Case Report

Unilateral condylar hyperplasia treated with simultaneous 2-jaw orthognathic surgery and posterior segmental osteotomy

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ABSTRACT

A 25-year-old woman presented with left condylar hyperplasia, canting-type facial asymmetry, mandibular prognathism, and arch width discrepancy. Bone scintigraphy confirmed the inactive status of the condyle, and the temporomandibular joint functioned within the normal range; thus, orthognathic surgery without condylectomy was performed. To correct facial asymmetry successfully through orthognathic surgery, sufficient dentoalveolar decompensation must be achieved in the presurgical orthodontic phase. In cases of canting-type facial asymmetry, teeth on the nondeviated side are extruded as dentoalveolar compensation. Therefore, vertical decompensation is required for intrusion of the extruded teeth. A miniscrew and resin build-ups were used for the intrusion of teeth, and posterior segmental osteotomy was simultaneously performed with orthognathic surgery for further intrusion. The canting-type facial asymmetry was notably corrected through successful vertical decompensation and close cooperation between orthodontists and maxillofacial surgeons. After 2 years of retention, the treatment results remained stable. (*Angle Orthod.* 2023;93:236–252.)

KEY WORDS: CBCT; Unilateral condylar hyperplasia; Posterior segmental osteotomy

INTRODUCTION

The pursuit of beauty through symmetry has been noted throughout human history.[1] For example, the Taj Mahal is an architectural monument that demonstrates the beauty of symmetry. Humans prefer symmetric faces to asymmetric faces.[2] Mild facial asymmetry is not obvious, owing to the soft tissue and dentoalveolar compensation but facial asymmetry beyond a moderate level is easily noticeable.[3]

Facial asymmetry has varying etiology, including trauma, genetics, and tumors.[4] One cause of severe facial asymmetry is condylar hyperplasia (CH). CH, a very rare condition, is caused by excessive growth of the mandibular condyle, leading to facial asymmetry, mandibular prognathism, and temporomandibular disorder (TMD).[5] CH is more common in women than in men,[6] and its pathogenesis has not been completely elucidated.[7]

The treatment options for CH depend on the age of the patient and the activity of the mandibular condyle. For adult patients, condylectomy is selected if the affected condyle has an active status, and orthognathic surgery is considered if the affected condyle has an inactive status.[8,9]

CH can be broadly classified into three types: hemimandibular hyperplasia, in which the vertical lengths of the mandibular condyle and ramus increase; hemimandibular elongation, in which the horizontal lengths of the mandibular condyle and ramus increase; or a hybrid form.[9–11] In the hybrid form, there is a combination of the 2 vectors, with a resultant severe expression of the pathology. If the unilateral mandibular condyle increases in length vertically, canting-type facial asymmetry occurs. On the other hand, if the unilateral mandibular condyle increases in length horizontally, chin deviation occurs.[10] Canting-type facial asymmetry leads to dentoalveolar compensation, with extrusion of teeth on the nondeviated side. To correct canting-type facial asymmetry successfully

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Figure 1. Pretreatment facial and intraoral photographs.

through orthognathic surgery, vertical decompensation is needed for the intrusion of these teeth.[12,13] Methods using miniscrews or miniplates can be employed for the intrusion of teeth; however, for further intrusion, a surgical approach, such as segmental osteotomy or contouring surgery, is needed.[14]

In this report, a case of a patient with canting-type facial asymmetry resulting from CH is described in which simultaneous 2-jaw orthognathic surgery and posterior segmental osteotomy were used.

Diagnosis and Etiology

The patient was a 25-year-old woman with a chief complaint of facial asymmetry. She had no significant medical, traumatic, or family history. A clicking sound was noted in the left temporomandibular joint (TMJ). However, there were no specific TMDs.

On the pretreatment facial photograph, severe facial asymmetry was observed with the chin deviated to the right and the lip canted up on the right (Figure 1). On the pretreatment intraoral photograph and digital model, the anterior teeth showed a crossbite, the right posterior teeth showed a buccal crossbite, and the left posterior teeth showed an open bite (Figure 2). The pretreatment panoramic radiograph showed left condylar hyperplasia and mandibular molar height discrepancy. On posteroanterior cephalogram, severe mandibular canting was observed, and the frontal occlusal plane was not parallel to the Go-Go′ plane (Figure 3). The lateral cephalogram and tracing (Figure 4) showed mandibular prognathism (Table 1) and a severe height difference between the left and right lower mandibular borders.

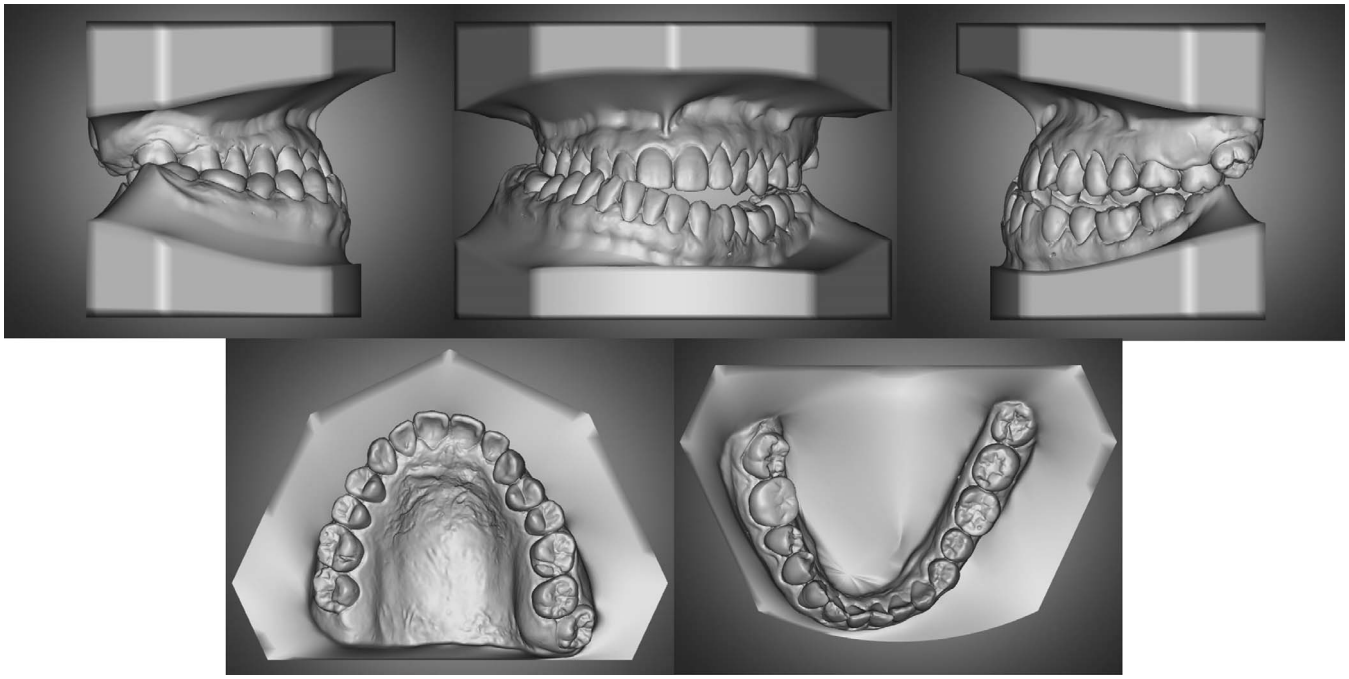

Figure 2. Pretreatment digital models.

According to cone-beam computed tomography (CBCT), the left mandibular ramal height was 24.1 mm longer than the right mandibular ramal height, and the left mandibular body length was 7.0 mm longer than the right mandibular body length. Menton was tipped 22.9 mm to the right, and the mandibular dental midline was deviated 8.1 mm to the right (Figure 5). An arch width discrepancy (AWD) was noted, in which the maxillary width was 8.1 mm shorter than the mandibular width based on the furcation of the first molar. The height of the left mandibular first molar was 6.8 mm higher than that of the right mandibular first molar. The right maxillary molars were buccally inclined (Figure 6). Because the patient had canting-type facial asymmetry and chin deviation, the patient was diagnosed with a hybrid form of condylar hyperplasia.

Treatment Objectives

The treatment goals for this patient were: (1) correction of the AWD, (2) intrusion of the left mandibular molar region and decompensation of buccolingual inclination in the molar region, (3) correction of facial asymmetry and mandibular prognathism, (4) development of normal overbite and overjet, and (5) development of a good occlusal relationship and improvement of esthetics.

Treatment Alternatives

Since there was severe facial asymmetry with mandibular prognathism, the surgical method was selected for optimal results instead of camouflage treatment. Two surgical options were discussed: (1) 2-jaw orthognathic surgery with condylectomy, and (2) 2-jaw orthognathic surgery without condylectomy. The latter option was selected because the inactive status of the condyle was confirmed through bone scintigraphy (condyle-to-clivus ratio: 1.11, relative percentage uptake: 50.4%), and the TMJ functioned within the normal range. In addition, because the intrusion of mandibular molars using a miniscrew and resin build-up has limitations, a posterior segmental osteotomy was planned simultaneously with the 2-jaw surgery for additional intrusion of the left mandibular molars.

Treatment Progress

Presurgical orthodontic treatment. First, the maxilla was expanded to improve the AWD. Considering the patient's age and the large amount of expansion needed, a miniscrew-assisted rapid palatal expansion (MARPE) or surgically assisted rapid palatal expansion (SARPE) could be used. Because SARPE was an invasive surgical procedure with high risks and high costs,[15] MARPE was used first (Figure 7). If MARPE failed, it was planned to consider SARPE. After maxillary expansion, a fixed orthodontic appliance was bonded to begin leveling and alignment. For intrusion, a miniscrew was implanted between the left mandibular first and second molars. Resin build-ups,[16] which did not require patient cooperation and could be used even in the presence of brackets and wires, were

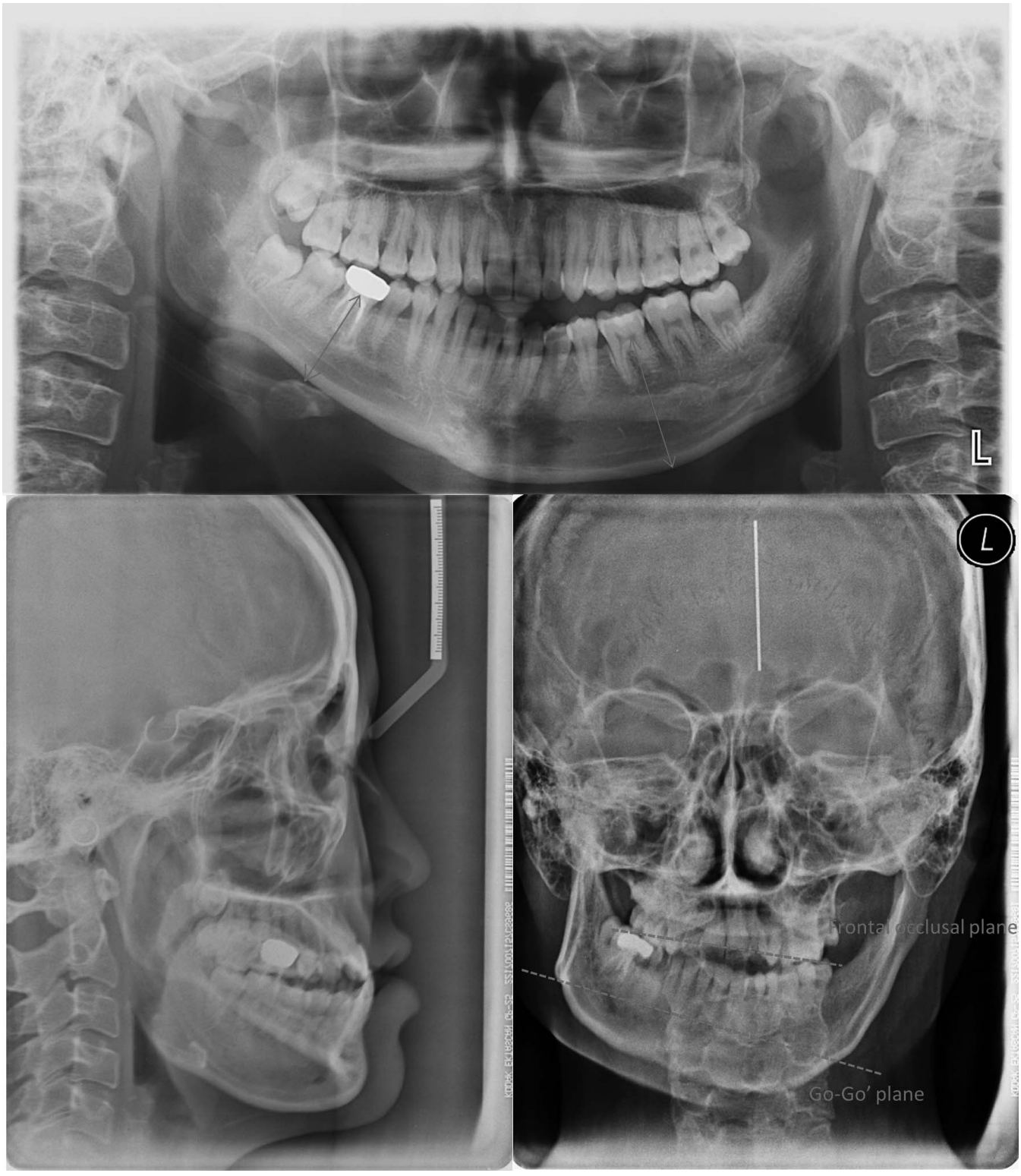

Figure 3. Pretreatment radiographs.

applied to the occlusal surfaces of the left mandibular molars to attempt further intrusion (Figure 8). Study casts were frequently obtained to be analyzed for arch coordination. The miniscrew of the MARPE and crisscross elastics were used for decompensation of the buccolingual inclination and arch coordination. An open coil spring was inserted between the left mandibular second premolar and first molar to create

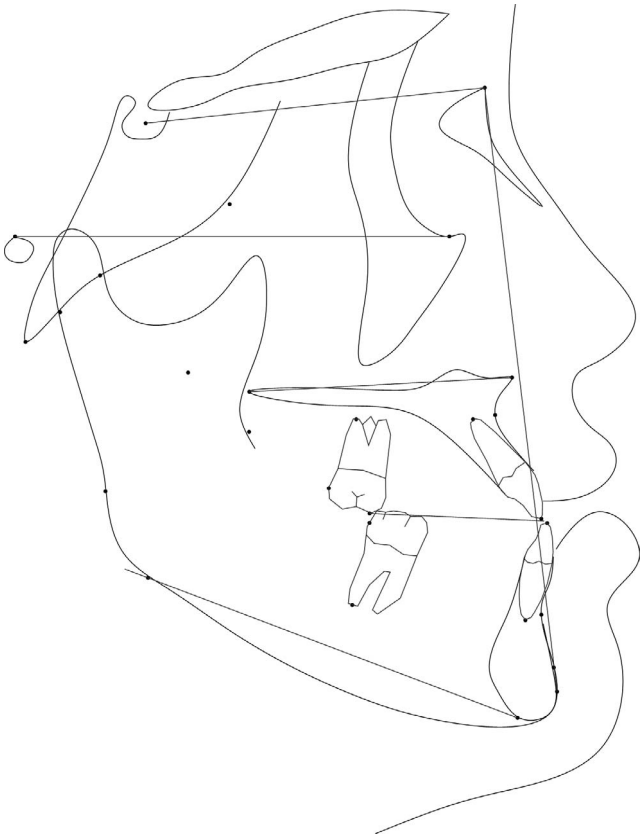

Figure 4. Pretreatment lateral cephalogram tracing.

a gap for the incision for segmental osteotomy. After 13 months, the AWD and buccolingual inclination of the molar region were corrected. Interocclusal clearance was also accomplished since it was required for canting correction on the left (Figure 9).

Orthognathic Surgery

At the immediate presurgical timepoint, re-evaluation was done and showed that Le Fort I osteotomy was required for leveling though the initial plan had been to avoid Le Fort I osteotomy. A 3-dimensional surgical simulation was used to plan the orthognathic surgery (Figure 10). Propelling Le Fort I osteotomy,[17,18] which involved shortening of the longer side and lengthening of the shorter side, was performed in the maxilla to improve maxilla canting. Considering the deviated chin, asymmetric setback sagittal split ramus osteotomy was performed in the mandible. To reduce the gap between the proximal and distal segments, an intentional osteotomy of the posterior part of the distal segment was performed.[19] To fill the remaining gap, a bone graft using the residual bone was performed. In addition, for the intrusion of the left mandibular molar, posterior segmental osteotomy was performed simultaneously with 2-jaw surgery (Figure 11). The osteotomized posterior segment was fixed using a long screw.

Table 1. Cephalometric Measurements

Measurements	Norm	Initial	Final
SNA (°)	81.6	85.8	87.7
SNB (°)	79.1	89.3	85.3
ANB (°)	2.4	−3.5	2.4
FMA (°)	25.0	23.6	26.7
U1-SN (°)	107.0	120.7	104.0
IMPA (°)	95.9	83.9	91.2
Overbite (mm)	2.3	v1.7	2.2
Overjet (mm)	3.2	−2.0	2.9

Postsurgical Orthodontic Treatment

One month after orthognathic surgery, the left vertical elastics on the miniscrews, which were implanted for intermaxillary fixation, were used to stabilize the occlusion. A lace-back was used to fix the left mandibular molar region where the posterior segmental osteotomy was performed. Three months after surgery, a full archwire was inserted to the left mandibular molar for tooth movement. After 14 months of postsurgical orthodontic treatment, good occlusion was achieved and facial asymmetry was improved. After debonding the fixed orthodontic appliances, fixed retainers were bonded in the anterior region. Circumferential retainers were then placed in the maxilla and mandible.

Treatment Results

After 27 months of treatment, a Class I molar and canine relationship was achieved (Figures 12–19). The correction of the AWD improved the right posterior buccal crossbite. ANB improved from −3.5° to 2.4°, improving the mandibular prognathism and anterior crossbite. The midlines of the maxilla and mandible were aligned, producing a normal overbite and overjet. The canted occlusal plane was significantly improved, leading to facial symmetry. The lateral cephalogram showed an improvement in the height difference between the left and right lower mandibular borders. The patient did not show any specific discomfort in the TMJ. After 2 years of retention, the treatment results remained stable (Figure 20).

DISCUSSION

In general, patients with CH have a normal mandibular shape but a vertically longer mandibular condyle. As a result, canting-type facial asymmetry occurs.[20] Camouflage orthodontic treatment is used in some cases of mild CH, but this is not an ideal solution. Condylectomy can be considered a priority for cases of CH beyond a moderate level, but there is a risk of

Figure 5. Pretreatment cone-beam computed tomography images.

temporomandibular dysfunction after surgery.[21–23] Therefore, if the patient's condyle is confirmed to be inactive through bone scintigraphy, orthognathic surgery is recommended.[8,9] In addition, adolescents with CH must wait until growth ceases because facial asymmetry may get severe.[8]

Patients with severe facial asymmetry require orthognathic surgery with orthodontic treatment to

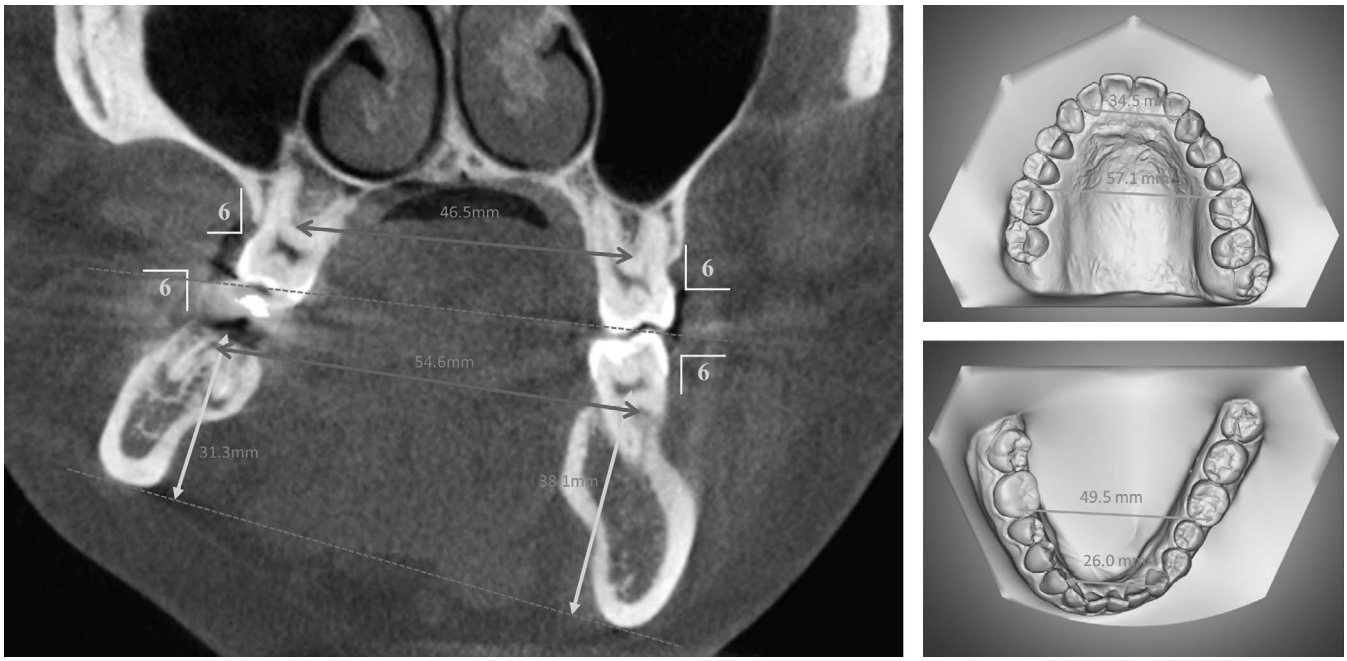

Figure 6. Pretreatment coronal cut of cone-beam computed tomography at the first molar site and dental arch width.

Figure 7. Maxillary expansion using miniscrew-assisted rapid palatal expander.

improve function and esthetics. Orthognathic surgery for facial asymmetry first adjusts the maxilla to the facial midline in the natural head position and then adjusts the mandible to the maxillary midline. The aim of presurgical orthodontic treatment is dentoalveolar decompensation. In other words, it is important to evaluate the labiolingual angulation of the anterior teeth, mesiodistal and buccolingual inclination of the posterior teeth, and extrusion of teeth because teeth move to compensate for skeletal disharmony. There are different methods for dentoalveolar decompensation depending on the type of facial asymmetry (canting, yawing, or translation type).[12,24] Horizontal decompensation is needed in yawing-type facial

Figure 8. Left lower molar intrusion using a miniscrew and resin buildups.

Figure 9. Intraoral photographs immediately before orthognathic surgery.

asymmetry to make the mesiodistally inclined teeth upright. Transverse decompensation is needed in translation-type facial asymmetry to make the buccolingually inclined teeth upright. Vertical decompensation is needed in canting-type facial asymmetry for intrusion of the extruded teeth on the non-deviated side. If presurgical orthodontic treatment fails to achieve sufficient dental decompensation, it is difficult to improve skeletal disharmony.

CH occurs at an early age and progresses over the long term, leading to the extrusion of the teeth on the nondeviated side owing to vertical compensation (Figure 21).[25] Because of the extrusion of the teeth, the frontal occlusal plane is not parallel to the Go-Go' plane, which makes it difficult to completely correct canting-type facial asymmetry. If presurgical orthodontic treatment fails to achieve sufficient vertical decompensation, it will lead to a lack of interocclusal clearance on the nondeviated side and, consequently, mandibular asymmetry will remain because the mandible cannot roll enough during orthognathic surgery. Contouring surgery or overcorrection of maxillary canting can be alternatives, but they are not fundamental treatments.[25] Therefore, orthognathic surgery after sufficient vertical decompensation is the best treatment option for improving canting-type facial asymmetry.

Orthodontic intrusion mechanisms, such as miniscrews or resin buildups, can be applied for intrusion of extruded teeth. However, because such methods offer only a limited amount of intrusion, further intrusion is achieved by surgical methods, including lower border ostectomy and subapical segmental osteotomy. There is a risk of damaging the inferior alveolar nerve during lower border ostectomy, which may require inferior alveolar nerve repositioning.[14,26] In this case, this approach was excluded because the lower mandibular border and the mandibular canal of the patient were too close to each other. There are two methods of posterior segmental osteotomy: one performed separately from 2-jaw surgery,[22] and one performed simultaneously with 2-jaw surgery. The disadvantage of the former method is that the patient has to undergo surgery under general anesthesia twice. Therefore, in the case presented, the latter method was selected; however, because of its difficulty, this method requires close cooperation between orthodontists and maxillofacial surgeons from the diagnosis phase.

Depending on the methods, the amount of molar intrusion was different. The average amount of molar intrusion with resin buildups was 1 mm.[16] The average amount of mandibular first and second molar intrusion with miniscrews was 1.7 mm and 2.8 mm, respectively.[27] A case report showed that the amount of molar intrusion with maxillary posterior segmental osteotomy was approximately 7 mm.[28]

The miniscrew, which was implanted only on the buccal side of the mandible, caused intrusion as well as buccoversion of the teeth. The combination of miniscrews with light force and fixed orthodontic appliances with rigid rectangular archwires may provide a balanced force system for effective intrusion of

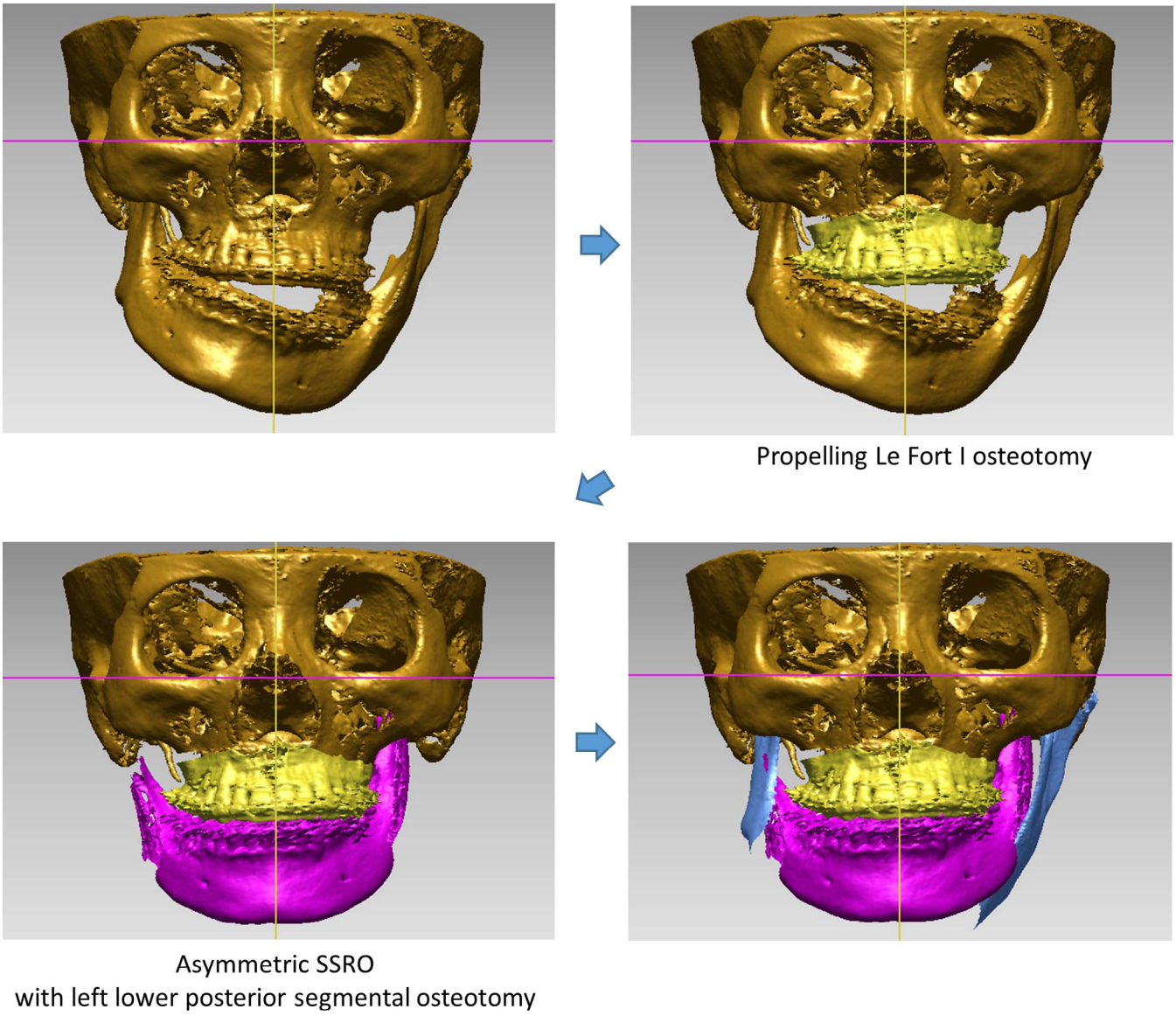

Figure 10. 3D simulation for orthognathic surgery.

molars. In addition, the occlusal force of resin buildup helped control the buccolingual root axis.

There were some limitations with the results of treatment. First, the patient still showed a prognathic chin because a posterior impaction of the maxilla was not sufficiently performed. Second, the patient still showed a difference in the mouth commissure and the mandibular border. This would be enhanced by additional surgery such as muscle attachment surgery[29] and contouring surgery.[22]

Canting-type facial asymmetry resulting from CH was successfully corrected through simultaneous 2-jaw orthognathic surgery and posterior segmental osteotomy. After 2 years of retention, the patient had no TMD and maintained a good facial appearance and occlusion. Long-term follow-up is needed in the future.

CONCLUSIONS

- To successfully correct facial asymmetry through orthognathic surgery, sufficient dentoalveolar decompensation must be achieved in the presurgical orthodontic phase.
- In the case presented of canting-type facial asymmetry caused by CH, miniscrews and resin build-ups were used for vertical decompensation.
- For further vertical decompensation, posterior segmental osteotomy was simultaneously performed with 2-jaw orthognathic surgery.
- An improvement in canting-type facial asymmetry was achieved because of successful vertical decompensation and close cooperation between orthodontists and maxillofacial surgeons.

Figure 11. Left lower molar segmental osteotomy for molar intrusion.

ACKNOWLEDGMENTS

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Figure 12. Posttreatment facial and intraoral photographs.

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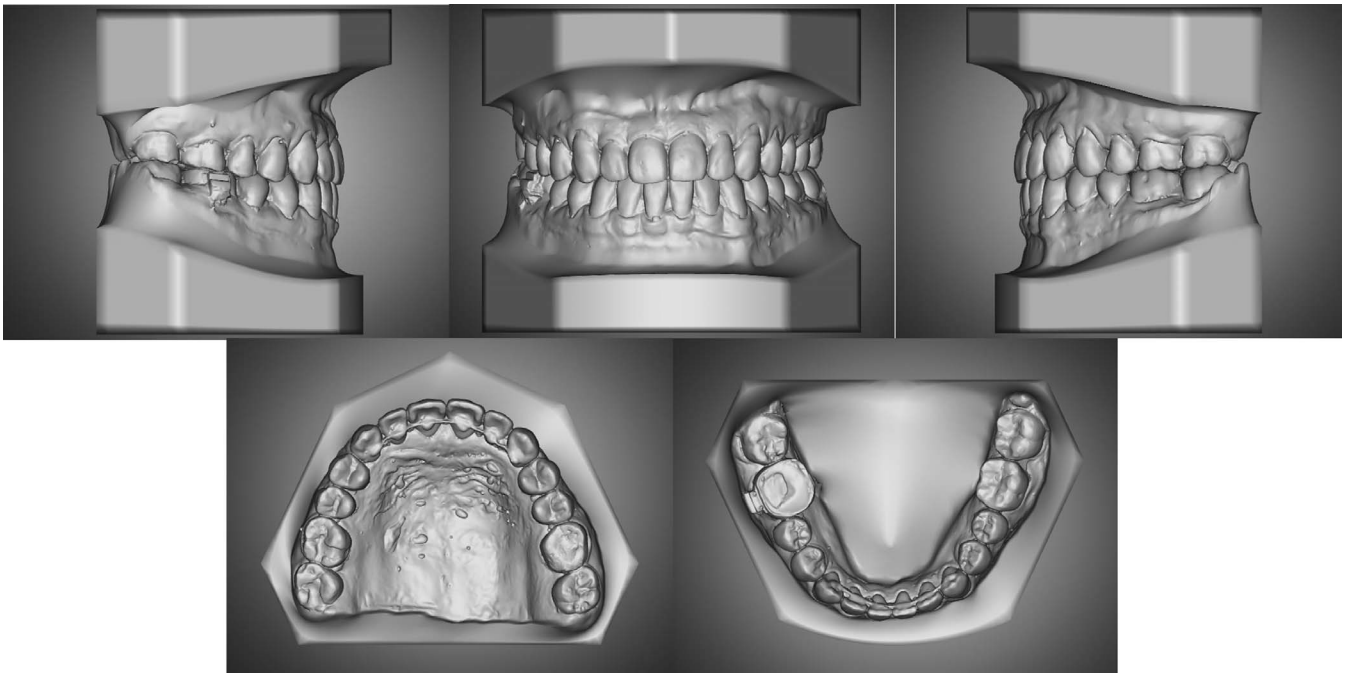

Figure 13. Posttreatment digital models.

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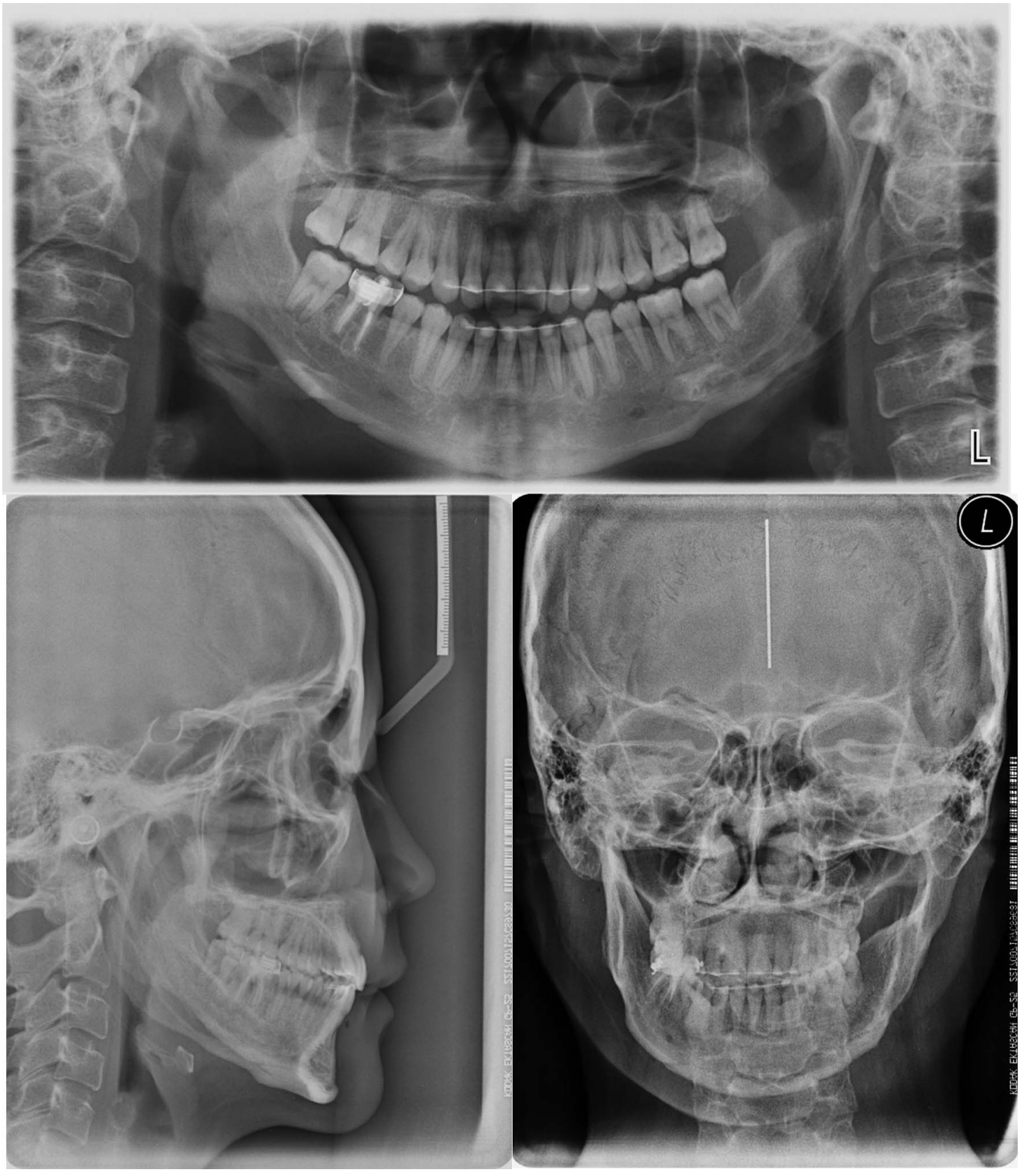

Figure 14. Posttreatment radiographs.

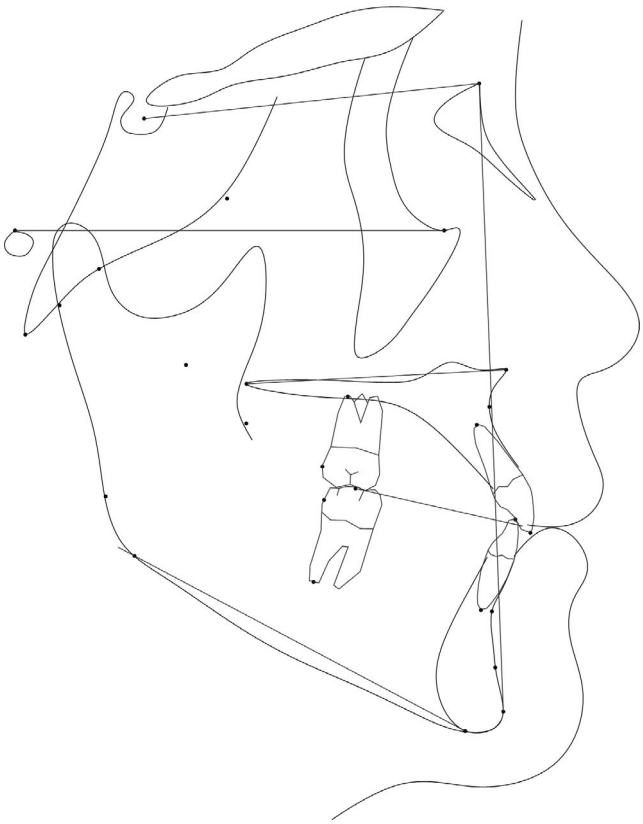

Figure 15. Posttreatment lateral cephalogram tracing.

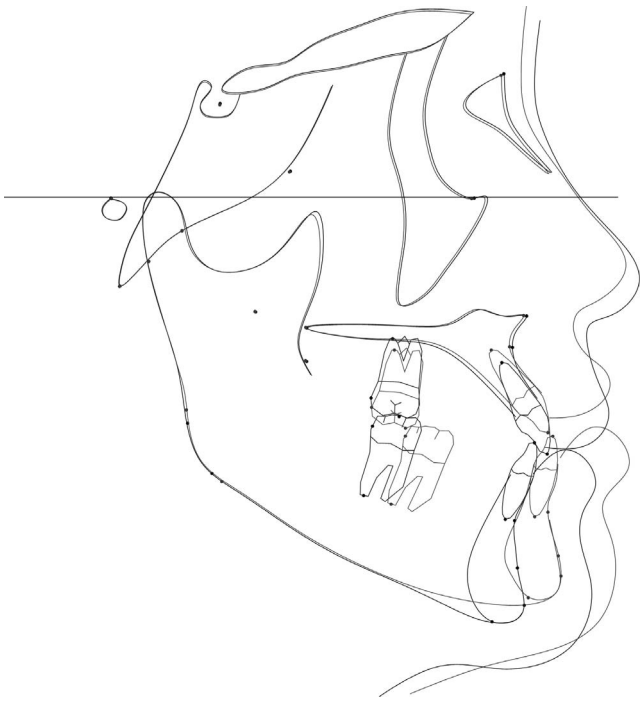

Figure 16. Cephalometric superimpositions. Blue line: pretreatment, black line: posttreatment.

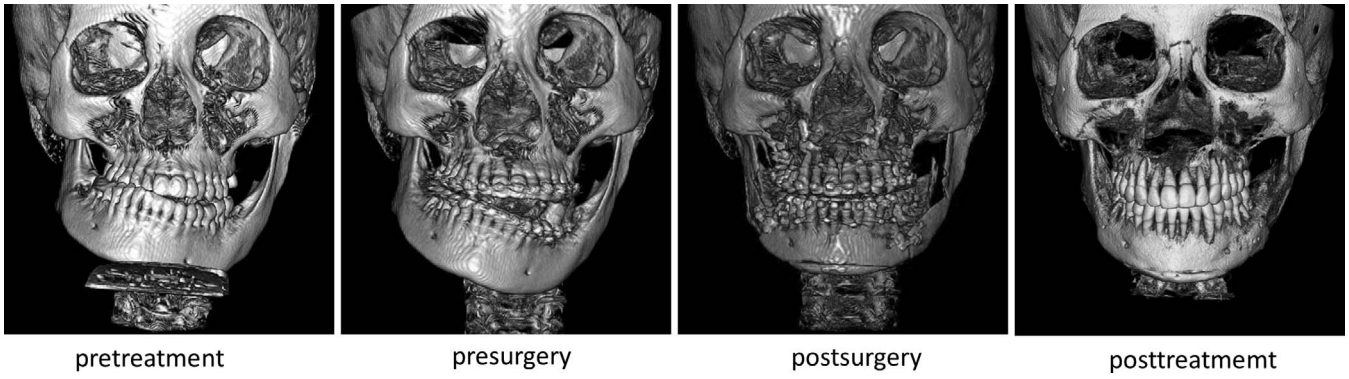

Figure 17. 3D volume-rendering images.

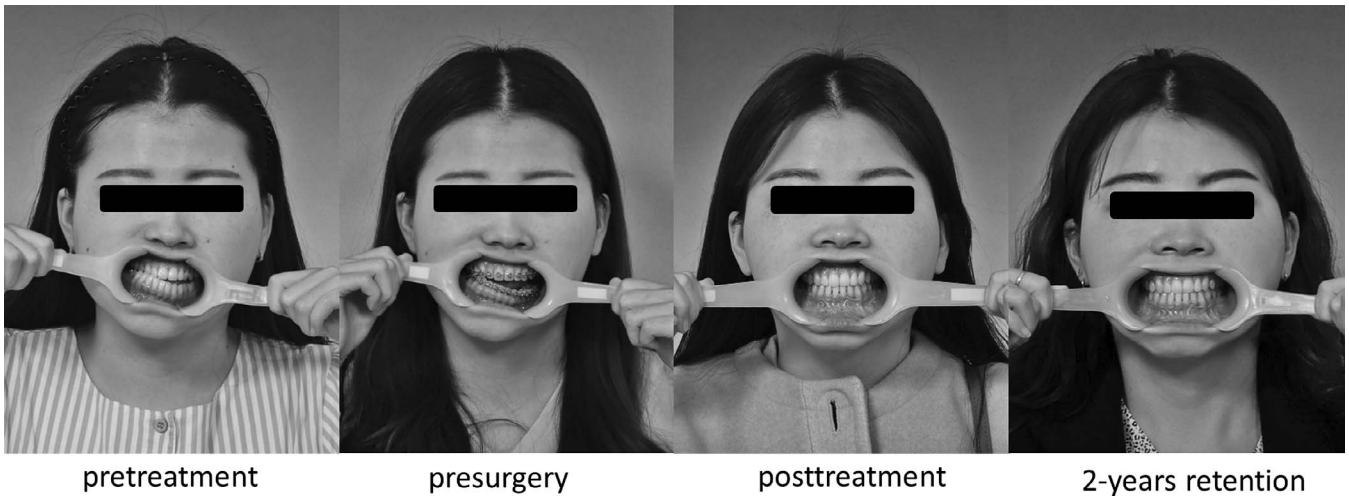

Figure 18. Occlusal canting correction.

Figure 19. Changes in the height of the mandibular first molar

Figure 20. Facial and intraoral photographs after 2 years of retention.

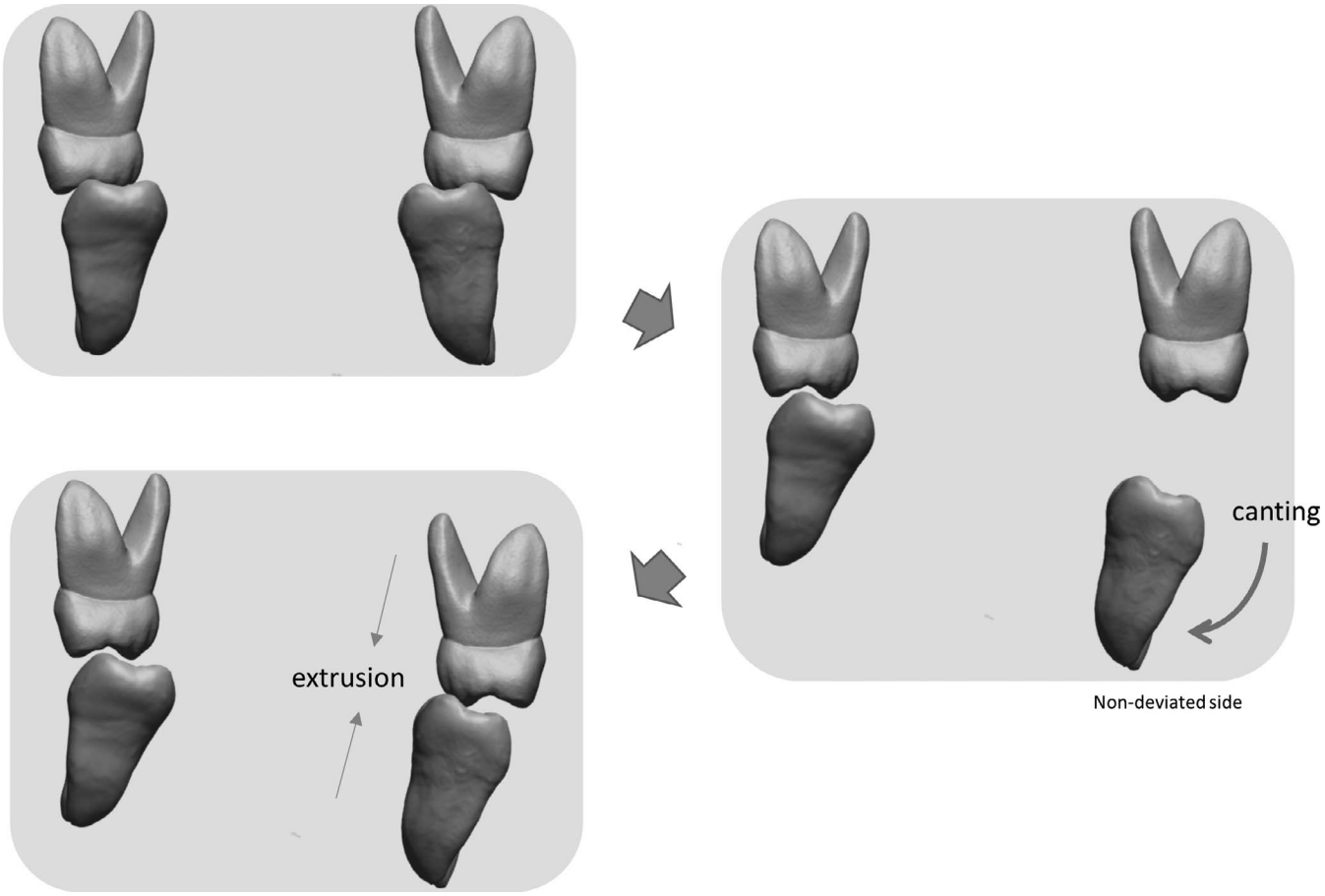

Figure 21. Dentoalveolar compensation in case of canting-type facial asymmetry.