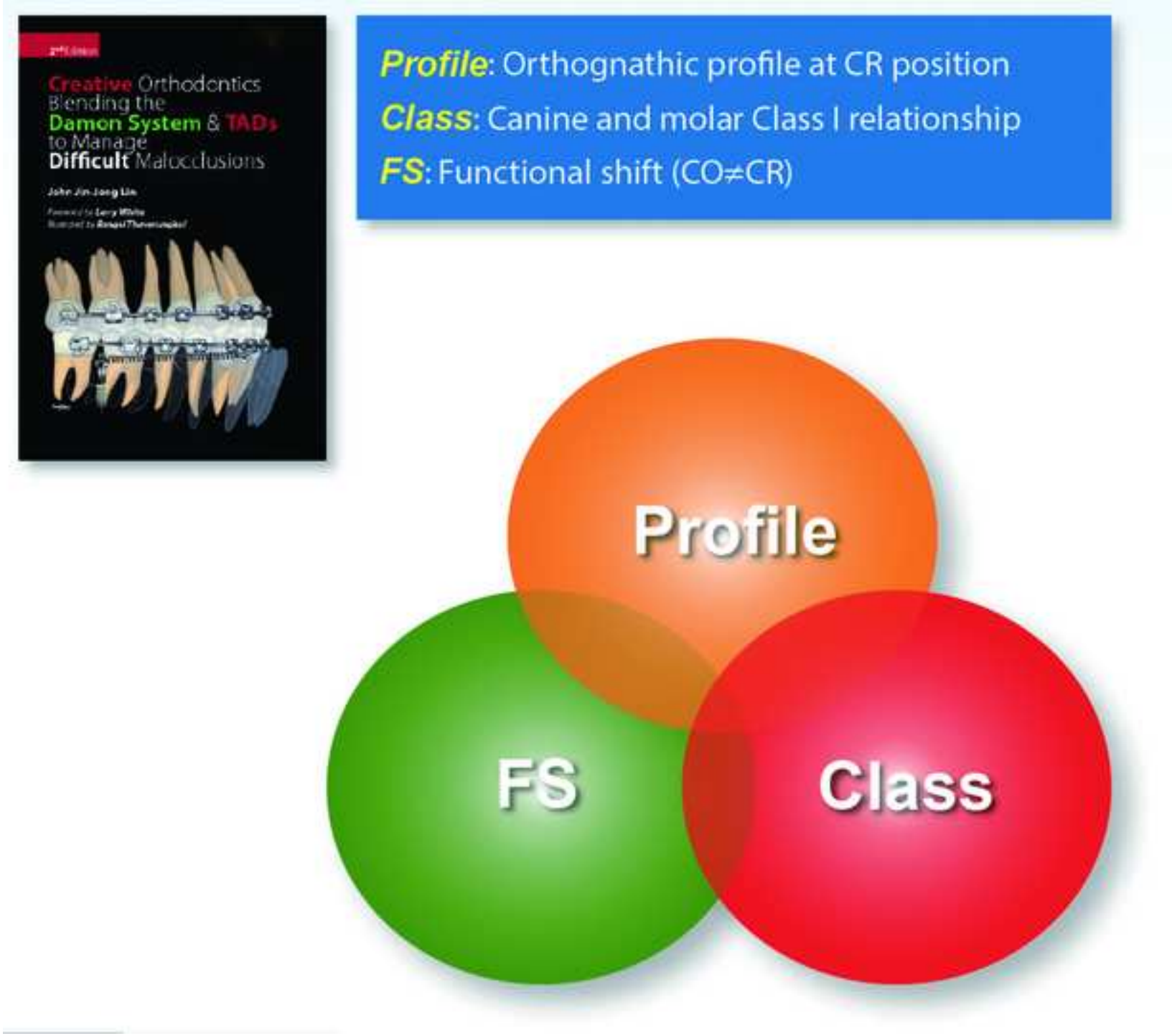

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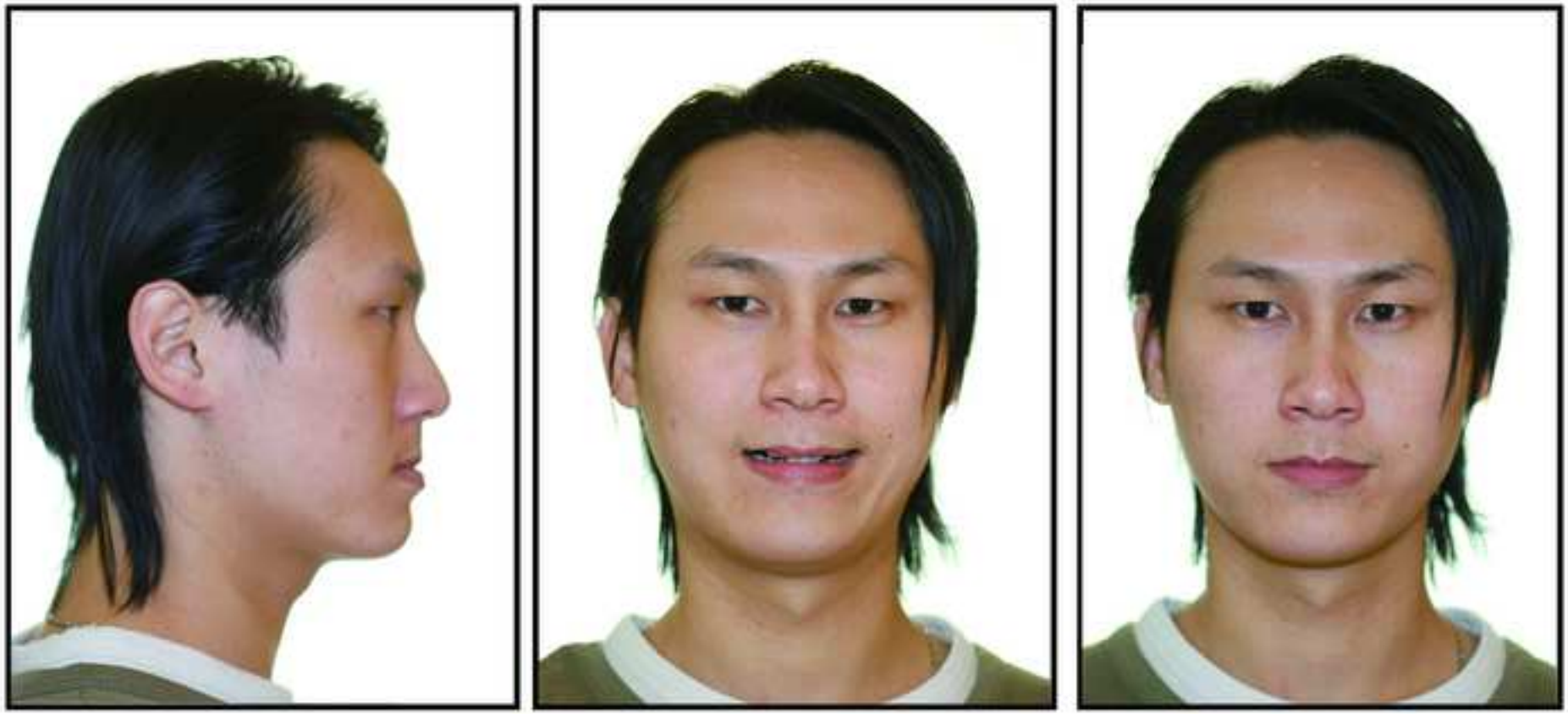

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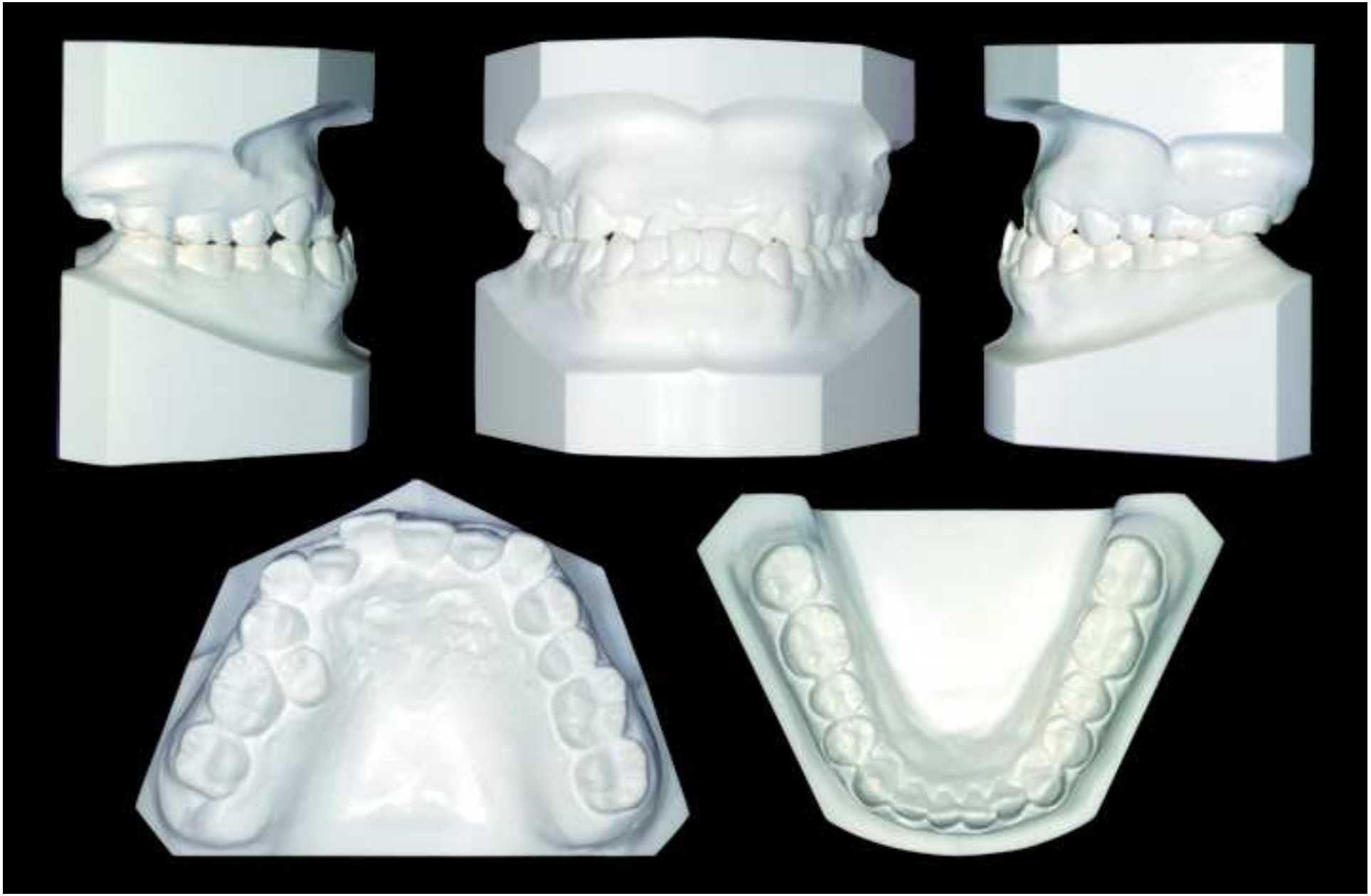

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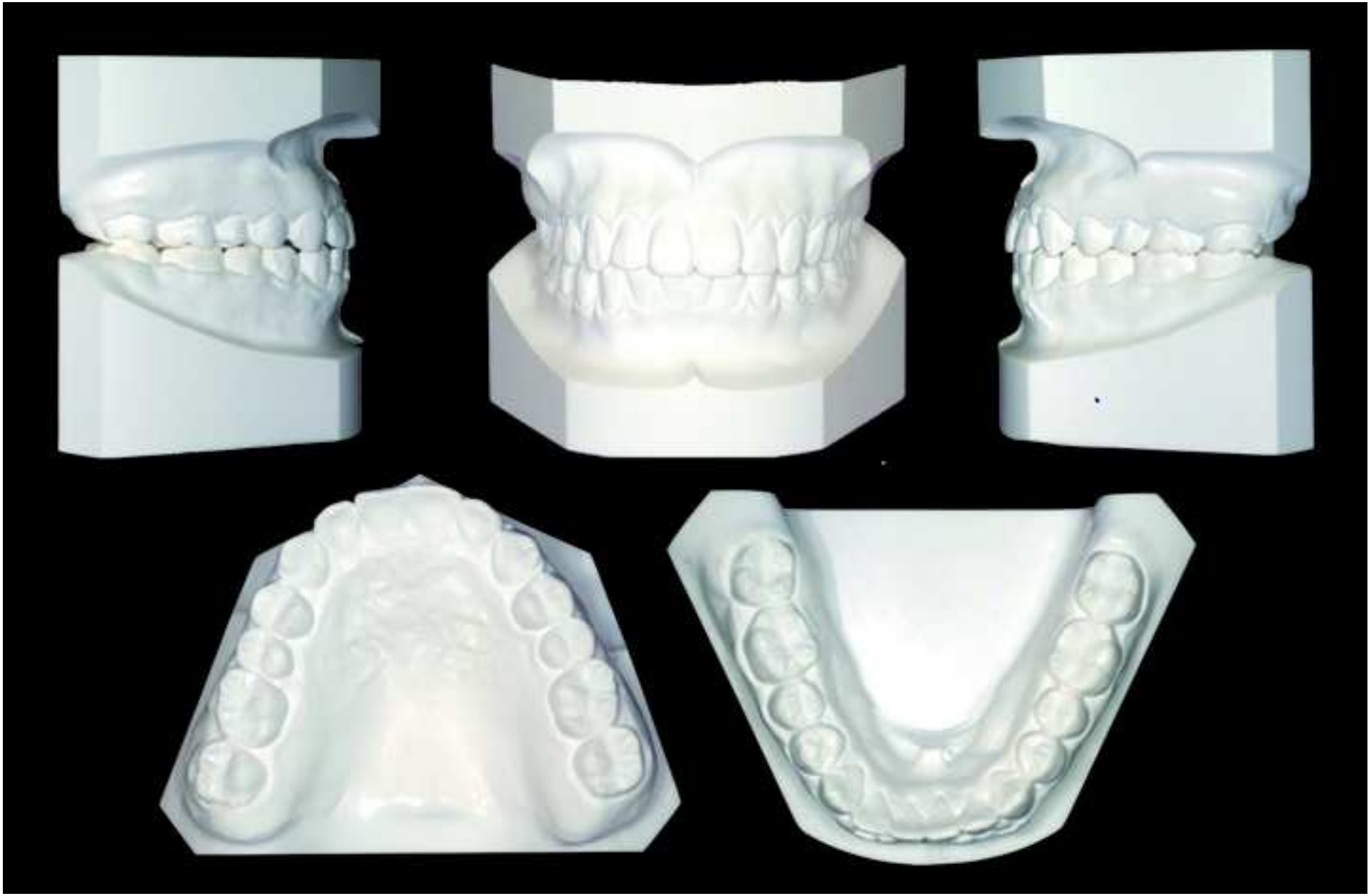

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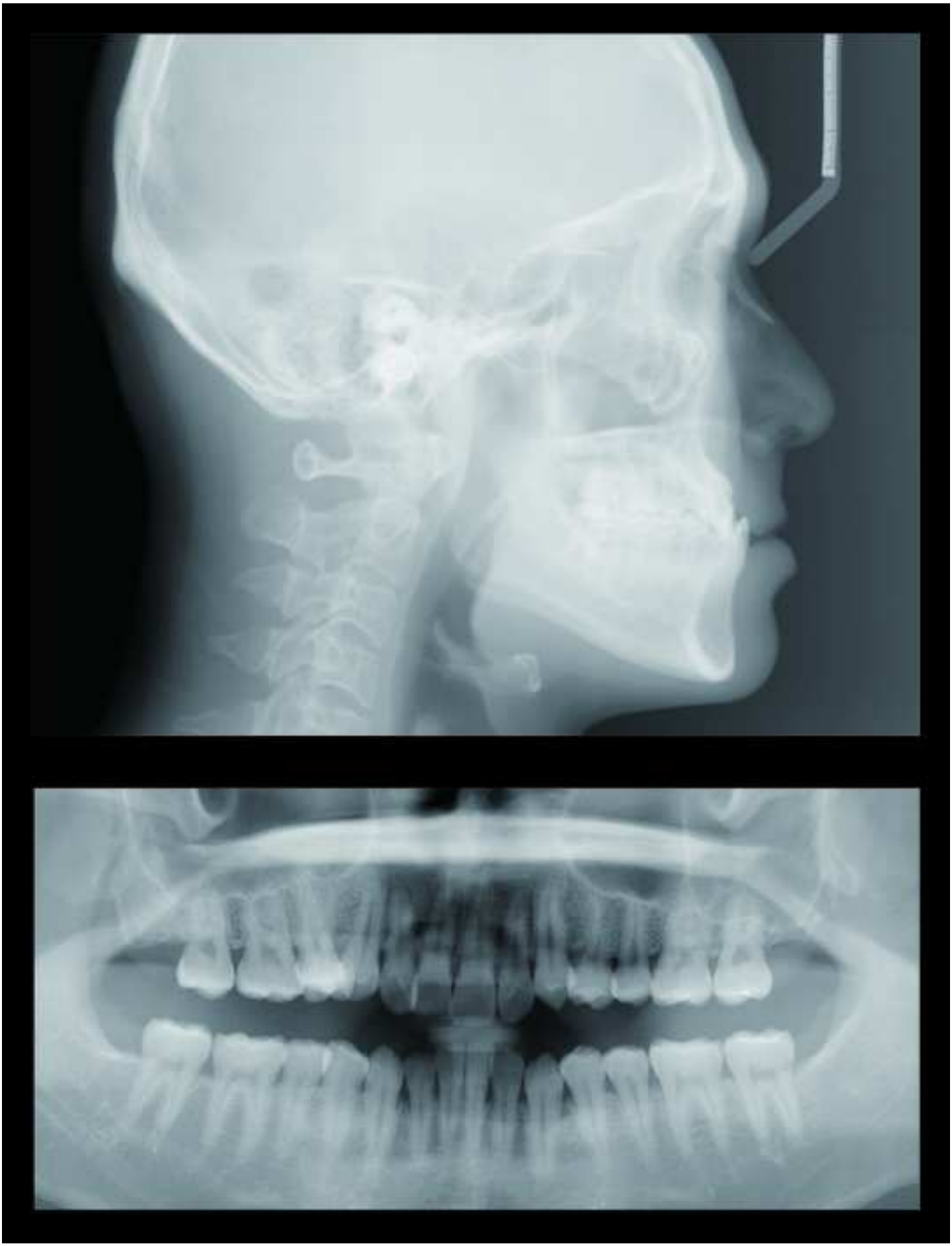

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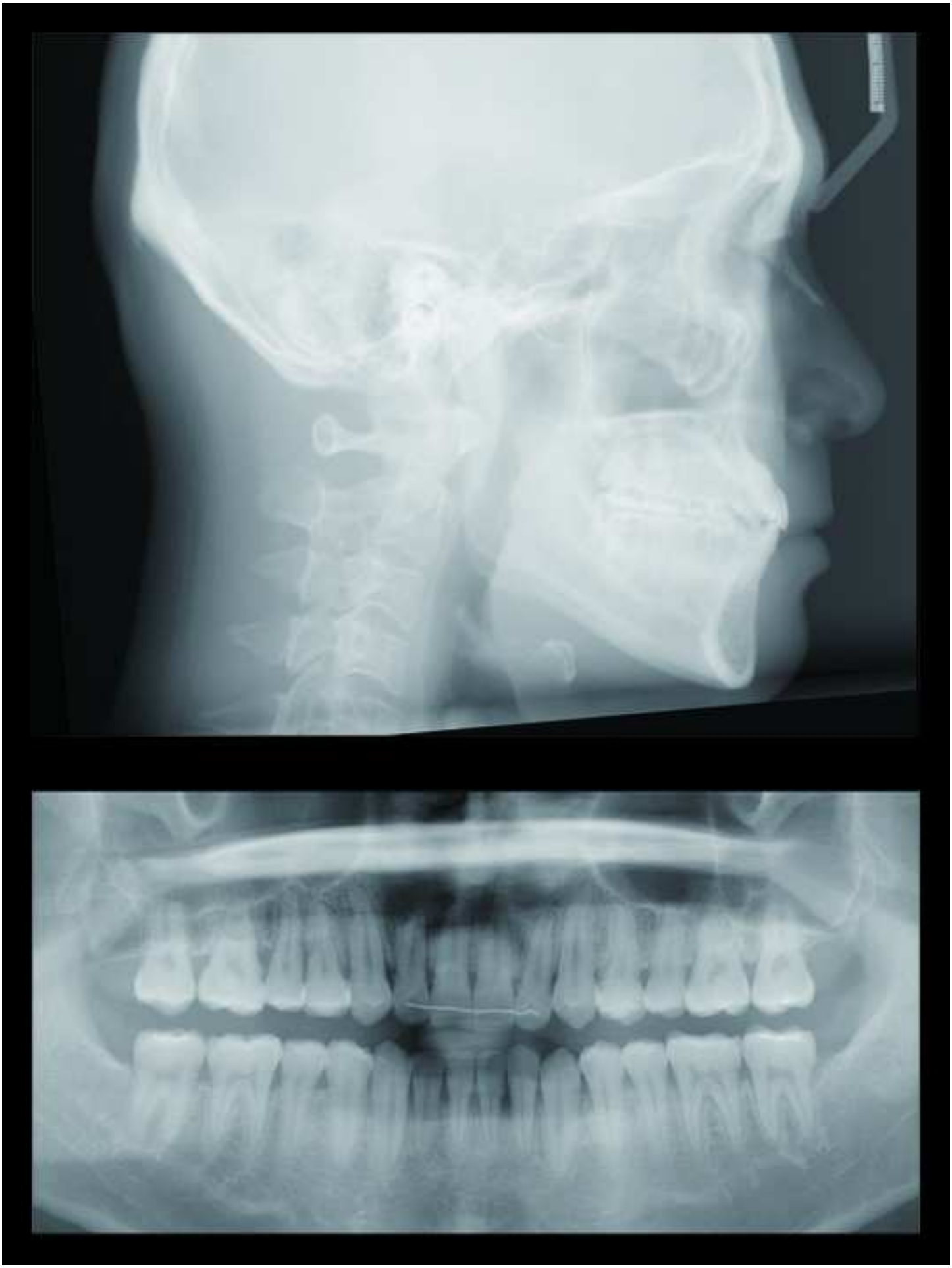

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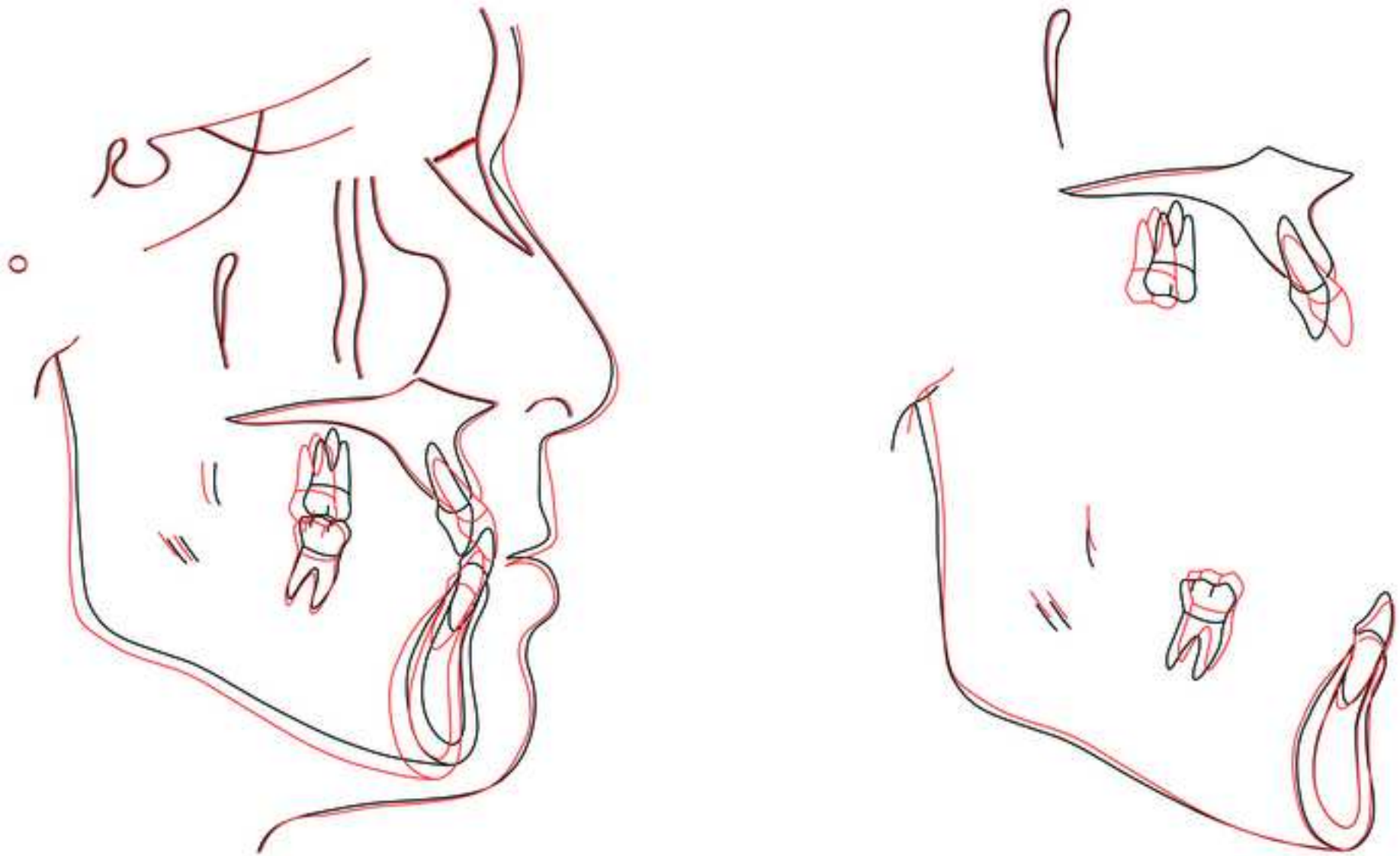

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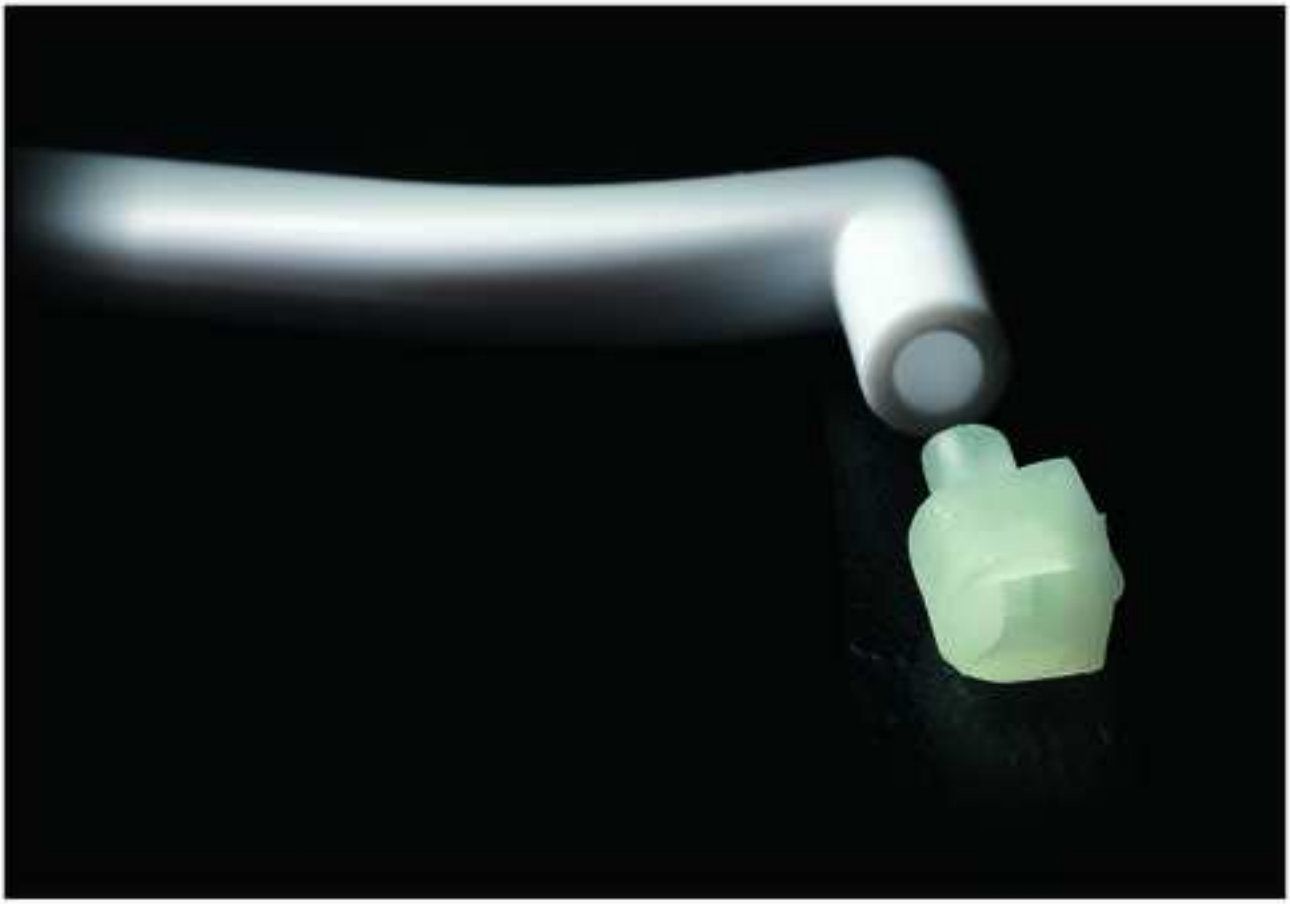

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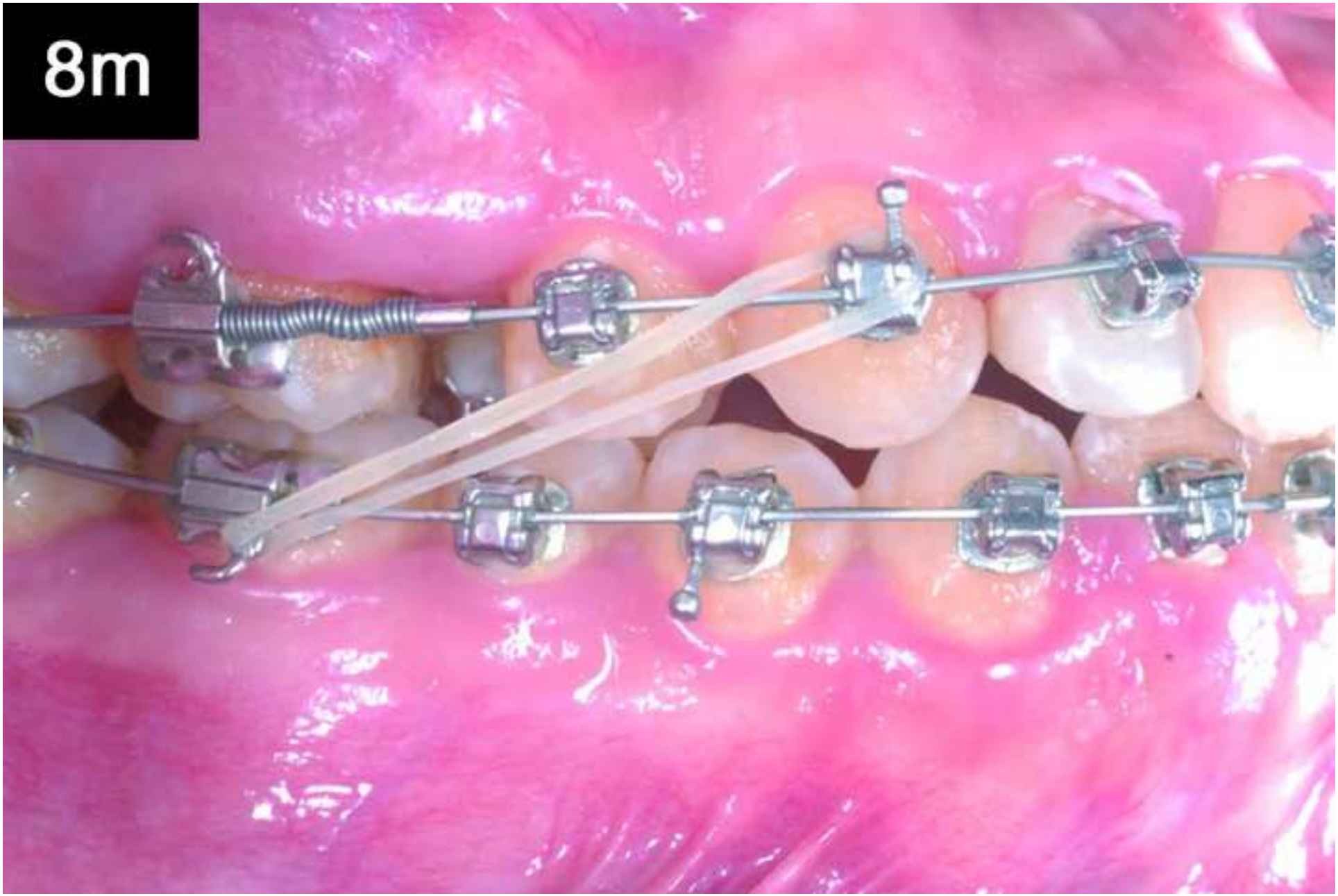

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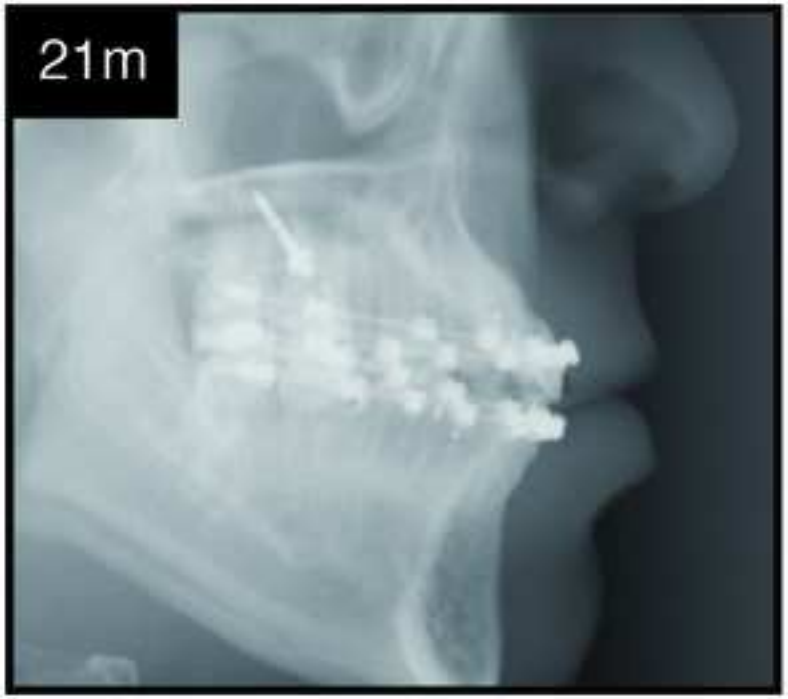

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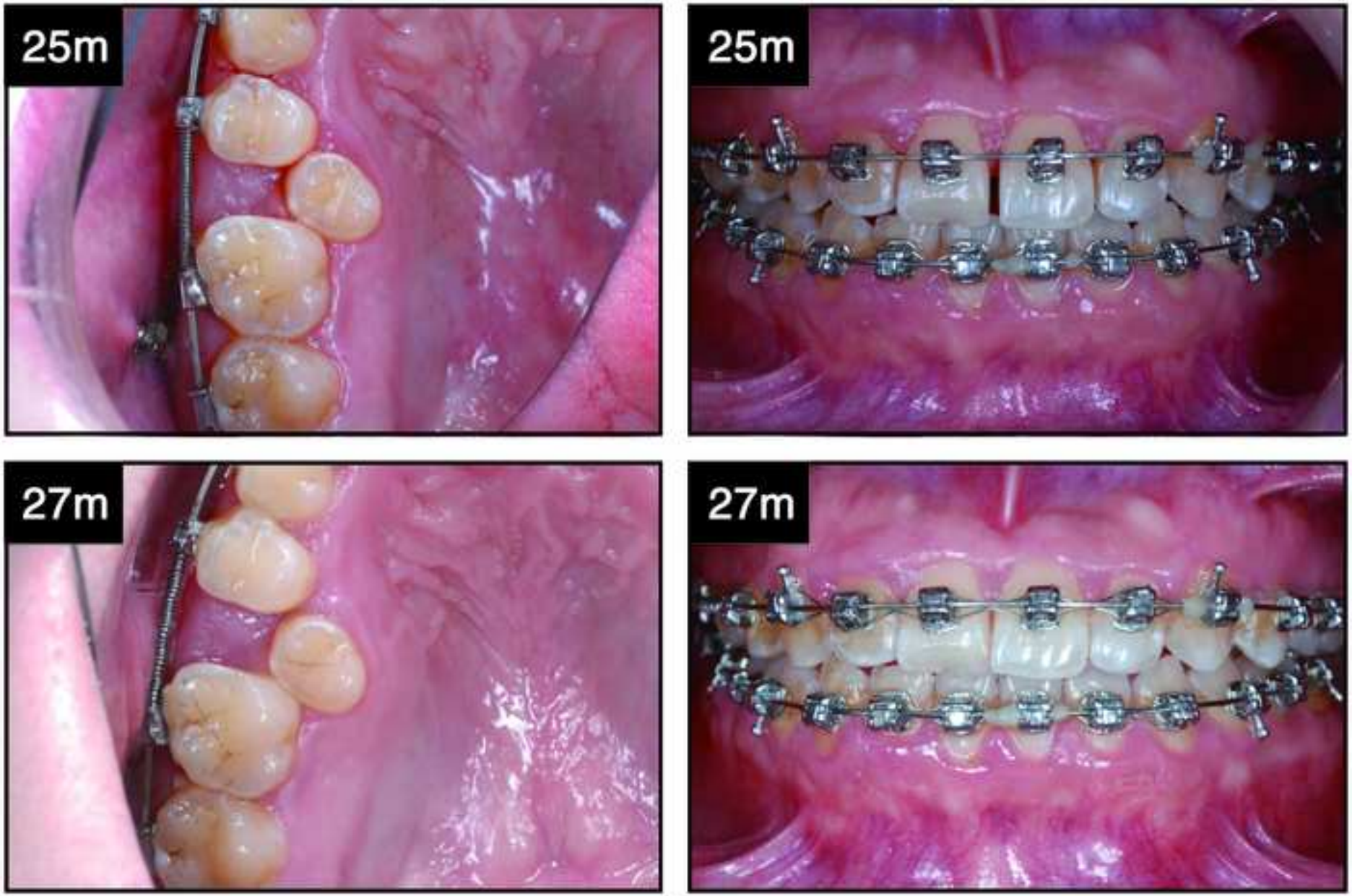

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Table

CEPHALOMETRIC			
SKELETAL ANALYSIS			
	PRE-TX	POST-TX	DIFF.
SNA°	81°	81°	0°
SNB°	84°	82°	2°
ANB°	-3°	-1°	2°
SN-MP°	28°	29°	1°
FMA°	23°	24°	1°
DENTAL ANALYSIS			
U1 TO NA mm	3 mm	7 mm	4 mm
U1 TO SN°	102°	114.5°	12.5°
L1 TO NB mm	3 mm	3 mm	0 mm
L1 TO MP°	88°	91.5°	3.5°
FACIAL ANALYSIS			
E-LINE UL	-5 mm	-4 mm	1 mm
E-LINE LL	-0.5 mm	-2 mm	1.5 mm

Table

DQ Torque			
Torque	**U1**	**U2**	**U3**
High	22	13	11
Std	15	6	7
Low	2	-5	-9
Std upside down	-15	-6	-7

Torque	**L1**	**L2**	**L3**
High	11	11	13
Std	-3	-3	7
Low	-11	-11	0

Table

	Ext.	Not
1. Profile	Protrusion	Straight
2. Md. angle	High	Low
3. Bite	Open	Deep
4. Ant. inclination	Flaring	Flat
5. Crowding	> 7mm	None
6. Decay/missing	Present	????
7. P’t perception	OK	No
8. Etc…		

Table

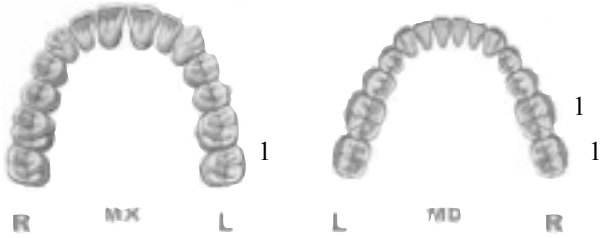
Cast-Radiograph Evaluation

Case # 1 **Patient**

Total Score: 28

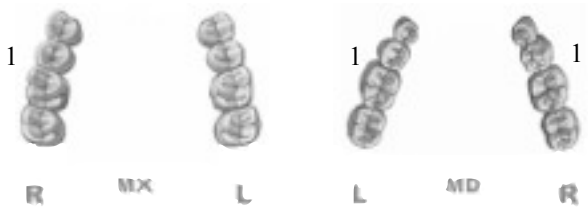
Alignment/Rotations

3



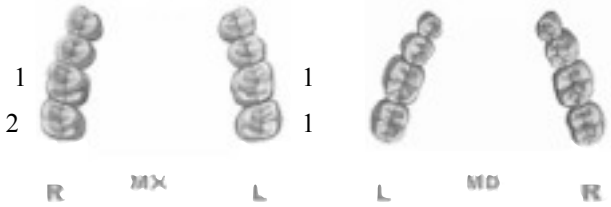
Marginal Ridges

3



Buccolingual Inclination

5

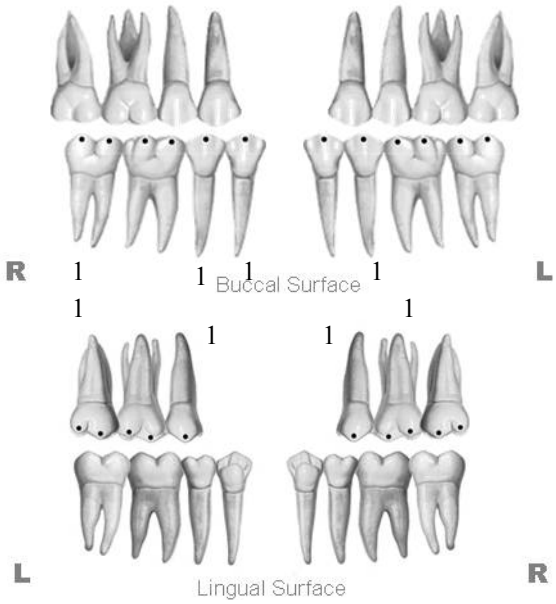


Overjet

4

Occlusal Contacts

8

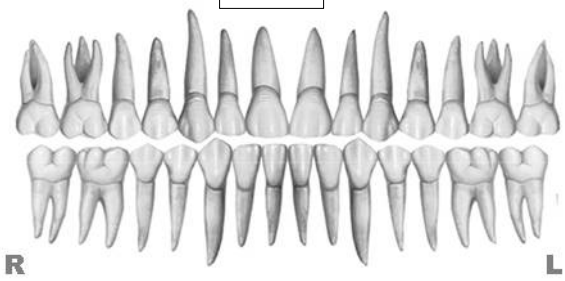


Occlusal Relationships

4

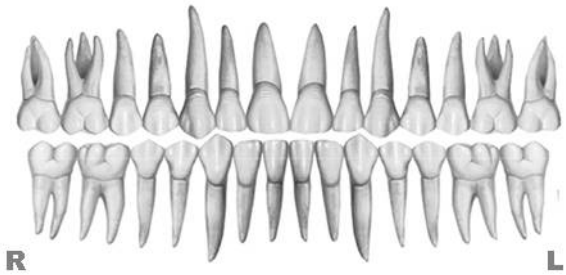
Interproximal Contacts

0



Root Angulation

1 1



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.

Table

Discrepancy Index Worksheet

TOTAL D.I. SCORE 37

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 =

2+ 2+ 2+ 3+ 2+ 2

Total = 13

OVERBITE

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

Total = 3

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 = 7

OCCLUSION

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

Total = 4

LINGUAL POSTERIOR X-BITE

1 pt. per tooth Total = 1

BUCCAL POSTERIOR X-BITE

2 pts. per tooth Total = 0

CEPHALOMETRICS (See Instructions)

ANB ≥ 6° or ≤ -2° = 4 pts.

Each degree < -2° 1 x 1 pt. = 1

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 = 5

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. =	2
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	1 x 2 pts. =	2

Identify: ectopic eruption of #4

Total = 4

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 = 0

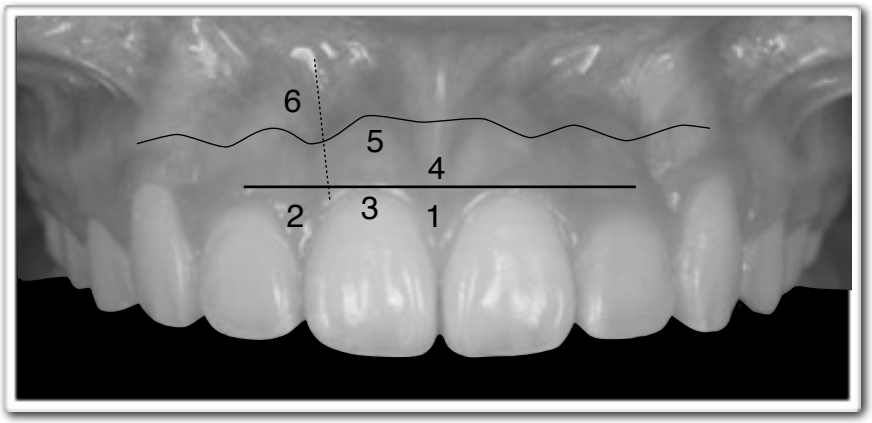
Table

Pink & White Esthetic Score

Total Score: = 3

1. Pink Esthetic Score

Total = 1

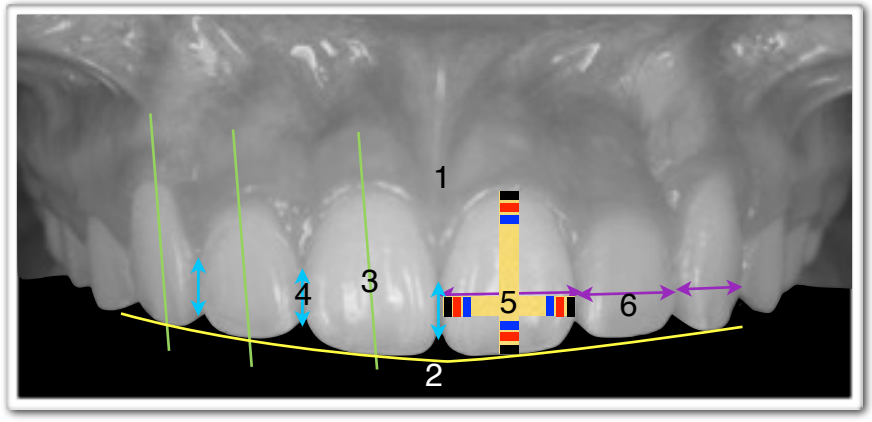


1. M-D Papilla	0 1 2
2. Keratinized Gingiva	0 1 2
3. Curvature of Gingival Margin	0 1 2
4. Level of Gingival Margin	0 1 2
5. Root Convexity (Torque)	0 1 2
6. Scar Formation	0 1 2

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 = 2



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

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

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