Title Page

Article Title:

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

Author names and affiliations:

a. Lee, Angle SA
Director,
Bell Dental Clinic, No. 12, Ln.59, Jiangong 1st Rd., East Dist., HsinChu city 300, Taiwan
E-mail: ivyanpig@gmail.com

b. Chang, Chris CH
Director,
Beethoven Orthodontic Center, No. 6, Ln.59, Jiangong 1st Rd., East Dist., HsinChu city 300, Taiwan
E-mail: beethoven.tw@gmail.com, beeth.oven@hinet.net

c. Roberts, W. Eugene
Affiliations:
- Professor Emeritus of Orthodontics, Indiana University, School of Dentistry, 1121 W. Michigan St. Indianapolis, IN 46202
- Adjunct Professor of Mechanical Engineering, IUPUI, Indianapolis. IN 46202
- Visiting Professor of Orthodontics, Loma Linda University, School of Dentistry, Loma Linda, CA 92350

E-mail: werobert@iu.edu

Corresponding author:

Roberts, W. Eugene
Affiliations:
- Professor Emeritus of Orthodontics, Indiana University, School of Dentistry, 1121 W. Michigan St. Indianapolis, IN 46202
- Adjunct Professor of Mechanical Engineering, IUPUI, Indianapolis. IN 46202
- Visiting Professor of Orthodontics, Loma Linda University, School of Dentistry, Loma Linda, CA 92350

Phone: 317-823-6115 or 317-410-2805
Address: 8260 Skipjack Drive, Indianapolis, IN 46236
E-mail: werobert@iu.edu, werobert@me.com

This is the author's manuscript of the article published in final edited form as:

Lee, S.-A., Chang, C. C. H., & Roberts, W. E. (2018). Severe unilateral scissors-bite with a constricted mandibular arch: Bite turbos and extra-alveolar bone screws in the infrazygomatic crests and mandibular buccal shelf. American Journal of Orthodontics and Dentofacial Orthopedics, 154(4), 554–569. https://doi.org/10.1016/j.ajodo.2017.03.032

***Highlights (for review)**

Highlights

- A severe functional deficit (ABO Discrepancy Index of 25) was associated with a full-buccal unilateral crossbite (Brodie Bite), Class II occlusion, maxillary protrusion, and crowding in both arches.
- Anchorage was provided by extra-alveolar bone screws buccal to the molars in each arch.
- All steps in the mechanics are well documented with clinical photographs and drawings.
- The patient was treated conservatively in 27 months, with no extractions nor orthognathic surgery, to an ABO Cast-Radiograph Evaluation of 22.
- 38-month follow-up records document continuing improvement in dental alignment.

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

Abstract

Introduction: A 33-year-old female presented with a chief complaint of difficulty chewing, due to a constricted lower arch and a unilateral full buccal crossbite (scissors-bite or Brodie bite). She requested minimally invasive treatment, but agreed to anchorage with extra-alveolar (E-A) temporary anchorage devices (TADs) as needed.

Diagnosis: Facial form was convex with protrusive, but competent lips. Skeletally the maxilla was protrusive (SNA 86º) with an ANB 5º. Crowding was 5-mm in the lower arch and 3-mm in the upper arch. The mandibular midline was deviated to the left ~2-mm, which was consistent with a medially and inferiorly displaced right mandibular condyle.

Etiology: Ectopic eruption of the upper right (UR) permanent first molar, to the buccal of the lower first molar cusps, resulted in a 2-mm functional shift of the mandible to the left, which subsequently developed into a full buccal crossbite on the right side.

Treatment: A conservative nonextraction approach was indicated with passive self-ligating brackets. Glass ionomer bite turbos (BTs) were bonded on the occlusal surfaces of the upper left (UL) molars at one month of treatment (1M). The E-A TAD that was indicated was a 2x12-mm OrthoBoneScrew® (OBS), which was inserted in the right mandibular buccal shelf (MBS). Elastomeric chains, anchored by the OBS, extended to lingual buttons bonded on the lingually inclined lower right (LR) molars. Cross elastics were added as secondary uprighting mechanics. The UL BTs were reduced at four months (4M) and removed one month later. At eleven months (11M), BTs were bonded on the lingual surfaces of the upper central incisors, and an OBS was inserted in each infrazygomatic crest (IZC). The Class II relationship was resolved with bimaxillary retraction of the maxillary arch with IZC anchorage and intermaxillary elastics. Inter-proximal reduction was performed to correct the black interdental spaces and the anterior flaring of the incisors.

Results: The scissors-bite and lingually inclined LR posterior segment were sufficiently corrected after 3 months of the treatment to begin normal occlusion in the right posterior segments to intrude the UR molars. The anterior BTs opened space for the extrusion of posterior teeth to level the lower arch, and the IZC bone screws anchored the retraction of the maxillary arch. In 27 months, this difficult malocclusion, with a Discrepancy Index (DI) of 25, was treated to a Cast-Radiograph Evaluation (CRE) of 22 and a Pink & White Esthetic Score of 3.

Introduction

Buccal crossbite is a malocclusion where the palatal cusp of the maxillary tooth is buccal to the buccal cusp of the opposing mandibular dentition; lingual crossbite is where the maxillary buccal cusp is lingual to the buccal cusp tip of the opposing mandibular tooth. Brodie[1] defined a malocclusion as a “Brodie bite” or “Brodie syndrome” when the

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

Diagnosis and Etiology

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

Pre-treatment cephalometrics revealed a protrusive pattern of the maxilla, incisors, and lips (Fig. 5 & Table 1). The panoramic radiograph revealed extrusion of the LR posterior segment (Fig. 6) consistent with the unilateral scissors-bite. The temporomandibular joint (TMJ) radiographs showed no significant difference in the morphology or kinematics (movement) of the right and left condyles in the open and rest (closed) positions (Fig. 7), but the right condylar head in the rest position was more posteriorly and inferiorly positioned, which was consistent with mandibular deviation on closing (Fig. 2). No temporomandibular disorder (TMD) signs or symptoms were reported or clinically evident.

Asymmetric malocclusions such as scissors-bite may be associated with TMD,[6] and the etiology of the buccal crossbite may be genetic, congenital or developmental.[7] There was no history or morphologic evidence of a skeletal or dental anomaly, so the most likely etiology was developmental: a buccal ectopic eruption of the UR first molar at ~age 6 yr. This abnormal eruption pattern produces a functional shift of the mandible that results in the rest of the buccal segment erupting in buccal crossbite during the late transitional stage of dental development (age 10-12 yr).[7] The American Board of Orthodontic (ABO) Discrepancy Index (DI) for the current malocclusion was 25 points, as shown in the supplementary worksheet 1.[8]

Treatment Objectives

1. Correct the unilateral posterior scissors-bite
2. Upright the lingually inclined LR buccal segment
3. Eliminate the occlusal cant due to the extruded UR buccal segment
4. Achieve Class I canine and molar relationships
5. Correct the midline discrepancy
6. Produce an ideal overbite and overjet relationship
7. Optimize the intermaxillary occlusion
8. Correct facial convexity and asymmetry

Treatment Alternatives

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

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

Treatment Progress

An 0.022-in slot Damon Q® fixed appliance (Ormco, Glendora, California) with passive self-ligating (PSL) brackets was selected. Standard torque brackets were bonded on all teeth in the maxillary arch. One month later, the mandibular arch was also bonded with standard torque brackets. The initial archwires were 0.014-in copper-nickel-titanium (CuNiTi). All archwires and orthodontic auxiliaries were produced by the same company. Two occlusal BTs were constructed with Fuji II type II glass ionomer cement (GC America, Alsip IL) on the upper left (UL) molars to increase intermaxillary space to allow the collapsed LR molars to upright with no resistance (Fig. 8). The mechanics to correct the scissors-bite were: (1) an E-A MBS OrthoBoneScrew® (OBS, 2x12-mm, Newton's A Ltd, Hsinchu City, Taiwan) inserted in the LR buccal shelf,[14-17] with two power chains connected from the miniscrew to the two buttons on the lingual side of each LR molar, and (2) two cross elastics (Chipmunk, 1/8-in, 3.5-oz) were applied on UR and LR molars. In the 4th month, the scissors-bite was corrected, so the height of the occlusal BTs were progressively reduced to begin establishing a normal bilateral posterior occlusion.

As molars uprighted, the 6-mm distance between the LR miniscrew and the molar tube decreased to ~0-mm (Fig. 9). The MBS bone screw and occlusal BTs were removed in the 5th month of treatment. The maxillary archwire was changed to 0.014x0.025-in CuNiTi to resolve the remaining rotations, begin torque control, and continue the correction of arch symmetry. In the 6th month, the archwires were changed to 0.017x0.025-in titanium-molybdenum alloy (TMA®) in the maxillary arch and 0.014x0.025-in CuNiTi in the mandibular arch. A lingual crossbite tendency was noted for the left molars; thus, two buttons were bonded on the palatal surfaces of the UL molars to anchorage cross elastics (Chipmunk, 1/8-in, 3.5-oz). In the 7th month, the maxillary archwire was changed to 0.016x0.025-in stainless-steel (SS), which was adjusted to deliver progressive lingual root torque on the right premolar and molar segments to improve the overjet and intermaxillary alignment. The SS archwire was also constricted to develop a more symmetric arch form. An 0.017x0.025-in TMA archwire was placed in the mandibular arch. In the 9th month, the archwire was changed to 0.019x0.025-in SS in the maxillary arch to finalize torque control, with 0.016x0.025-in SS in the mandibular arch to establish symmetry.

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

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

During the detailing phase, the brackets were repositioned to correct marginal ridge discrepancies. Inter-proximal reduction (IPR) reshaped the maxillary and mandibular incisors to eliminate the black interdental spaces and increase the interproximal space between the incisors to resolve anterior flaring (Fig. 10). Two weeks before the completion of active treatment, the maxillary archwire was sectioned distally to the canines, and continuous intermaxillary elastics (Ostrich, 3/4-in, 2-oz) were utilized to settle the posterior occlusion.[18] After 27 months of active treatment, all appliances were removed and retention was accomplished with upper and lower clear overlay retainers, worn nights only after 6 months. Figs. 11a-d are a sequence of intraoral photographs documenting the entire treatment sequence.

Treatment Results

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

The post-treatment panoramic film (Fig. 15) showed good axial inclinations of all teeth except the mandibular molars. The latter displayed a root-mesial axial inclination that resulted in marginal ridge discrepancies (Worksheet 2). The cephalometric film (Fig. 16) and superimposed tracings (Fig. 17) showed that the lip protrusion was corrected. The SNA was decreased from 86° to 85° due to bone modeling during retraction of the maxillary incisors. Both SN-MP and FMA increased 1° due to the clockwise mandibular rotation (Table 1, Fig. 17), which appears to reflect inadequate intrusion of the LR first molar (Fig. 15). The maxillary incisors were retracted and extruded, and the mandibular incisors were retracted and intruded. The maxillary molars were retracted and intruded, but the mandibular molars were retracted and extruded. The post-treatment TMJ transcranial radiographs (Fig. 18) showed condylar heads returned to symmetric morphology and kinematics. The patient did not report any TMD signs or symptoms before, during or after treatment.

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

Discussion

The first consideration for scissor-bite correction is to determine if orthognathic surgery is necessary.[13] A wide variety of orthodontic mechanics have been proposed: intermaxillary cross elastics,[6] TAD anchorage,[9,10,12,13] removable plate with a Ti-Ni wire,[11] transpalatal arch (TPA) with intramaxillary elastics,[20,21] quad-helix,[22] and lingual arch

appliances with intramaxillary elastics.[23] The vertical overlap of a buccal crossbite requires dental intrusion or opening of the bite to correct the cusp in fossa discrepancy. For instance, unilateral cross elastics produce extrusive force that may result in clockwise rotation of the mandible, cant of the occlusal plane, occlusal prematurities and an anterior openbite. In addition, cooperation is a critical factor with a removable plate[11] or cross elastics.[24]

I-R miniscrews are commonly used as skeletal anchorage because they are relatively easy to insert, provide direct anchorage to intrude teeth, and do not require compliance.[10,24-26] However, a scissor bite of multiple teeth with a large vertical overlap is very difficult to correct with orthodontic mechanics, even with bone screw anchorage, especially in an adult. Therefore, most severe scissors-bite cases have been managed with surgical orthodontics.[6,27,28]

The current patient (Figs. 1-4) presented with a scissors-bite of the UR buccal segment that articulated with a lingually tipped LR buccal segment. The extruded UR molars and premolars impinged on the lower gingiva (Fig. 3). Orthognathic surgery is usually indicated for such a severe malocclusion. However, E-A TADs with contralateral bite turbos allowed the opportunity to reverse the etiology of the malocclusion by intruding the UR buccal segment and uprighting the LR buccal segment. There were three steps in the correction process:

1. **Adequate Bite Opening:** A 5-mm posterior open-bite was created with BTs to allow the buccal cusps of the LR molar and premolars to pass the lingual cusps of the opposing upper buccal segment (Fig. 8). The BTs were reduced and eventually removed when the posterior overjet was corrected.
2. **Simultaneous Intrusion and Buccal Tipping:** Elastic chains attached to the lingual buttons on the LR molars pass over the occlusal surfaces and connect to the MBS bone screw. Because of the archwire connecting the teeth, these mechanics intruded and uprighted the entire buccal segment (Figs. 8 and 9). Supplemental cross elastics provided additional lateral force for the crossbite correction. The extrusive force on the lower segment due to the cross elastics was offset by the intrusive force delivered by the elastomeric chains connected to the MBS bone screw. There are three benefits favoring an MBS bone screw compared to I-R bone screw:
    - **a. Prominent Head:** The OBS has a large head with deep undercuts to readily retain elastomeric chains which produces efficient uprighting of the LR segment (Fig. 19).
    - **b. More Buccal Position:** The E-A TAD can be positioned up to 10-mm to the buccal of the lingually tipped molars (Fig. 19). This is adequate space to upright the entire buccal segment with one bone screw. I-R TADs interfere with movement of the teeth and frequent replacement would be necessary (Fig. 19).
    - **c. Variable Head Position:** The OBS head can be positioned as close to the soft tissue as needed. The clinician can screw it in deeper if a more intrusive force component is needed (Fig. 21).
3. **Compatible with Cross Elastics:** An elastomeric chain anchored by an MBS bone screw provides very effective intrusion of the LR molars, which permits the supplemental use of cross elastics. These combined mechanics uprighted the LR molars 6-mm in three months (Figs. 8 & 9).

Severe Class II unilateral scissors-bite was corrected with a minimally invasive approach that reversed the etiology of the malocclusion. This conservative treatment avoided extractions and orthognathic surgery. Once the transverse discrepancy was corrected, IZC bone screws were used as E-A posterior maxillary anchorage to retract the entire maxillary arch. After 16 months of retraction, the patient's profile was corrected (Fig. 22). The patient's occlusion and facial esthetics were stable at 38 months after treatment (Fig. 23), and the second order alignment of the dentition has continued to improve (Fig. 24).

Conclusions

1. E-A bone screws are a minimally invasive approach for resolving severe scissors-bite malocclusion complicated with maxillary protrusion.
2. Uprighting the LR buccal segment with a MBS bone screw provided normal occlusion to intrude the extruded maxillary molars. However, it is important to insure that there is adequate intrusion of upper and lower molars on the affected side to avoid opening the VDO (clockwise rotation of the mandible).
3. Bilateral IZC bone screws were effective for reducing maxillary protrusion by retracting the entire maxillary arch.
4. Correcting axial inclinations in the buccal segments is important for avoiding marginal ridge discrepancies.

Acknowledgment

Thanks to Mr. Paul Head for proofreading this article and Dr. Rungsi Thavarungkul for the beautiful illustrations.

References

1. Brodie AG. Bureau of public relations. Orthodontics. J Am Dent Assoc 1943;30(5):433-8.
2. Sim JM. Minor tooth movement in children. 2nd ed. St Louis: Mosby; 1977. p. 278-300.
3. Van der Linden FPGM, Boersma H. Diagnosis and treatment planning in dentofacial orthopedics. Chicago: Quintessence; 1987. p. 65, 266.
4. Moyers RE. Handbook of Orthodontics. 4th ed. Chicago: Year Book Medical; 1988. p. 392-6.
5. Proffit WR, Fields HW, Sarver DM. Special considerations in treatment for adults. Contemporary orthodontics. 4th ed. St Louis: Mosby 2007;18:639-44.
6. Suda N, Tominaga N, Niinaka Y, Amagasa T, Moriyama K. Orthognathic treatment for a patient with facial asymmetry associated with unilateral scissors-bite and a collapsed mandibular arch. Am J Orthod Dentofacial Orthop 2012;141(1):94-104.
7. Kutin G, Hawes RR. Posterior cross-bites in the deciduous and mixed dentitions. Am J Orthod 1969;56(5):491-504.
8. Cangialosi TJ, Riolo ML, Owens SE, Jr., Dykhouse VJ, Moffitt AH, Grubb JE, Greco PM, English JD, James RD. The ABO discrepancy index: a measure of case complexity. Am J Orthod Dentofacial Orthop 2004;125(3):270-8.
9. Chugh VK, Sharma VP, Tandon P, Singh GP. Brodie bite with an extracted mandibular first molar in a young adult: a case report. Am J Orthod Dentofacial Orthop 2009;137(5):694-700.
10. Jung MH. Treatment of severe scissor bite in a middle-aged adult with orthodontic mini-implants. Am J Orthod Dentofacial Orthop 2011;139(4 Suppl):S154-65.
11. Ohmori H, Ono T. Unilateral scissors bite treated with a removable plate that incorporates a Ti-Ni wire. Orthodontics (Chic.) 2013;14(1):e222-6.
12. Ishihara Y, Kuroda S, Sugawara Y, Kurosaka H, Takano-Yamamoto T, Yamashiro T. Long-term stability of implant-anchored orthodontics in an adult patient with a Class II division 2 malocclusion and a unilateral scissors-bite. Am J Orthod Dentofacial Orthop 2014;145(4 Suppl):S100-13
13. Kim KA, Yu JJ, Chen Y, Kim SJ, Kim SH, Nelson G. Surgery versus nonsurgery option for scissors bite treatment. J Craniofac Surg 2015;26(8):e726-9.

14. Chang CH, Huang C, Roberts WE. 3D cortical bone anatomy of the mandibular buccal shelf: a CBCT study to define sites for extra-alveolar bone screws to treat Class III malocclusion. Int J Orthod Implantol 2016;41:74-82

15. Chang CH, Liu SSY, Roberts WE. Primary failure rate for 1680 extra-alveolar mandibular buccal shelf mini-screws placed in movable mucous or attached gingiva. Angle Orthod 2015;85:905-10.

16. Chang CH, Roberts WE. Stability of mini-screws on buccal shelves: a retrospective study of 1680 mini-screw insertions by the same orthodontists. Int J Orthod Implantol 2013;30:76-8.

17. Chang CH, Roberts WE. A Retrospective Study of the Extra- alveolar Screw Placement on Buccal Shelves. Int J Orthod Implantol 2013;32:80-9.

18. Steffen JM, Haltom FT. The five-cent tooth positioner. J Clin Orthod 1987;21(8):528-9.

19. Casko JS, Vaden JL, Kokich VG, Damone J, James RD, Cangialosi TJ, Riolo ML, Owens SE, Jr., Bills ED. Objective grading system for dental casts and panoramic radiographs. American Board of Orthodontics. Am J Orthod Dentofacial Orthop 1998;114(5):589-99.

20. Kucher G, Weiland FJ. Goal-oriented positioning of upper second molars using the palatal intrusion technique. Am J Orthod Dentofacial Orthop 1996;110(5):466-8.

21. Nakamura S, Miyajima K, Nagahara K, Yokoi Y. Correction of single-tooth crossbite. J Clin Orthod 1995;29(4): 257-62.

22. Nojima K, Takaku S, Murase C, Nishii Y, Sueishi K. A case report of bilateral Brodie bite in early mixed dentition using bonded constriction quad-helix appliance. Bull Tokyo Dent Coll 2011;52(1):39-46.

23. Lim KF. Correction of posterior single-tooth crossbite. J Clin Orthod 1996;30(5):276.

24. Tamamura N, Kuroda S, Sugawara Y, Takano-Yamamoto T, Yamashiro T. Use of palatal miniscrew anchorage and lingual multi-bracket appliances to enhance efficiency of molar scissors-bite correction. Angle Orthod 2009;79(3): 577-84.

25. Ishihara Y, Kuroda S, Sugawara Y, Kurosaka H, Takano-Yamamoto T, Yamashiro T. Long-term stability of implant-anchored orthodontics in an adult patient with a Class II Division 2 malocclusion and a unilateral molar scissors-bite. Am J Orthod Dentofacial Orthop 2014;145(4 Suppl):S100-13.

26. Park HS, Kwon OW, Sung JH. Uprighting second molars with micro-implant anchorage. J Clin Orthod 2004;38(2): 100-3; quiz 92.

27. Ramsay DS, Wallen TR, Bloomquist DS. Case report MM. Surgical-orthodontic correction of bilateral buccal crossbite (Brodie syndrome). Angle Orthod 1990;60(4):305-11.

28. Shimazaki K, Otsubo K, Yonemitsu I, Kimizuka S, Omura S, Ono T. Severe unilateral scissor bite and bimaxillary protrusion treated by horseshoe Le Fort I osteotomy combined with mid-alveolar osteotomy. Angle Orthod 2014;84(2):374-9.

FIGURE LEGENDS

Fig. 1: Pre-treatment facial and intraoral photographs

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

Fig. 3: Dental casts showed UR premolars and molars impinge on the mandibular gingiva.

Fig. 4: Pre-treatment dental models (casts)

Fig. 5: Pre-treatment lateral cephalometric radiograph

Fig. 6: Pre-treatment panoramic radiograph

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

Fig. 8: In the 1st month of treatment, 0.014-in CuNiTi archwires were placed in both arches. Elastomeric chains from the lingual buttons on the LR molars were activated with the MBS bone screw (yellow arrow).

a. BTs were added to the occlusal surfaces of the UL molars (green arrow).

b. A buccal view of the BTs (green arrow) shows that the bite is opened about 5-mm.

c. Cross elastics supplement the lateral force (white arrows) of the elastomeric chains that are

d. attached to the MBS bone screw (yellow arrows).

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

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

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

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

Fig. 11a: The frontal view of the treatment sequence is shown pre-treatment and after brackets were bonded on the upper arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

Fig. 11b: The right lateral view of the treatment sequence is shown pre-treatment and after brackets were bonded on the upper arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

Fig. 11c: The left lateral view of the treatment sequence is shown pre-treatment and after brackets were bonded on the upper arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

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

Fig. 11e: The mandibular occlusal view of the treatment sequence is shown pre-treatment and after brackets were bonded on the upper arch (0M). Progress is shown at treatment times in months: 1M, 4M, 10M, 16M, 24M, and 27M.

Fig. 12: Post-treatment facial and intraoral photographs

Fig. 13: The right lateral views of the pre- and post-treatment dental casts show the intrusion of the UR posterior teeth, relative to a dotted red line marking the plane of the desired gingival margins. Note that the LR posterior teeth are not visible on the pre-treatment cast.

Fig. 14: Post-treatment dental models (casts)

Fig. 15: Post-treatment panoramic radiograph

Fig. 16: Post-treatment lateral cephalometric radiograph

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

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

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

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

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

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

Fig. 23: 38-month follow-up facial and intraoral photographs

Fig. 24: 38-month follow-up panoramic radiograph

Table 1. Cephalometric summary

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
Click here to download high resolution image

Figure 2
Click here to download high resolution image

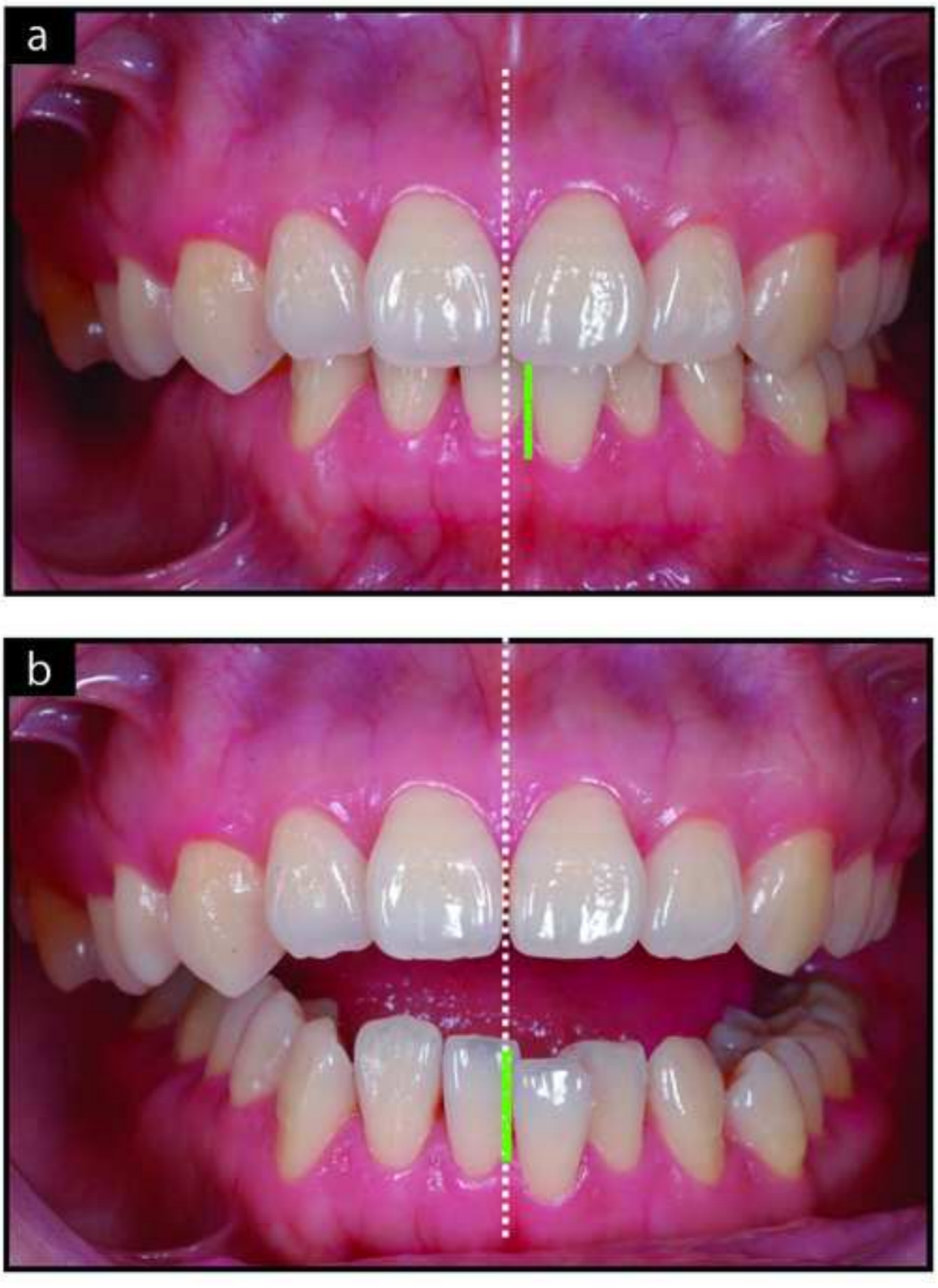


Figure 3
Click here to download high resolution image

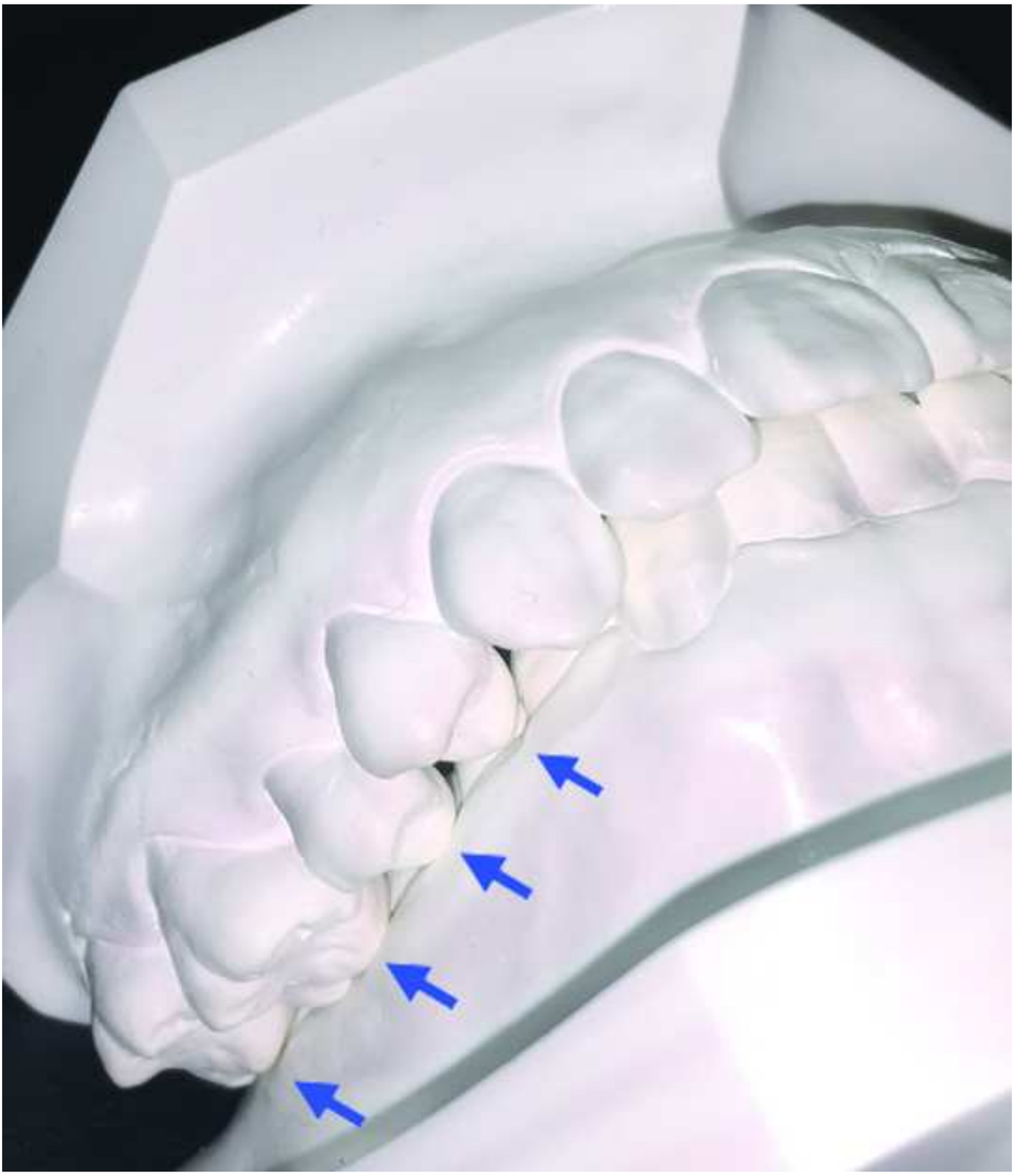


Figure 4

Click here to download high resolution image

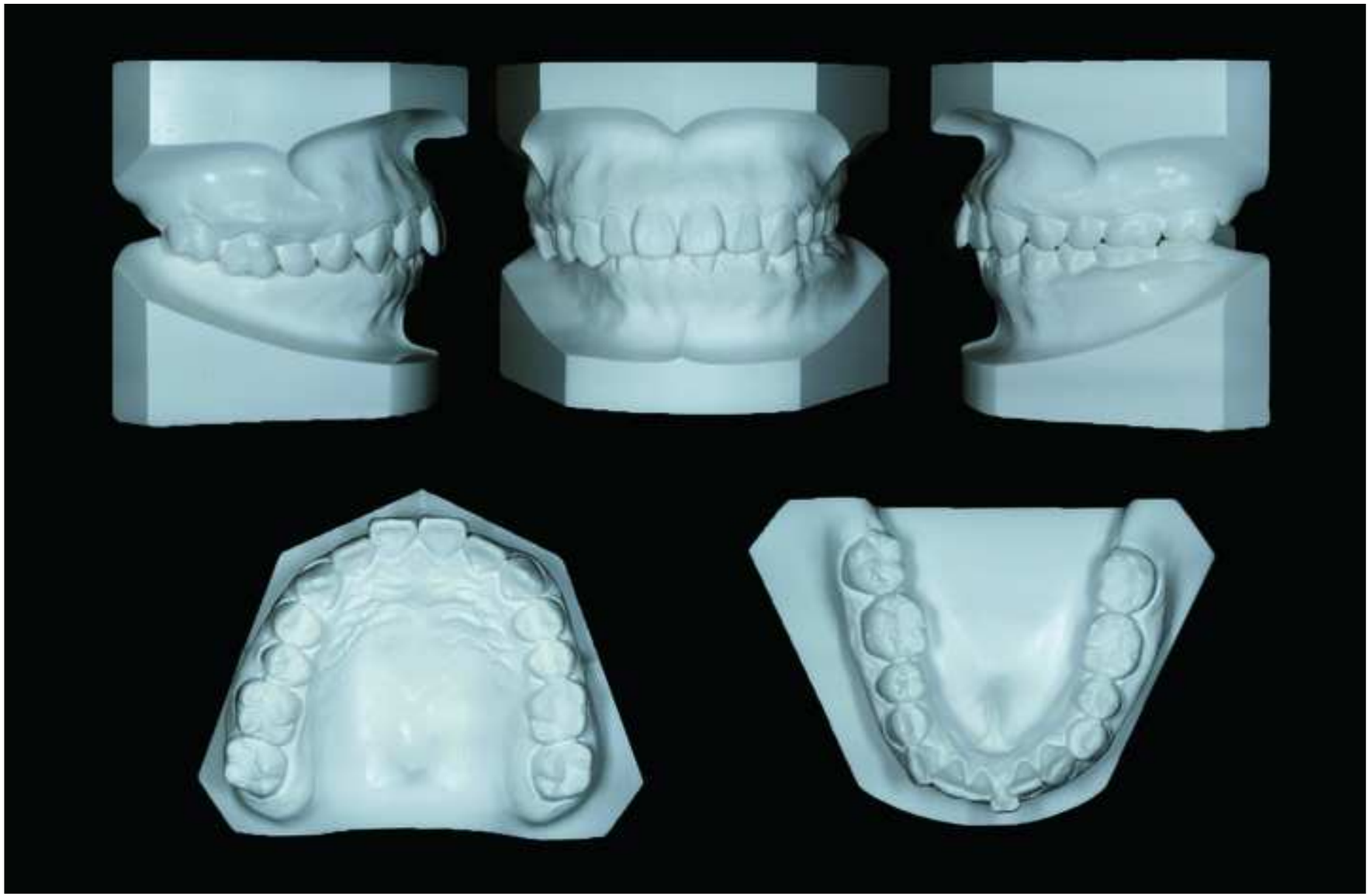


Figure 5

Click here to download high resolution image

Figure 6

Click here to download high resolution image

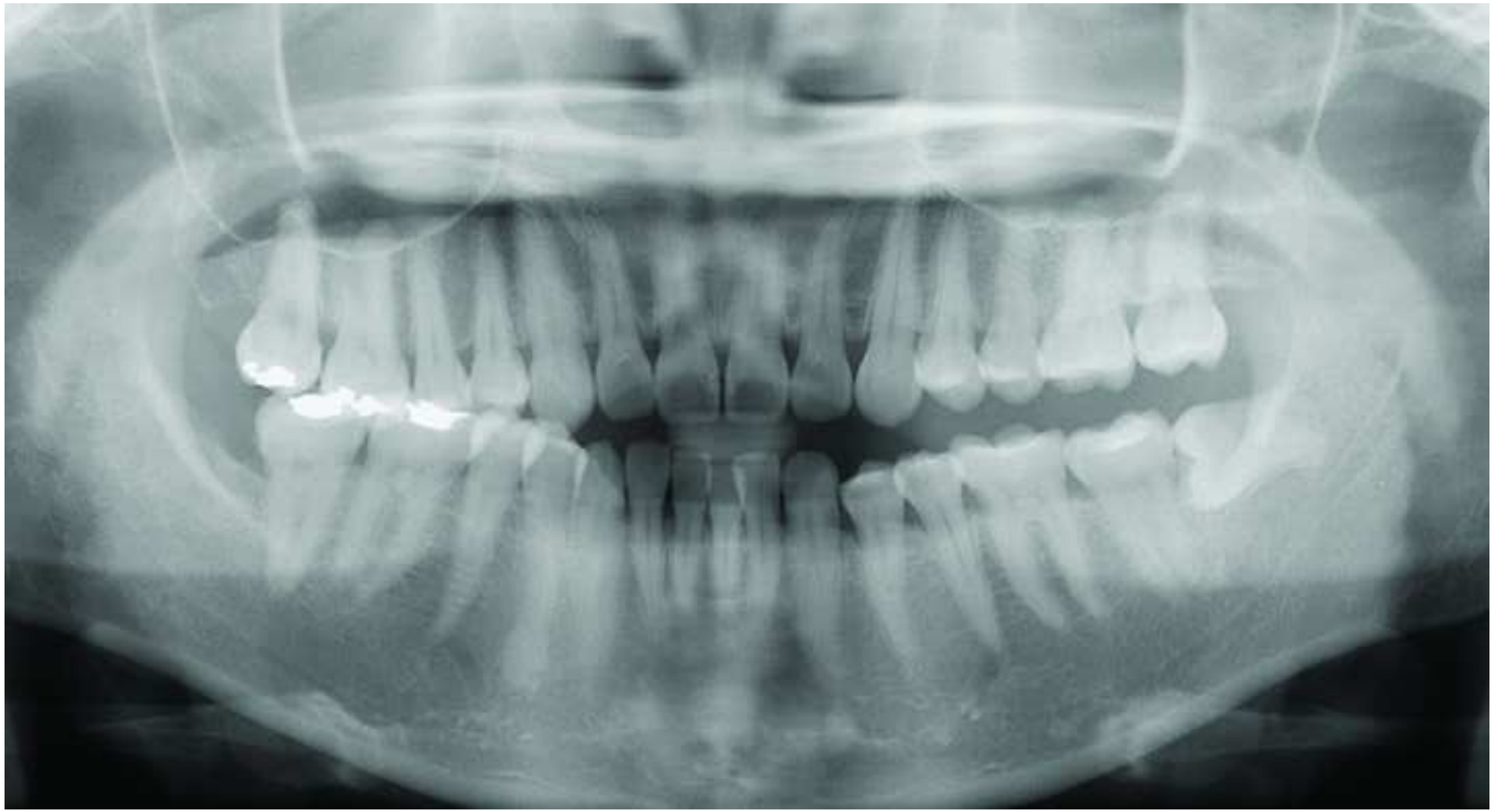


Figure 7
Click here to download high resolution image

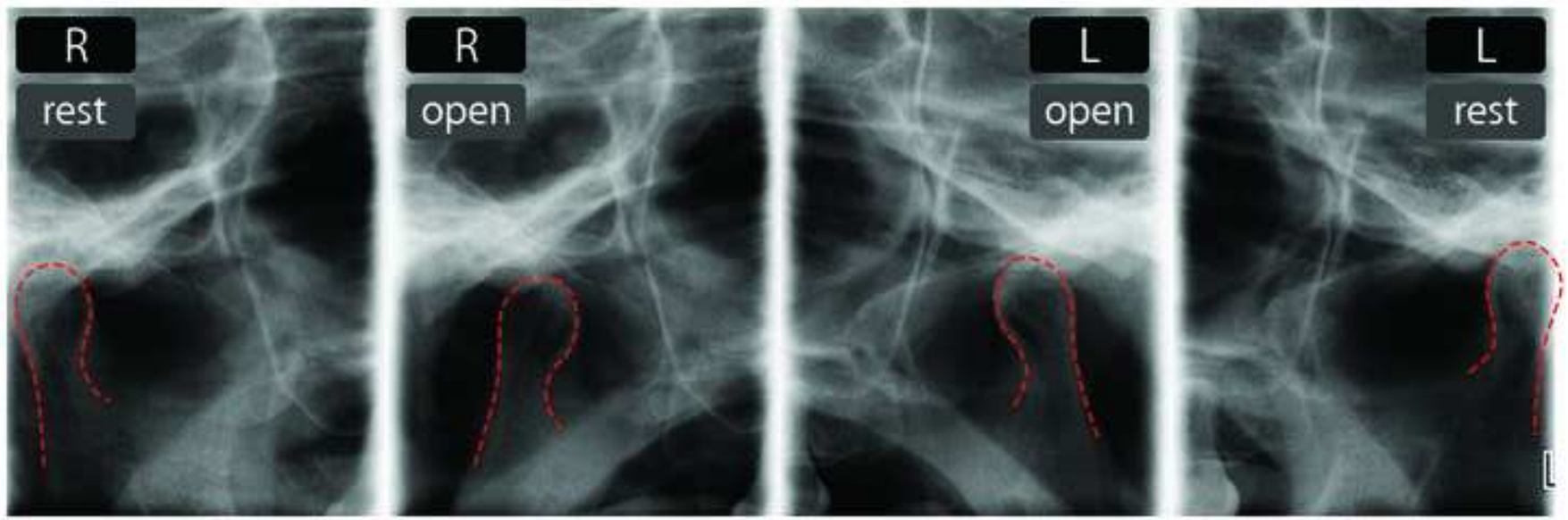


Figure 8

Click here to download high resolution image

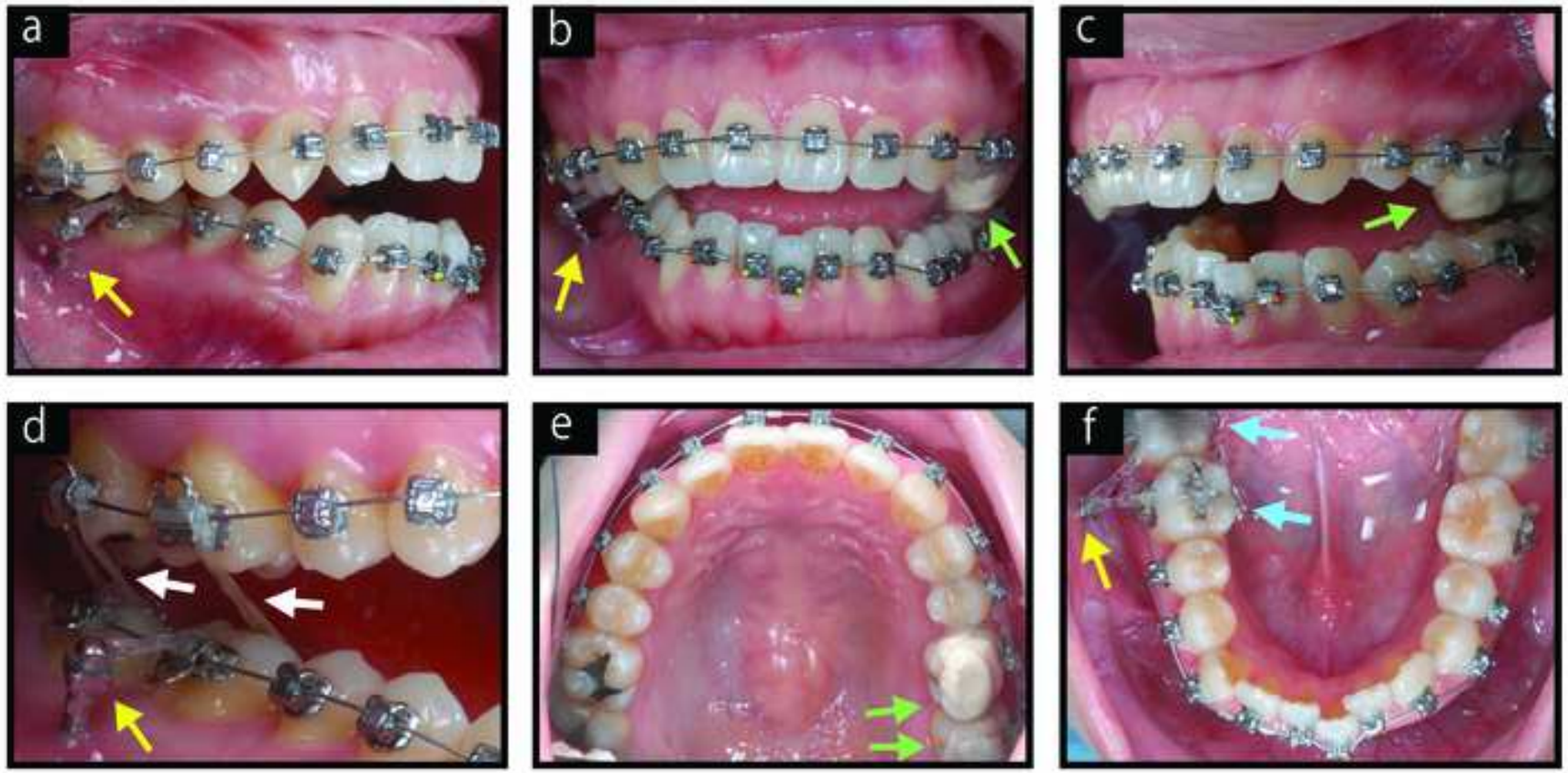


Figure 9
Click here to download high resolution image

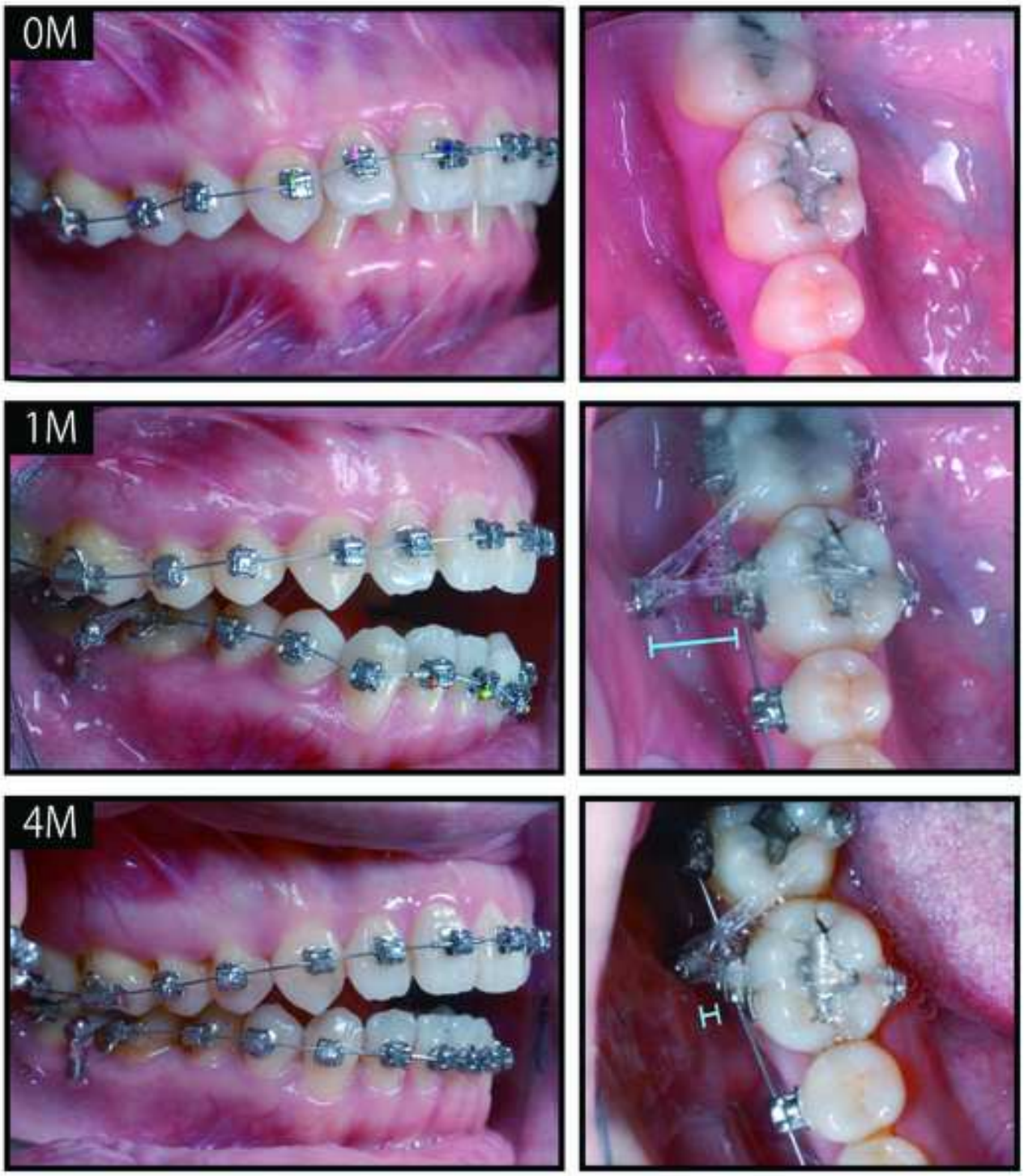


Figure 10
Click here to download high resolution image

Figure 11a
Click here to download high resolution image

Figure 11b

Click here to download high resolution image

Figure 11c
Click here to download high resolution image

Figure 11d

Click here to download high resolution image

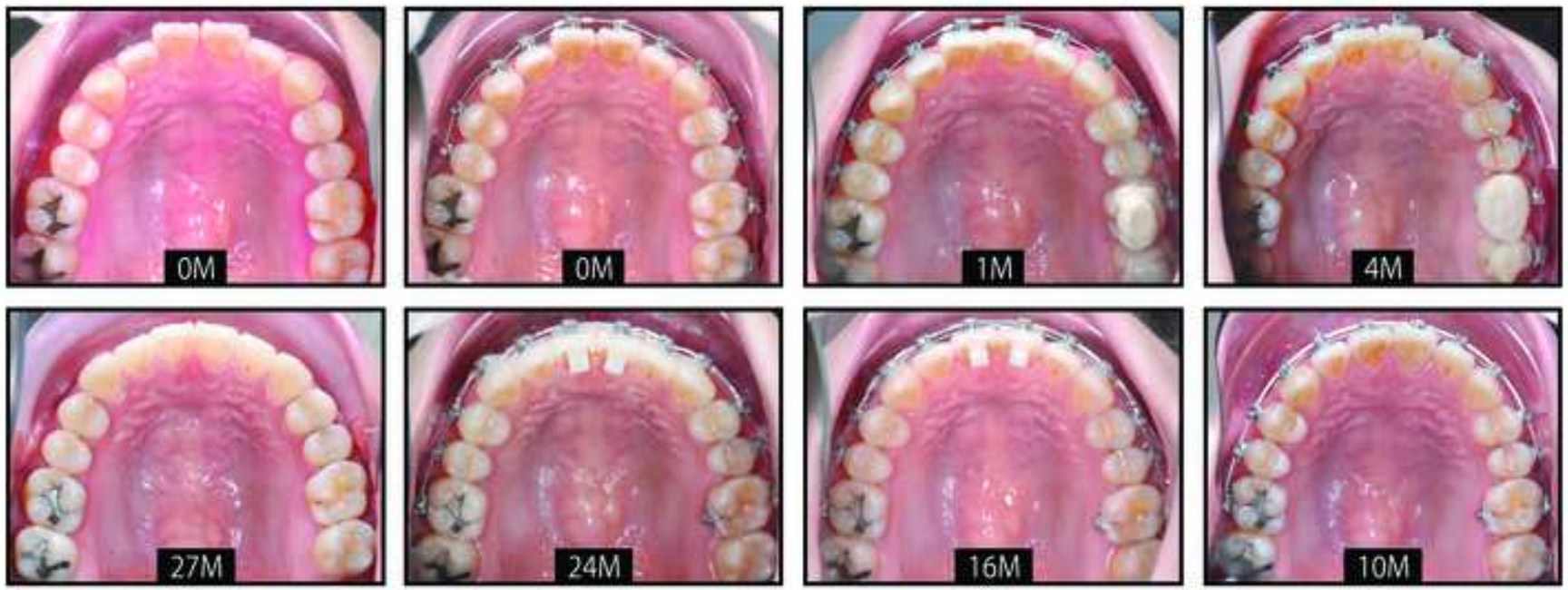


Figure 11e
Click here to download high resolution image

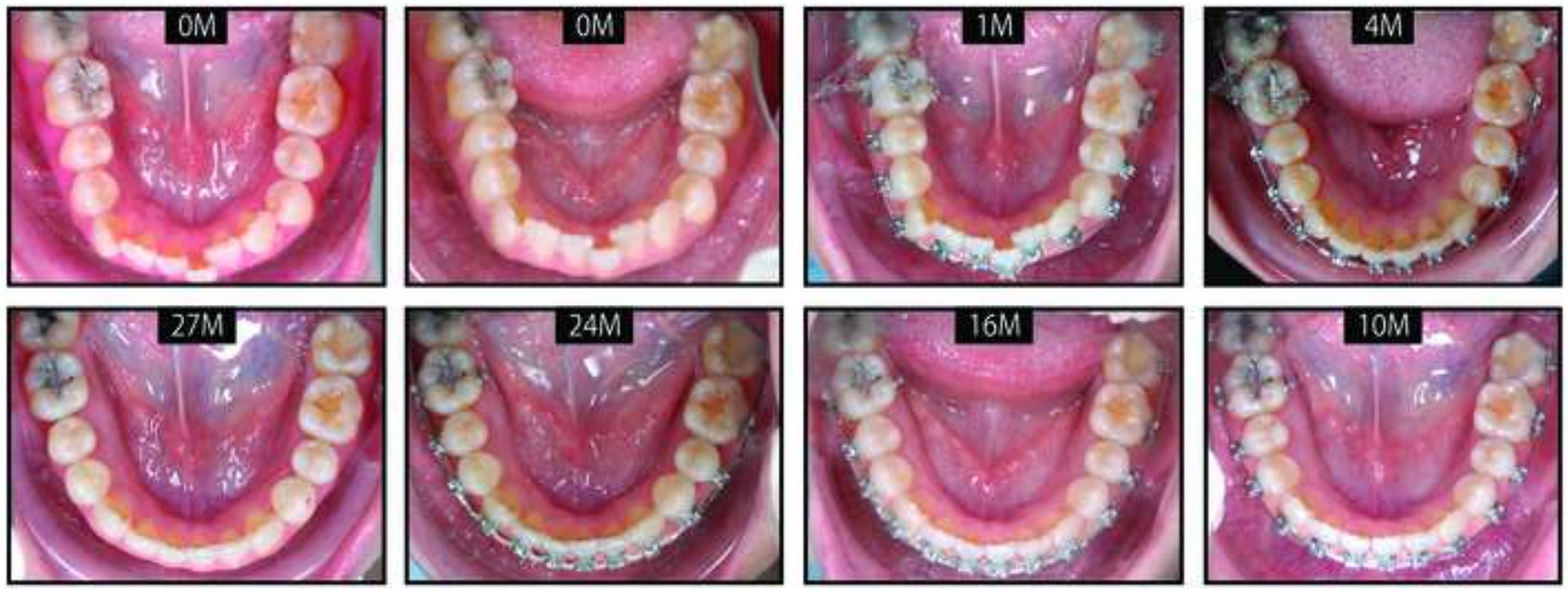


Figure 12
Click here to download high resolution image

Figure 13
Click here to download high resolution image

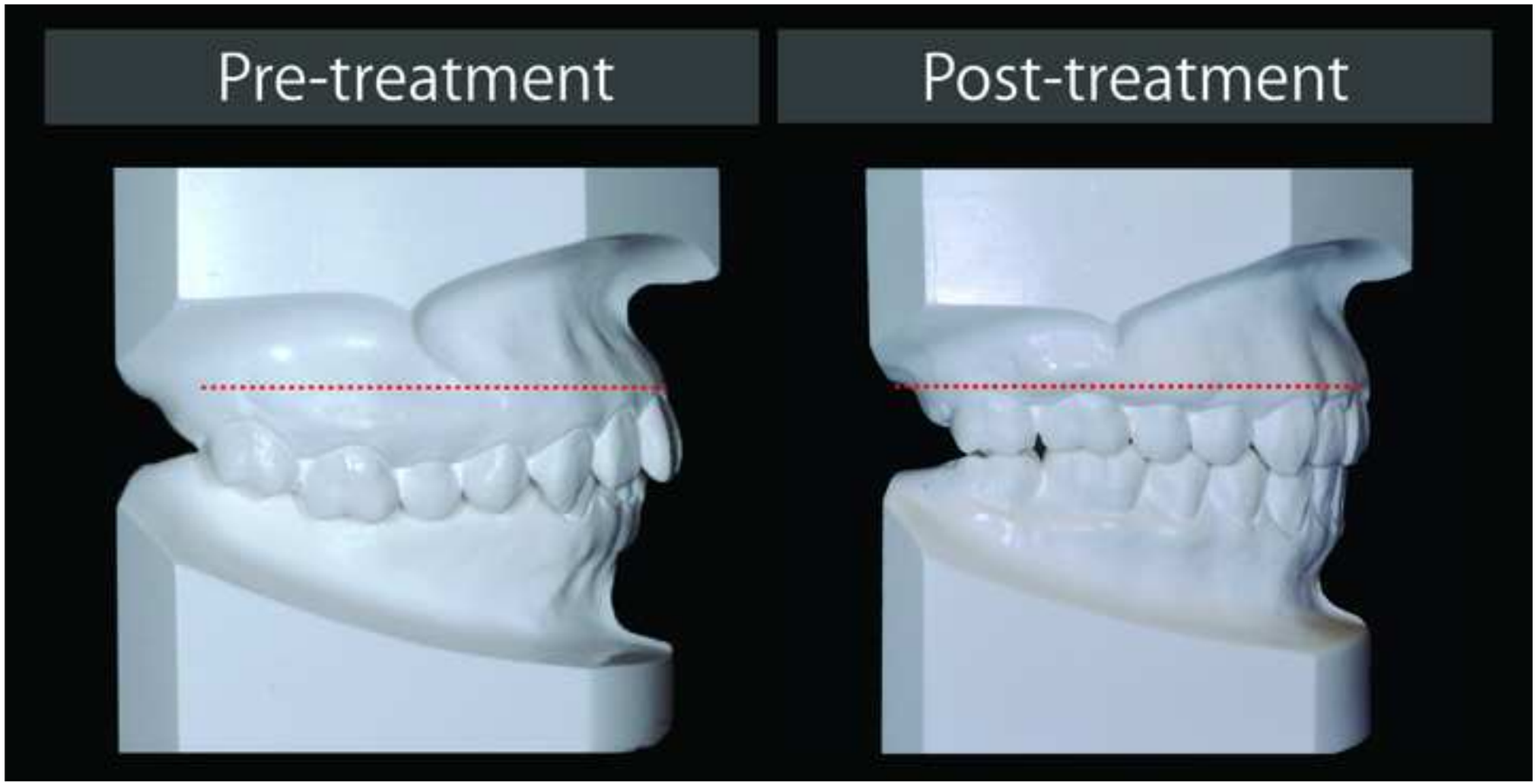


Figure 14
Click here to download high resolution image

Figure 15
Click here to download high resolution image

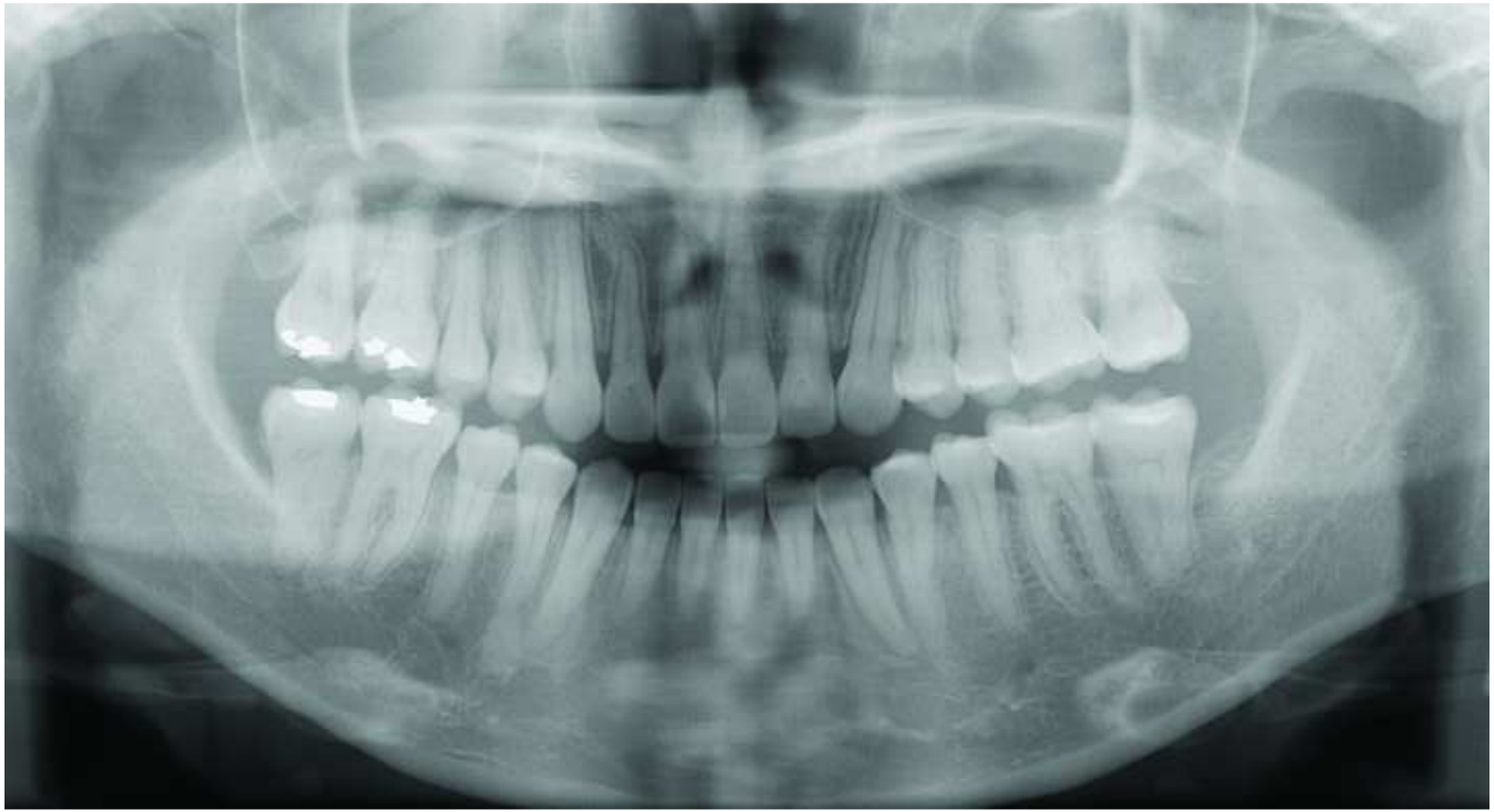


Figure 16

Click here to download high resolution image

Figure 17
Click here to download high resolution image

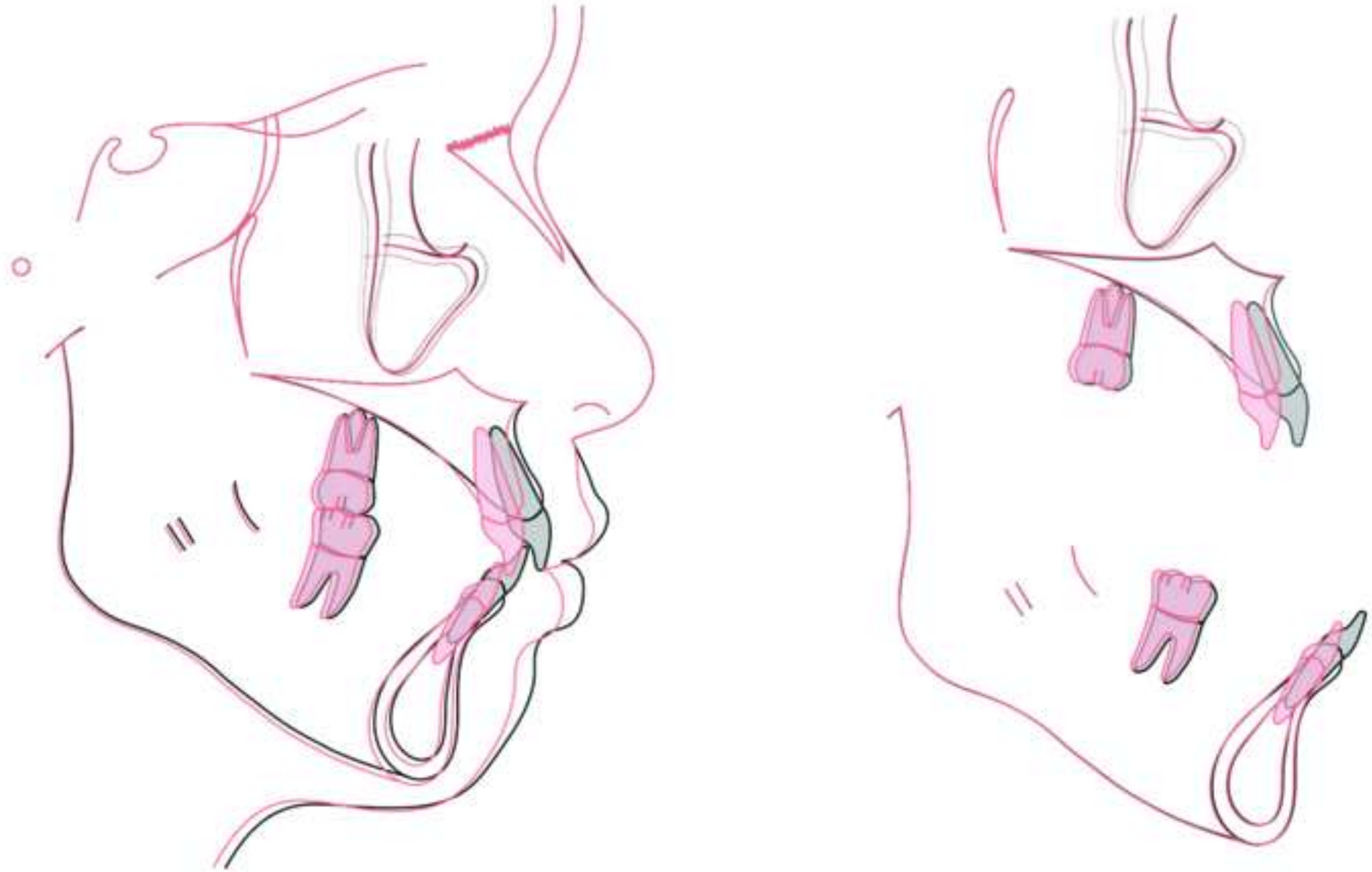


Figure 18
Click here to download high resolution image

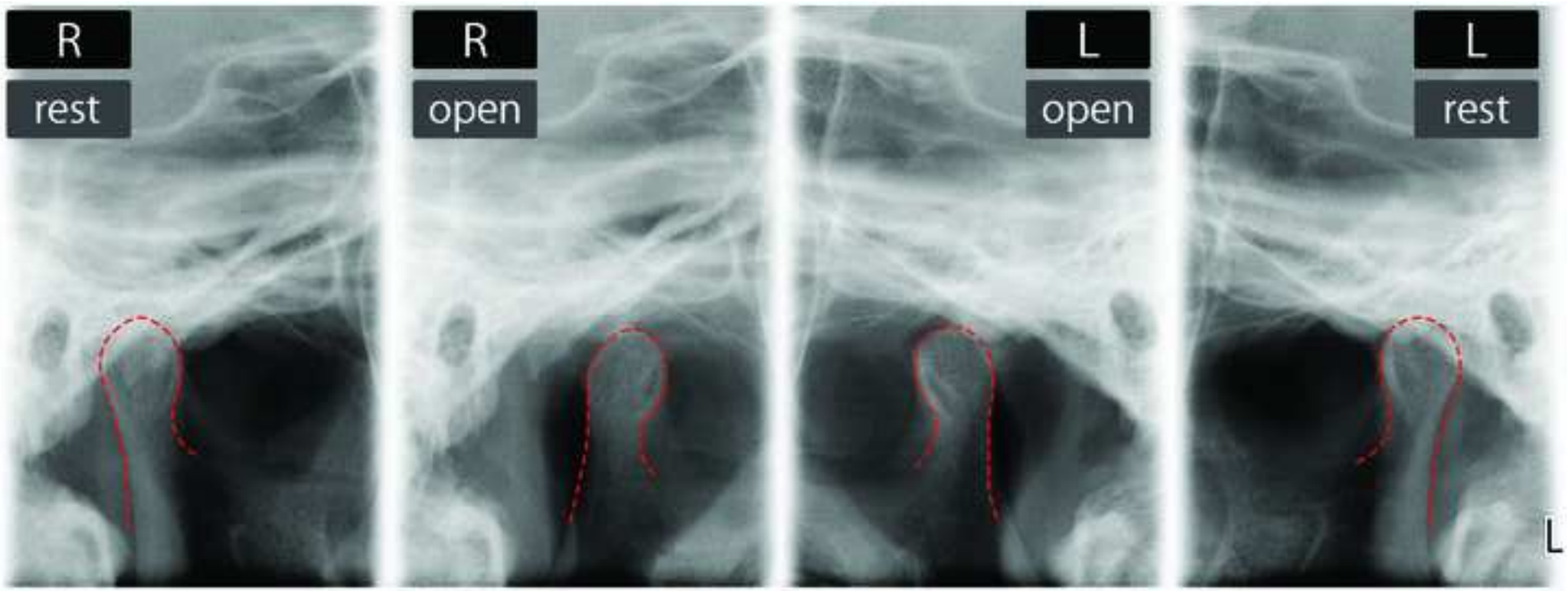


Figure 19

Click here to download high resolution image

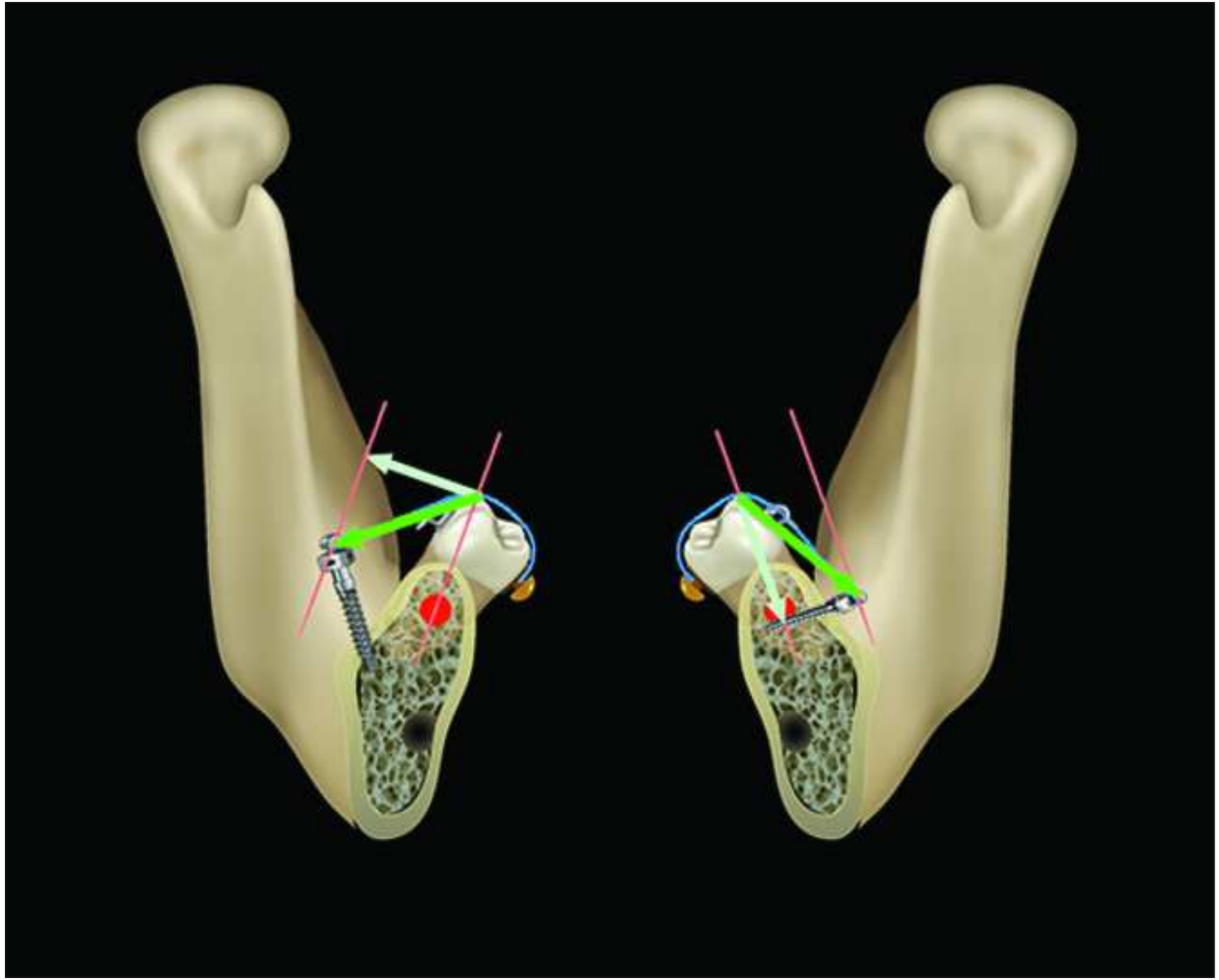


Figure 20

Click here to download high resolution image

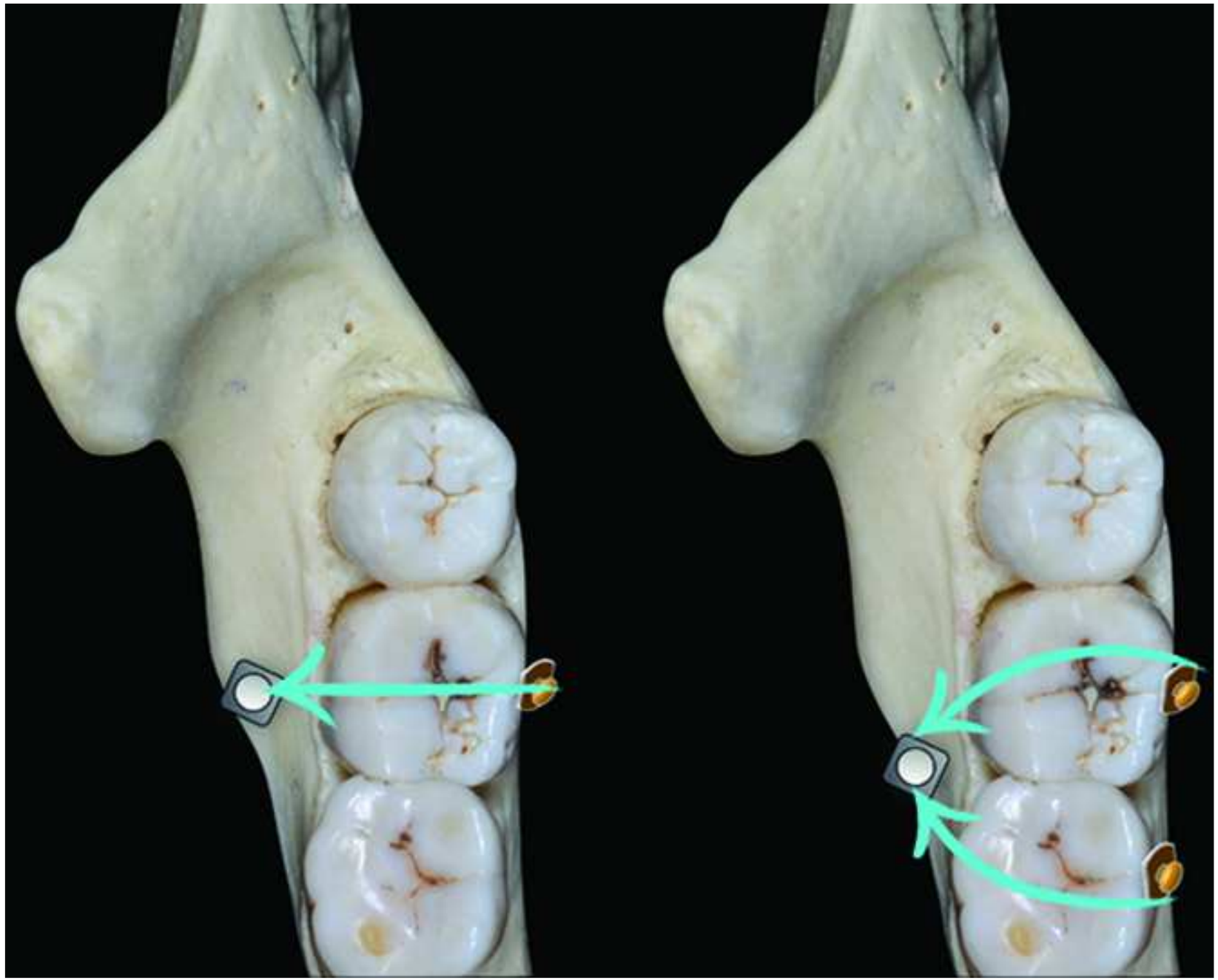


Figure 21

Click here to download high resolution image

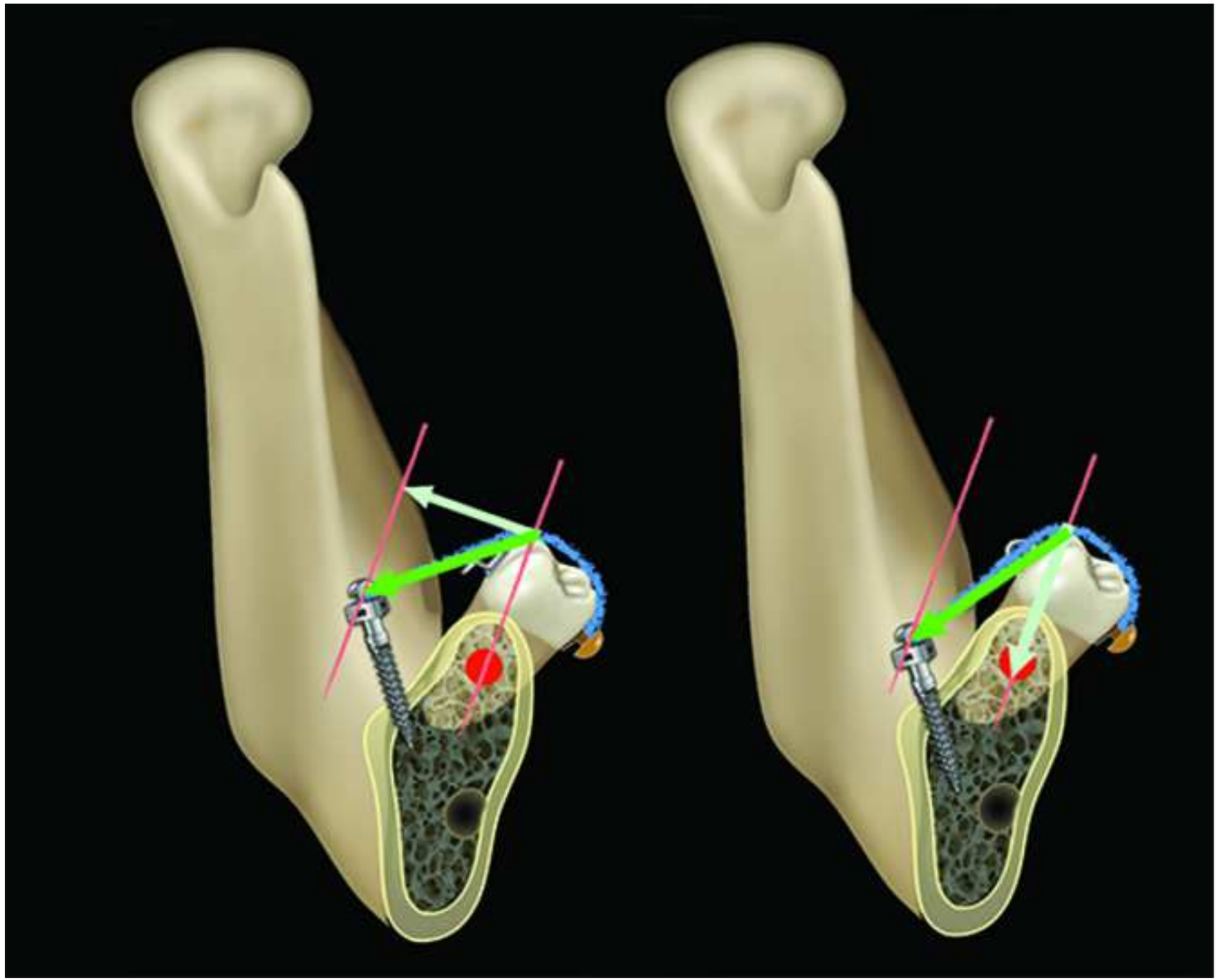
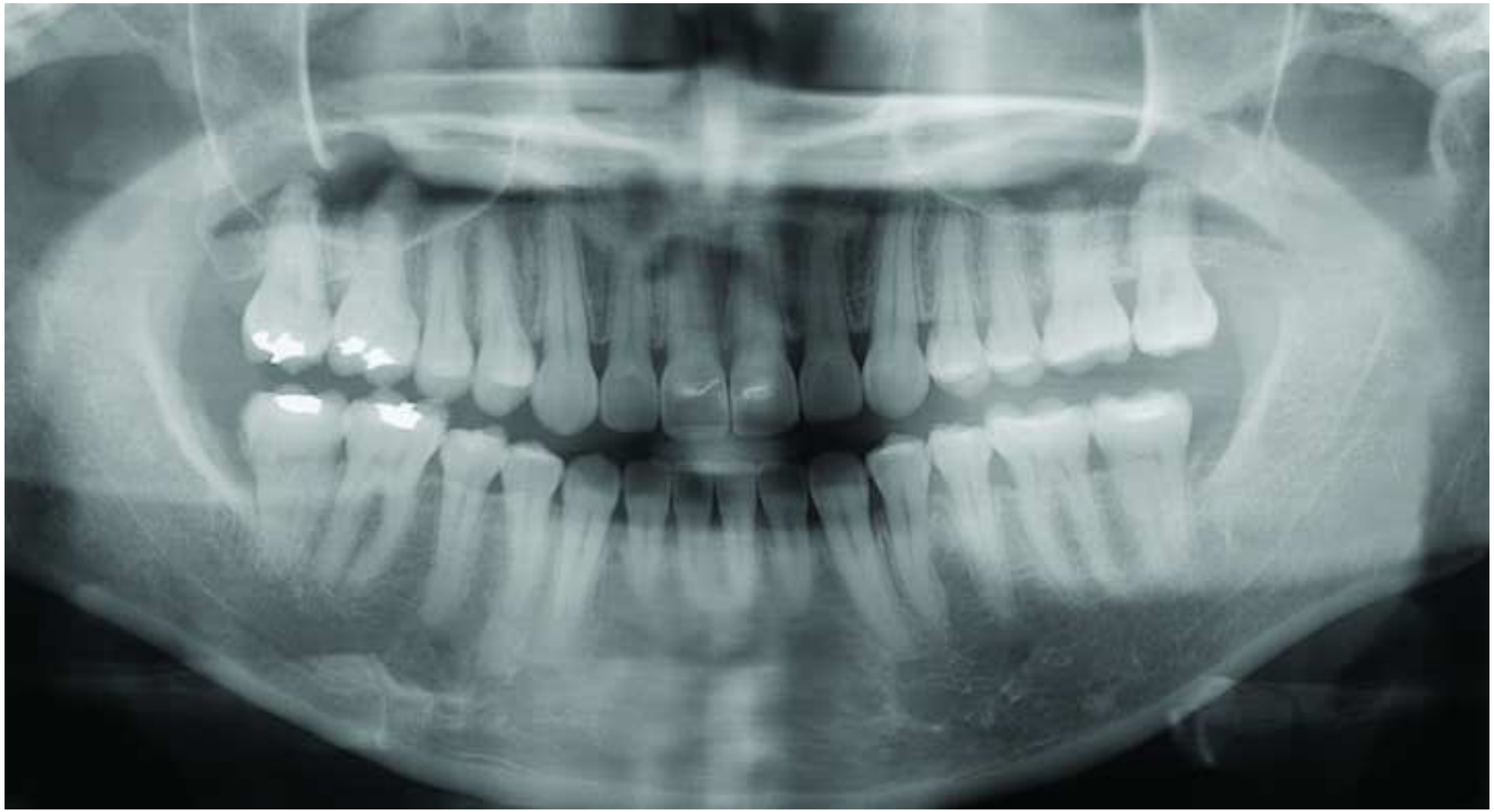


Figure 22
Click here to download high resolution image

Figure 23
Click here to download high resolution image

Figure 24
Click here to download high resolution image



*Copyright Release Form

Click here to download high resolution image

American Journal of Orthodontics and Dentofacial Orthopedics

COPYRIGHT STATEMENT

Must be signed by ALL authors

"The undersigned author(s) transfers all copyright ownership of the manuscript [title of article] to the American Association of Orthodontists in the event the work is published. The undersigned author(s) warrants that the article is original, does not infringe upon any copyright or other proprietary right of any third party, is not under consideration by another journal, has not been published previously, and includes any product that may derive from the published journal, whether print or electronic media. The author(s) confirm that they have reviewed and approved the final version of the manuscript. I (we) sign for and accept responsibility for releasing this material.

The corresponding author must be named Roberts, W. Eugene
(Type name) Signature

Each author's name must be typed underneath the signature.

Angle Lee — W. Eugene Roberts

Lee, Angle SA — Roberts, W. Eugene

Chang, Chris CH — Chris Chang

Date: Dec 27th, 2016

***Photo Release Form**

Click here to download high resolution image

Photo Release

Must be signed by the patient and/or the parent.

I consent to the taking of records, including photographs, and x-rays, before, during, and after treatment, and to the use of the records by my doctor in scientific papers, demonstrations, and all forms and media.

Patient's name Shao YUE MEI Signature Shao Yue Mei

Parent's name _____ Signature _____

Doctor's name Angle SA Lee Signature Angle Lee

Date Dec 27th, 2016

Return to:
American Journal of Orthodontics and Dentofacial Orthopedics
Orthodontics, School of Dentistry
D-569, Health Sciences Box 357446
Seattle, WA 98195
206-221-5413, phone

Permission to use photos
11/15/09

***ICMJE Statement on Conflict of Interest for each author**

Click here to download ICMJE Statement on Conflict of Interest for each author: coi_Dr. Lee.pdf

***ICMJE Statement on Conflict of Interest for each author**

Click here to download ICMJE Statement on Conflict of Interest for each author: coi_Dr. Chang.pdf

***ICMJE Statement on Conflict of Interest for each author**

Click here to download ICMJE Statement on Conflict of Interest for each author: coi_Dr. Roberts.pdf